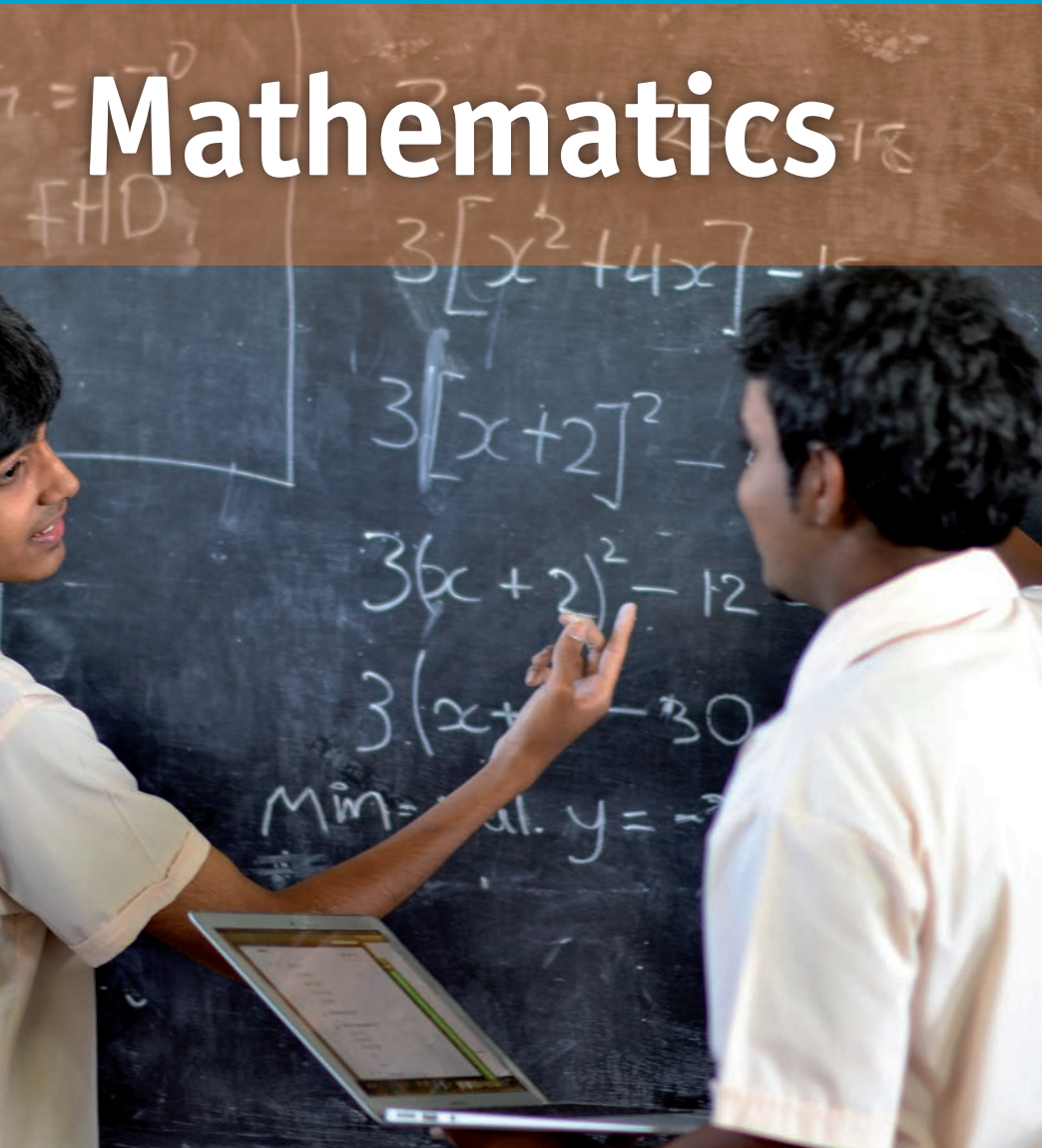




CARIBBEAN EXAMINATIONS COUNCIL

Mathematics



CSEC[®] PAST PAPERS

Macmillan Education
4 Crinan Street, London, N1 9XW
A division of Macmillan Publishers Limited
Companies and representatives throughout the world

www.macmillan-caribbean.com

ISBN 978-0-230-48278-4 AER

© Caribbean Examinations Council (CXC®) 2018
www.cxc.org
www.cxc-store.com

The author has asserted their right to be identified as the author of this work in accordance with the Copyright, Design and Patents Act 1988.

First published 2014

This revised edition published March 2018

All rights reserved; no part of this publication may be reproduced, stored in a retrieval system, transmitted in any form, or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of the publishers.

Designed by Macmillan Publishers Limited

Cover design by Macmillan Publishers Limited and Red Giraffe

Cover photograph © Caribbean Examinations Council (CXC®)

Cover photograph by Mrs Alberta Henry

With thanks to the students of the Sir Arthur Lewis Community College, St Lucia:

Akshay Mohan, Ravindra Mangar

CSEC® Mathematics Past Papers

LIST OF CONTENTS

Paper 02 January 2009	3
Paper 02 May/June 2009	24
Paper 02 May/June 2009	42
Paper 02 January 2010	53
Paper 02 May/June 2010	69
Paper 02 January 2011	84
Paper 02 May/June 2011	97
Paper 02 January 2012	111
Paper 02 May/June 2012	124
Paper 02 January 2013	140
Paper 02 May/June 2013	156
Paper 02 January 2014	173
Paper 02 May/June 2014	191
Paper 02 January 2015	209
Paper 02 May/June 2015	243
Paper 02 January 2016	279
Paper 02 May/June 2016	310
Paper 02 January 2017	338
Paper 02 May/June 2017	374
Paper 02 January 2018	410

TEST CODE **01234020**

FORM TP 2009015

JANUARY 2009

**CARIBBEAN EXAMINATIONS COUNCIL
SECONDARY EDUCATION CERTIFICATE
EXAMINATION
MATHEMATICS**

Paper 02 – General Proficiency

2 hours 40 minutes

06 JANUARY 2009 (a.m.)

INSTRUCTIONS TO CANDIDATES

1. Answer ALL questions in Section I, and ANY TWO in Section II.
2. Write your answers in the booklet provided.
3. All working must be shown clearly.
4. A list of formulae is provided on page 2 of this booklet.

Examination Materials

Electronic calculator (non-programmable)
Geometry set
Graph paper (provided)

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO

Copyright © 2007 Caribbean Examinations Council®.
All rights reserved.

01234020/JANUARY/F 2009

LIST OF FORMULAE

Volume of a prism $V = Ah$ where A is the area of a cross-section and h is the perpendicular length.

Volume of cylinder $V = \pi r^2 h$ where r is the radius of the base and h is the perpendicular height.

Volume of a right pyramid $V = \frac{1}{3} Ah$ where A is the area of the base and h is the perpendicular height.

Circumference $C = 2\pi r$ where r is the radius of the circle.

Area of a circle $A = \pi r^2$ where r is the radius of the circle.

Area of trapezium $A = \frac{1}{2} (a + b) h$ where a and b are the lengths of the parallel sides and h is the perpendicular distance between the parallel sides.

Roots of quadratic equations If $ax^2 + bx + c = 0$,

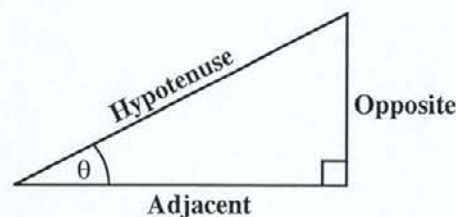
$$\text{then } x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Trigonometric ratios

$$\sin \theta = \frac{\text{opposite side}}{\text{hypotenuse}}$$

$$\cos \theta = \frac{\text{adjacent side}}{\text{hypotenuse}}$$

$$\tan \theta = \frac{\text{opposite side}}{\text{adjacent side}}$$



Area of triangle

Area of $\Delta = \frac{1}{2} bh$ where b is the length of the base and h is the perpendicular height

$$\text{Area of } \Delta ABC = \frac{1}{2} ab \sin C$$

$$\text{Area of } \Delta ABC = \sqrt{s(s-a)(s-b)(s-c)}$$

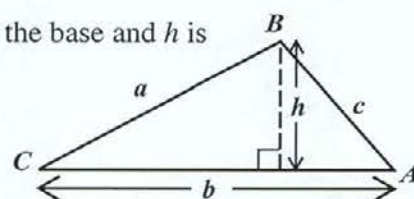
$$\text{where } s = \frac{a + b + c}{2}$$

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

Sine rule

Cosine rule

$$a^2 = b^2 + c^2 - 2bc \cos A$$



GO ON TO THE NEXT PAGE

NOTHING HAS BEEN OMITTED.

SECTION I

Answer ALL the questions in this section.

All working must be clearly shown.

1. (a) Calculate the EXACT value of

$$3\frac{3}{4} - 2\frac{1}{3} - \frac{5}{6}$$

giving your answer as a fraction.

(3 marks)

- (b) BDS\$ means Barbados dollars and EC\$ means Eastern Caribbean dollars.

(i) Karen exchanged BDS\$2 000.00 and received EC\$2 700.00. Calculate the value of one BDS\$ in EC\$. (2 marks)

(ii) If Karen exchanged EC\$432.00 for BDS\$, calculate the amount of BDS\$ which Karen would receive. (2 marks)

[Assume that the buying and selling rates are the same.]

- (c) A credit union pays 8% per annum compound interest on all fixed deposits. A customer deposited \$24 000 in an account. Calculate the TOTAL amount of money in the account at the end of two years. (4 marks)

Total 11 marks

2. (a) Simplify, expressing your answer as a single fraction

$$\frac{2m}{n} - \frac{5m}{3n}$$

(3 marks)

- (b) If $a * b = a^2 - b$, evaluate $5 * 2$.

(1 mark)

- (c) Factorize completely $3x - 6y + x^2 - 2xy$.

(2 marks)

- (d) A drinking straw of length 21 cm is cut into 3 pieces.
The length of the first piece is x cm.
The second piece is 3 cm shorter than the first piece.
The third piece is twice as long as the first piece.

(i) State, in terms of x , the length of EACH of the pieces. (2 marks)

(ii) Write an **expression**, in terms of x , to represent the sum of the lengths of the three pieces of drinking straw. (1 mark)

(iii) **Hence**, calculate the value of x . (3 marks)

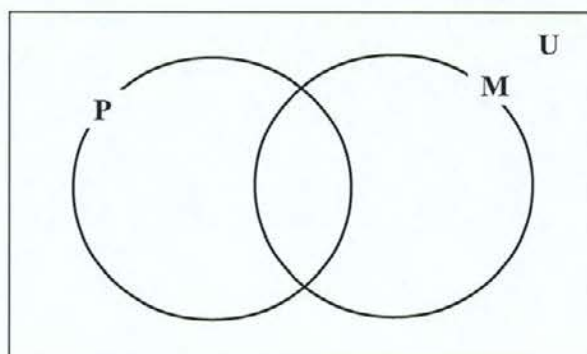
Total 12 marks

GO ON TO THE NEXT PAGE

3. (a) A school has 90 students in Form 5.
 54 students study Physical Education.
 42 students study Music.
 6 students study neither Physical Education nor Music.
 x students study both Physical Education and Music.

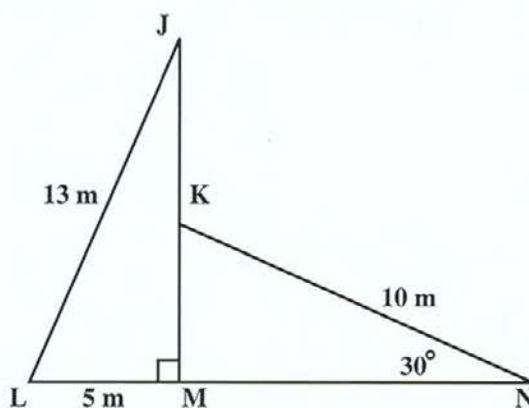
(i) Copy the Venn diagram shown below.

(1 mark)



- (ii) Show on your Venn diagram the information relating to the students in Form 5.
 (2 marks)
- (iii) Calculate the number of students who study BOTH Physical Education and Music.
 (3 marks)

- (b) The diagram below, **not drawn to scale**, shows two straight wires, LJ and NK , supporting a vertical pole, MJ . LMN is a straight line on the horizontal plane. Angle $JML = 90^\circ$, angle $KNM = 30^\circ$, $LJ = 13$ m, $LM = 5$ m and $KN = 10$ m.



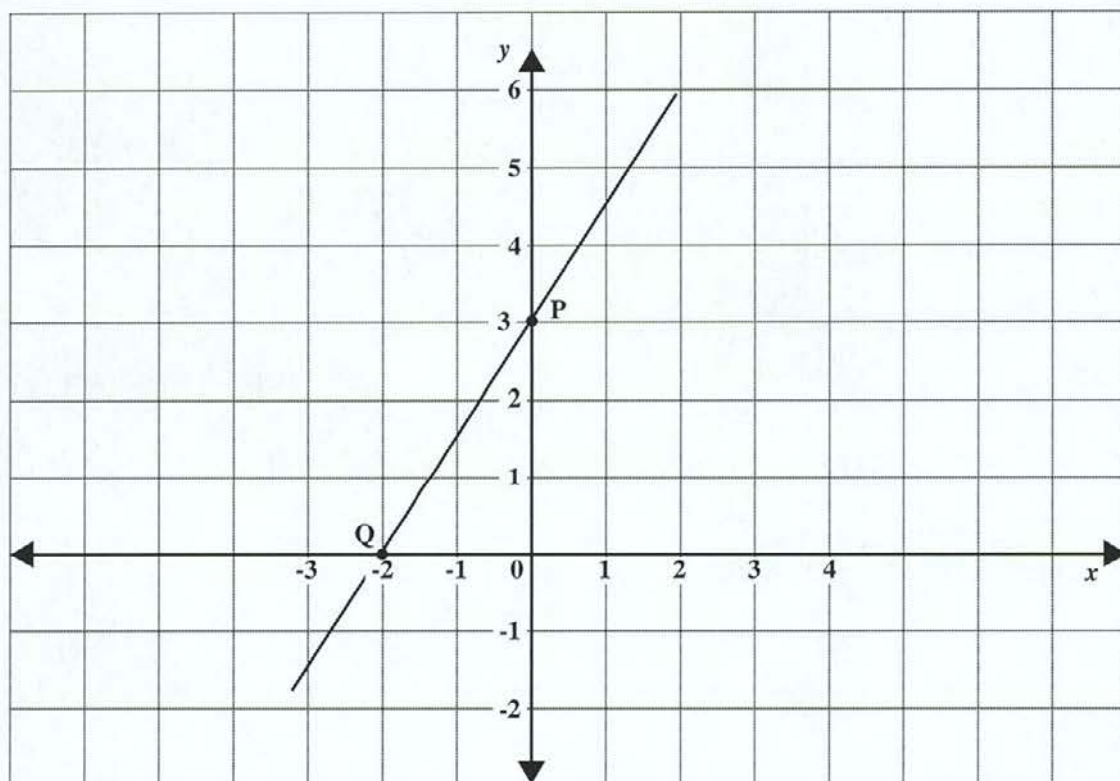
Calculate, in metres, the length of

- (i) MK (3 marks)
- (ii) JK . (3 marks)

Total 12 marks

GO ON TO THE NEXT PAGE

4. The diagram below represents the graph of a straight line which passes through the points P and Q .

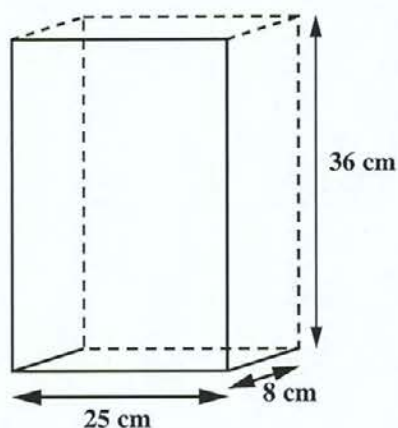


- (a) State the coordinates of P and Q . (2 marks)
- (b) Determine
- (i) the gradient of the line segment PQ (2 marks)
 - (ii) the equation of the line segment PQ . (2 marks)
- (c) The point $(-8, t)$ lies on the line segment PQ . Determine the value of t . (2 marks)
- The line segment, AB , is perpendicular to PQ , and passes through $(6, 2)$.
- (d) Determine the equation of AB in the form $y = mx + c$. (3 marks)

Total 11 marks

GO ON TO THE NEXT PAGE

5. A company makes cereal boxes in the shape of a right prism.

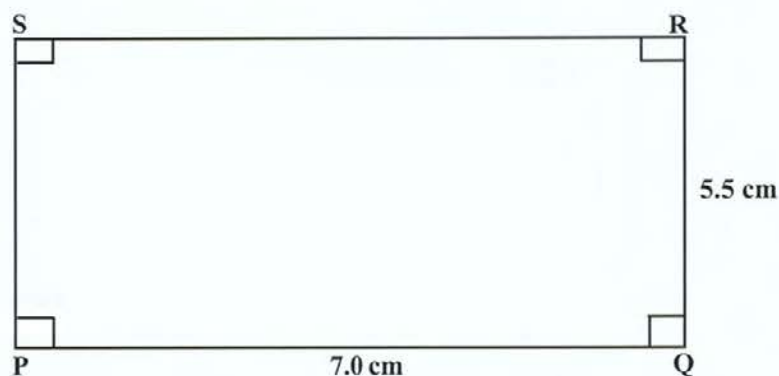


EACH large box has dimensions 25 cm by 8 cm by 36 cm.

- (a) Calculate the volume in cubic centimetres, of ONE large cereal box. (2 marks)
- (b) Calculate the total surface area of ONE large cereal box. (4 marks)
- (c) The cereal from ONE large box can exactly fill six small boxes, each of equal volume.
 - (i) Calculate the volume of ONE small cereal box. (2 marks)
 - (ii) If the height of a small box is 20 cm, list TWO different pairs of values which the company can use for the length and width of a small box. (2 marks)

Total 10 marks

6. (a) The diagram below, **not drawn to scale**, shows rectangle PQRS with $PQ = 7.0$ cm and $QR = 5.5$ cm.



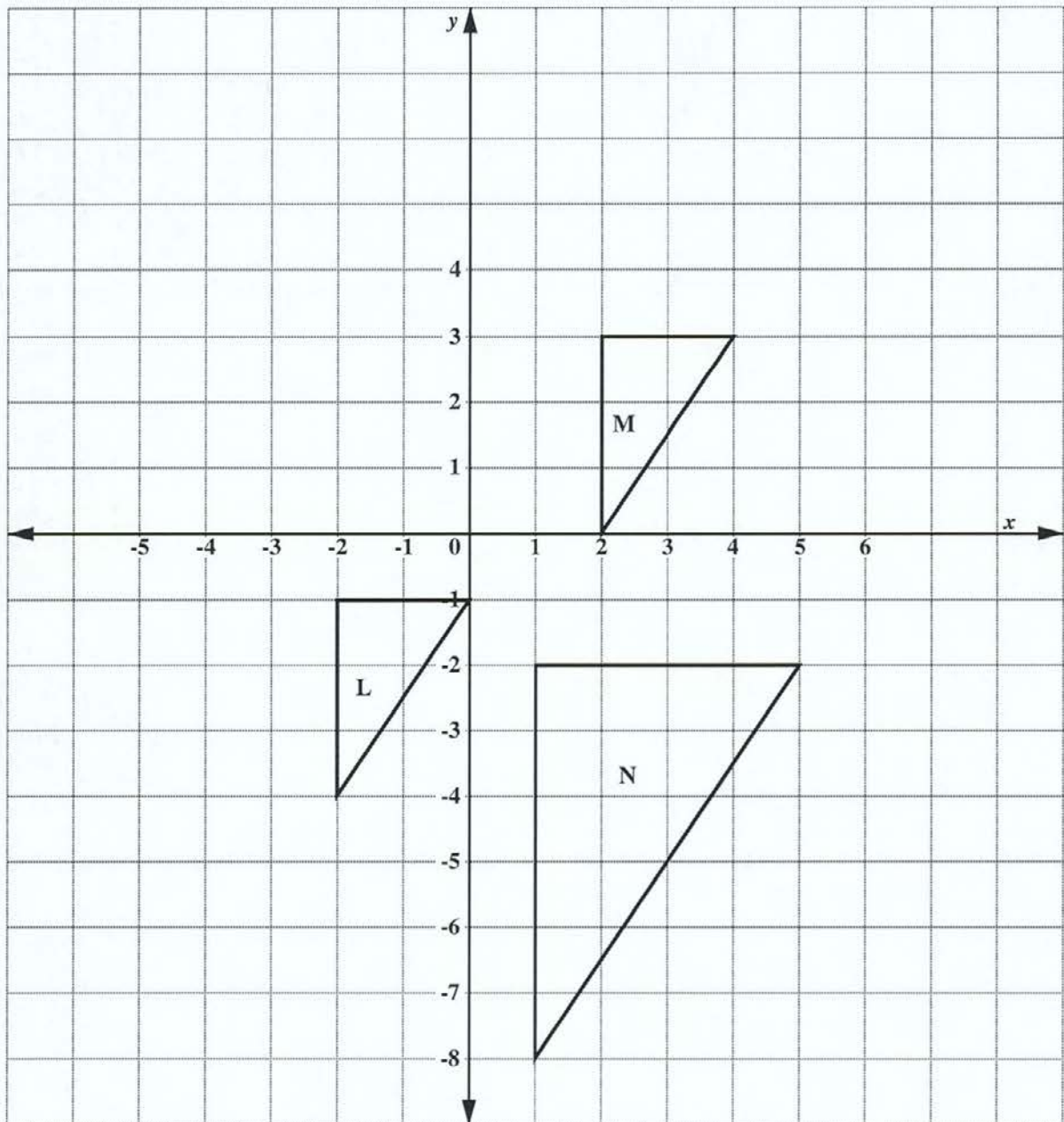
Using a ruler, a pencil and a pair of compasses only, construct the rectangle.

(6 marks)

GO ON TO THE NEXT PAGE

An answer sheet is provided for this question.

- (b) The diagram below shows three triangles labelled L , M and N .



GO ON TO THE NEXT PAGE

L is mapped onto M by a translation.

- (i) State, in the form $\begin{pmatrix} x \\ y \end{pmatrix}$, the vector which represents the translation.

(2 marks)

- (ii) L is mapped onto N by an enlargement:

- a) Find and label **on your answer sheet** the point G , the centre of the enlargement. **Show your method clearly.**
- b) State the coordinates of G .
- c) State the scale factor of the enlargement.

(4 marks)

Total 12 marks

GO ON TO THE NEXT PAGE

7. The table below shows the distribution of marks on a test for a group of 70 students.

Mark	Frequency	Cumulative Frequency
1 – 10	2	2
11 – 20	5	7
21 – 30	9	16
31 – 40	14	
41 – 50	16	
51 – 60	12	
61 – 70	8	
71 – 80	4	70

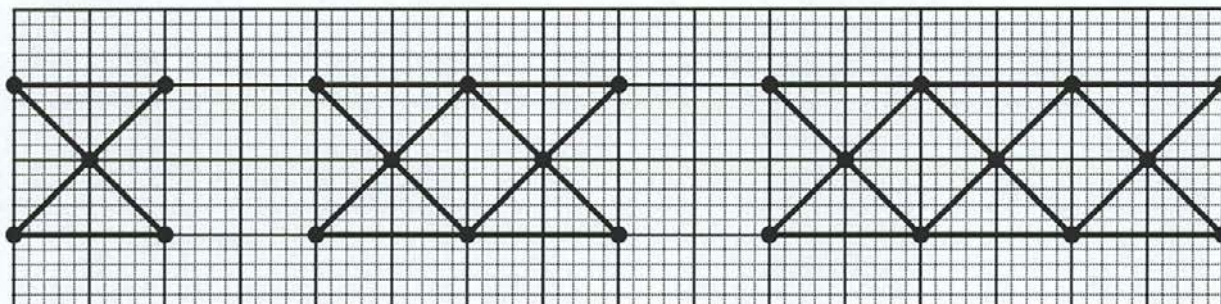
- (a) Copy and complete the table to show the cumulative frequency for the distribution. (2 marks)
- (b) (i) Using a scale of 1 cm to represent 5 marks on the horizontal axis and 1 cm to represent 5 students on the vertical axis, draw the cumulative frequency curve for the scores. (5 marks)
- (ii) What assumption have you made in drawing your curve through the point (0,0)? (1 mark)
- (c) The pass mark for the test is 47. Use your graph to determine the number of students who passed the test. (2 marks)
- (d) What is the probability that a student chosen at random had a mark less than or equal to 30? (2 marks)

Total 12 marks

GO ON TO THE NEXT PAGE

8. An answer sheet is provided for this question.

The figure below shows the first three diagrams in a sequence. Each diagram is made up of dots connected by line segments. In each diagram, there are d dots and l line segments.



On the answer sheet provided:

- (a) Draw the fourth diagram in the sequence. (2 marks)
- (b) Complete the table by inserting the missing values at the rows marked (i) and (ii).

	No. of dots d	Pattern connecting l and d	No. of line segments l	
	5	$2 \times 5 - 4$	6	
	8	$2 \times 8 - 4$	12	
	11	$2 \times 11 - 4$	18	
(i)	62	()	()	(2 marks)
(ii)	()	()	180	(2 marks)

- (c) (i) How many dots are in the sixth diagram of the sequence? (1 mark)
- (ii) How many line segments are in the seventh diagram of the sequence? (1 mark)
- (iii) Write the rule which shows how l is related to d . (2 marks)

Total 10 marks

GO ON TO THE NEXT PAGE

SECTION II

Answer TWO questions in this section.

ALGEBRA AND RELATIONS, FUNCTIONS AND GRAPHS

9. (a) Make t the subject of the formula

$$\frac{p}{2} = \sqrt{\frac{t+r}{g}}.$$

(3 marks)

- (b) (i) Express the function $f(x) = 2x^2 - 4x - 13$ in the form $f(x) = a(x+h)^2 + k$.

(3 marks)

Hence, or otherwise, determine

- (ii) the values of x at which the graph cuts the x -axis (4 marks)

- (iii) the interval for which $f(x) \leq 0$ (2 marks)

- (iv) the minimum value of $f(x)$ (1 mark)

- (v) the value of x at which $f(x)$ is a minimum. (2 marks)

Total 15 marks

10. (a) Two functions are defined as follows:

$$f: x \rightarrow x - 3$$

$$g: x \rightarrow x^2 - 1$$

- (i) Calculate $f(6)$. (1 mark)
- (ii) Find $f^{-1}(x)$. (1 mark)
- (iii) Show that $f g (2) = f g (-2) = 0$. (3 marks)

- (b) An answer sheet is provided for this question.

The distance-time graph below describes the journey of a train between two train stations, A and B. Answer the questions below **on the answer sheet**.



- (i) For how many minutes was the train at rest at B? (1 mark)
- (ii) Determine the average speed of the train, in km/h, on its journey from A to B. (3 marks)

The train continued its journey away from stations A and B to another station C, which is 50 km from B. The average speed on this journey was 60 km/h.

- (iii) Calculate the time, in minutes, taken for the train to travel from B to C. (3 marks)
- (iv) **On your answer sheet**, draw the line segment which describes the journey of the train from B to C. (3 marks)

Total 15 marks

GO ON TO THE NEXT PAGE

GEOMETRY AND TRIGONOMETRY

11. (a) (i) Copy and complete the table for the graph of

$$y = \frac{1}{2} \tan x, \text{ for } 10^\circ \leq x \leq 60^\circ.$$

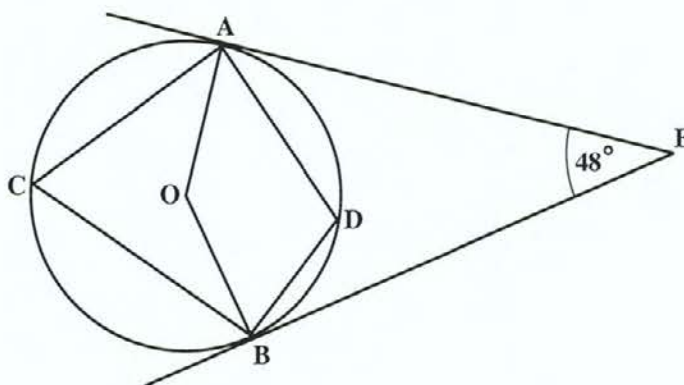
x	10°	20°	30°	40°	50°	60°
y	0.13		0.29		0.60	0.87

(1 mark)

- (ii) Using a scale of 2 cm to represent 10° (10 degrees) on the horizontal axis and 10 cm to represent 1 unit on the vertical axis, plot the values from the table and draw a smooth curve through your points. (4 marks)

- (iii) Use your graph to estimate the value of x when $y = 0.7$. (1 mark)

- (b) The diagram below, **not drawn to scale**, shows a circle with centre, O . EA and EB are tangents to the circle, and angle $AEB = 48^\circ$.



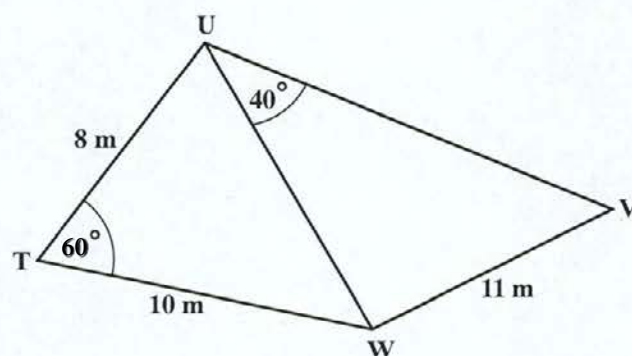
Calculate, **giving reasons for your answer**, the size of EACH of the following angles:

- (i) $\angle OAE$ (2 marks)
- (ii) $\angle AOB$ (3 marks)
- (iii) $\angle ACB$ (2 marks)
- (iv) $\angle ADB$ (2 marks)

Total 15 marks

GO ON TO THE NEXT PAGE

12. (a) On the diagram below, **not drawn to scale**, $TU = 8$ m, $TW = 10$ m, $VW = 11$ m, angle $UTW = 60^\circ$ and angle $WUV = 40^\circ$.



Calculate

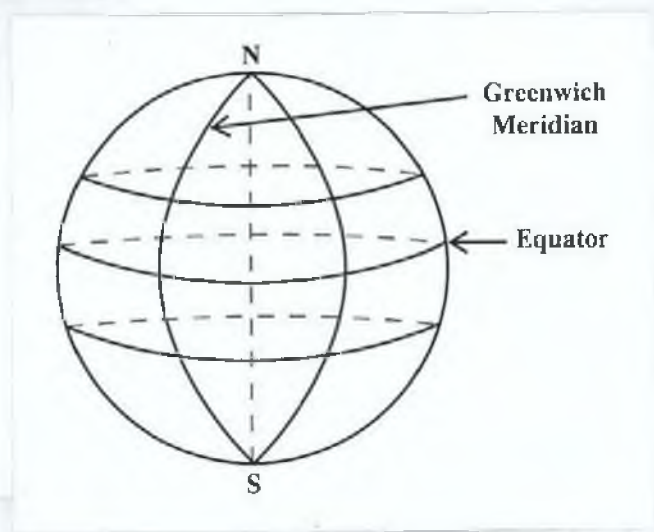
- (i) the length of UV (2 marks)
- (ii) the size of the angle UVW (2 marks)
- (iii) the area of triangle TUV . (2 marks)

GO ON TO THE NEXT PAGE

In this question use $\pi = \frac{22}{7}$, and assume that the earth is a sphere of radius 6 370 km.

- (b) The diagram below, **not drawn to scale**, represents the surface of the earth. The points N and S represent the North and South Poles respectively. The Equator and Greenwich Meridian are labelled. The following are also shown on the diagram but they are not labelled:

- circles of latitude 30°N and 20°S
- circle of longitude 40°E .



- (i) Copy the diagram and label it to show
- a) circles of latitude 30°N and 20°S
 - b) circle of longitude 40°E
 - c) the point P (30°N , 40°E). (5 marks)
- (ii) The position of the point Q is 20°S and 40°E .

Calculate, correct to 3 significant figures,

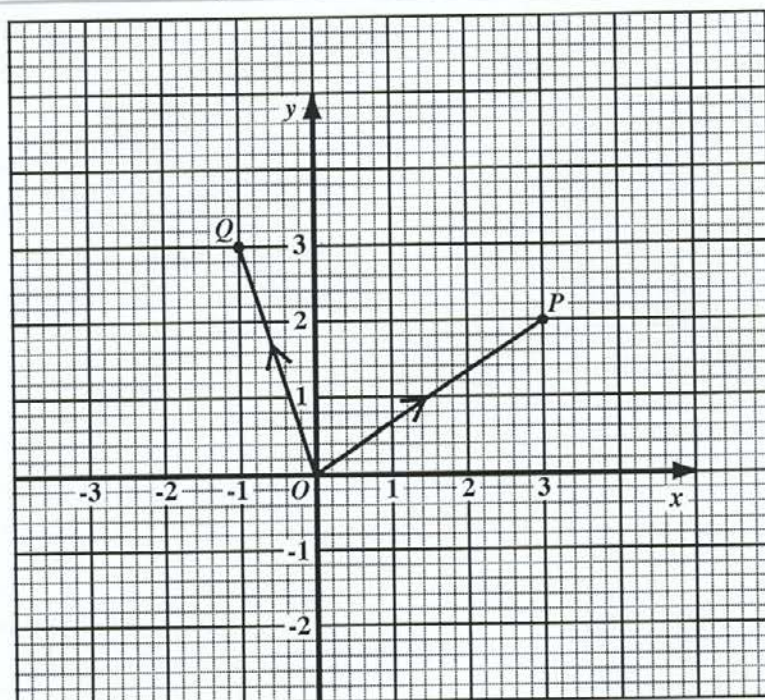
- a) the SHORTEST distance from P to Q measured along the common circle of longitude (2 marks)
- b) the radius of the circle of latitude on which Q lies. (2 marks)

Total 15 marks

GO ON TO THE NEXT PAGE

VECTORS AND MATRICES

13. The diagram below shows position vectors $\vec{OP}$ and $\vec{OQ}$.



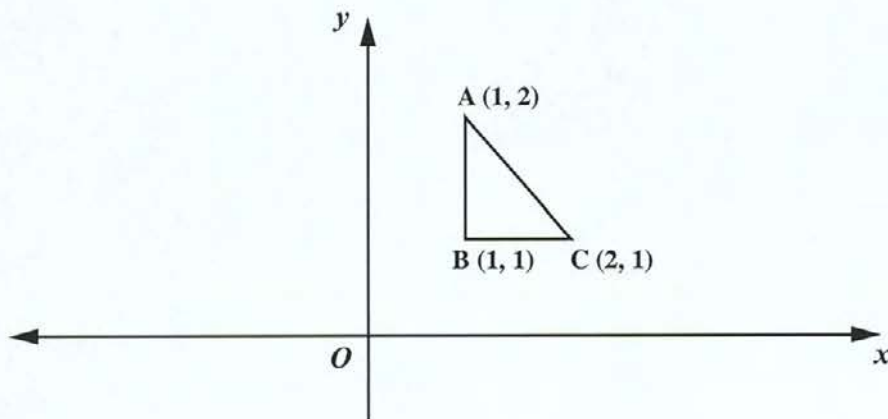
- (a) Write as a column vector, in the form $\begin{pmatrix} x \\ y \end{pmatrix}$
- $\vec{OP}$ (1 mark)
 - $\vec{OQ}$ (1 mark)
- (b) The point R has coordinates $(8, 9)$.
- Express $\vec{QR}$ as a vector in the form $\begin{pmatrix} x \\ y \end{pmatrix}$. (2 marks)
 - Using a vector method, show that $\vec{OP}$ is parallel to $\vec{QR}$. (1 mark)
 - Determine the magnitude of the vector $\vec{PR}$. (2 marks)
- (c) The point S has coordinates (a, b) .
- Write $\vec{QS}$ as a column vector, in terms of a and b . (2 marks)
 - Given that $\vec{QS} = \vec{OP}$, calculate the value of a and the value of b . (3 marks)
 - Using a vector method, show that $OPSQ$ is a parallelogram. (3 marks)

Total 15 marks

GO ON TO THE NEXT PAGE

14. (a) Calculate the matrix product $3AB$, where $A = \begin{pmatrix} 1 & 2 \\ 2 & 1 \end{pmatrix}$ and $B = \begin{pmatrix} 1 & 3 \\ 2 & 5 \end{pmatrix}$.
(3 marks)

- (b) The diagram below, **not drawn to scale**, shows a triangle, ABC whose coordinates are stated.



Triangle ABC undergoes two successive transformations, V followed by W , where

$$V = \begin{pmatrix} 2 & 0 \\ 0 & 2 \end{pmatrix} \text{ and } W = \begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}.$$

- (i) State the effect of V on triangle ABC . (2 marks)
- (ii) Determine the 2×2 matrix that represents the combined transformation of V followed by W . (3 marks)
- (iii) Using your matrix in (b) (ii), determine the coordinates of the image of triangle ABC under this combined transformation. (3 marks)
- (c) (i) Write the following simultaneous equations in the form $AX = B$ where A , X and B are matrices:
- $$\begin{aligned} 11x + 6y &= 6 \\ 9x + 5y &= 7 \end{aligned}$$
- (2 marks)
- (ii) **Hence**, write the solution for x and y as a product of two matrices. (2 marks)

Total 15 marks

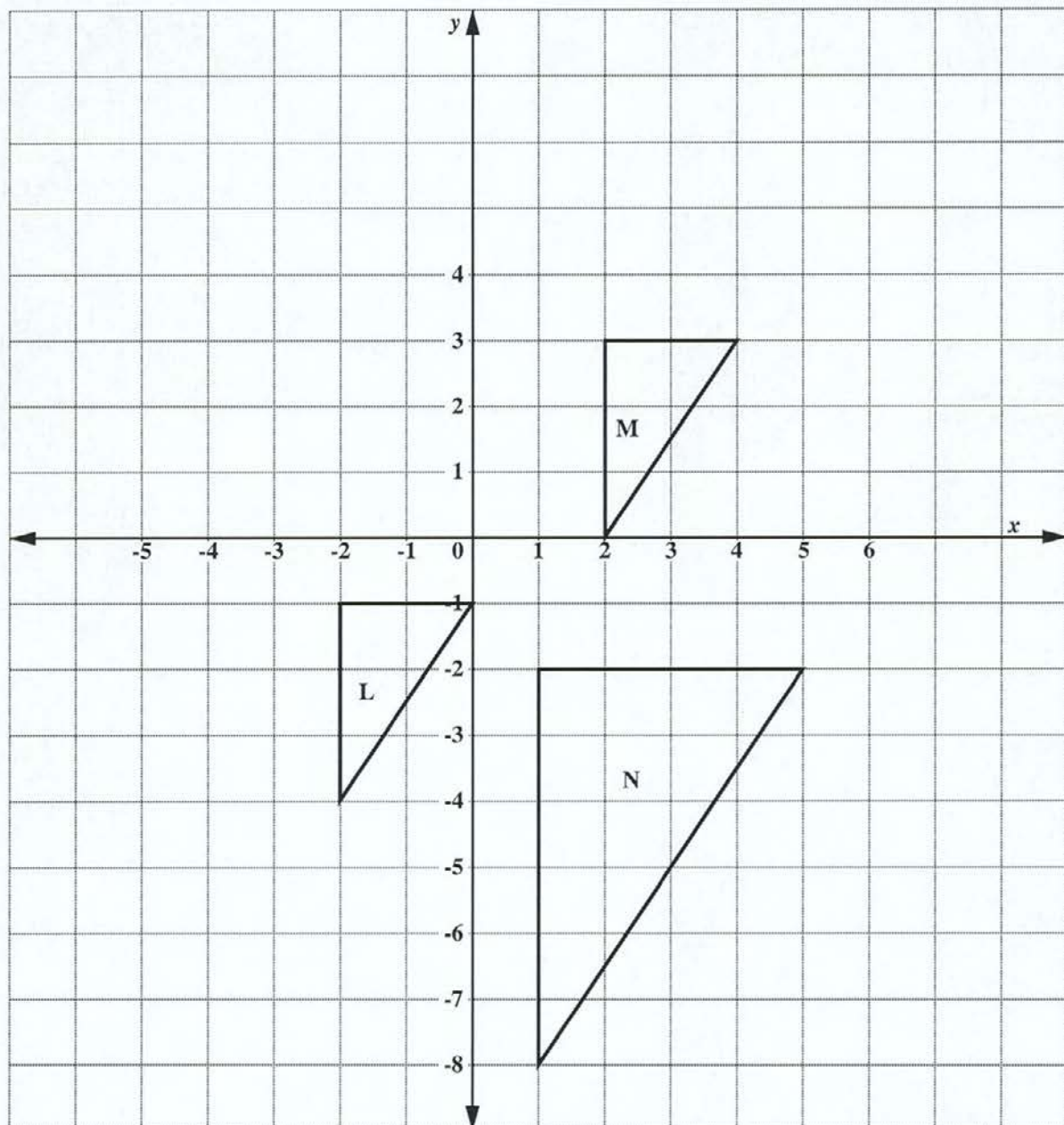
END OF TEST

CARIBBEAN EXAMINATIONS COUNCIL
SECONDARY EDUCATION CERTIFICATE
EXAMINATION
MATHEMATICS

Paper 02 – General Proficiency

Answer Sheet for Question 6 (b)

Candidate Number



ATTACH THIS ANSWER SHEET TO YOUR ANSWER BOOKLET

Candidate Number

No. of dots d	Pattern connecting l and d	No. of line segments l
5	$2 \times 5 - 4$	6
8	$2 \times 8 - 4$	12
11	$2 \times 11 - 4$	18
62	()	()
()	()	180

(iii) _____

01234020/JANUARY/F 2009

TEST CODE **01234020**

FORM TP 2009015

JANUARY 2009

CARIBBEAN EXAMINATIONS COUNCIL

**SECONDARY EDUCATION CERTIFICATE
EXAMINATION**

MATHEMATICS

Paper 02 – General Proficiency

Answer Sheet for Question 10 (b)

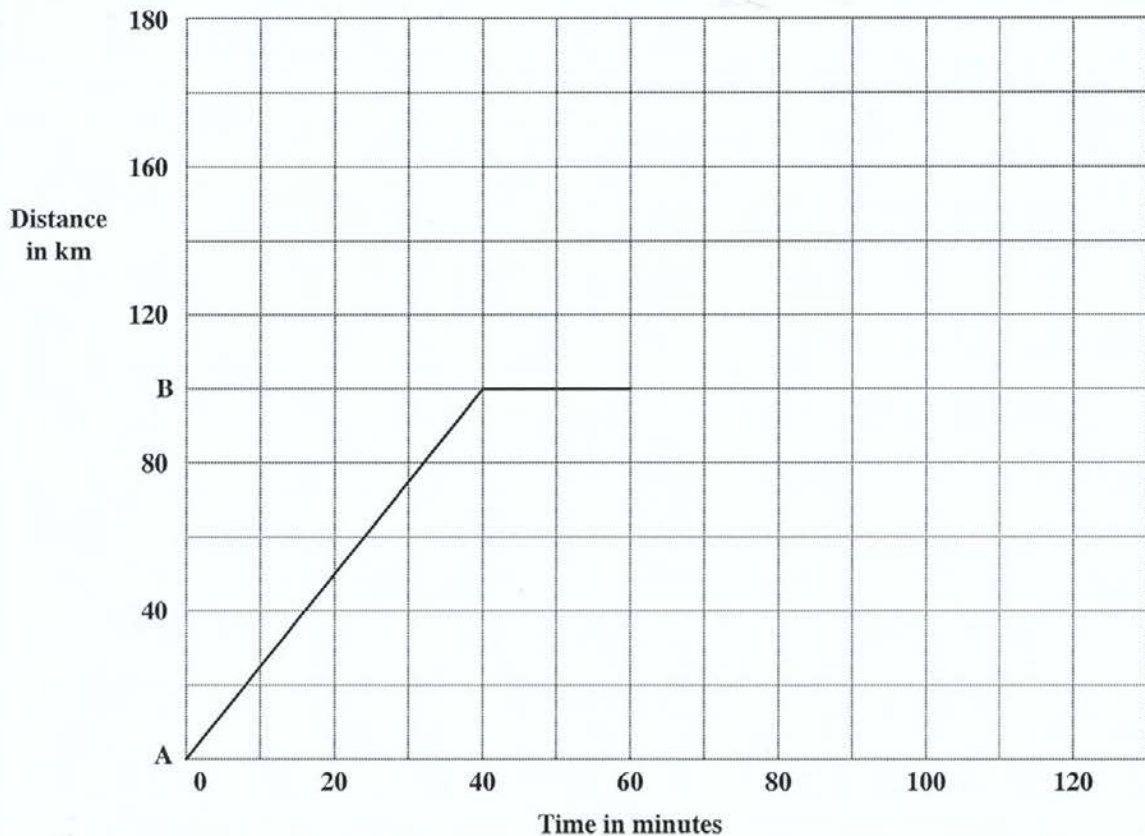
Candidate Number

(i) _____

(ii) _____

(iii) _____

(iv)



ATTACH THIS ANSWER SHEET TO YOUR ANSWER BOOKLET

TEST CODE **01234020**

FORM TP 2009092

MAY/JUNE 2009

**CARIBBEAN EXAMINATIONS COUNCIL
SECONDARY EDUCATION CERTIFICATE
EXAMINATION
MATHEMATICS**

Paper 02 – General Proficiency

2 hours 40 minutes

20 MAY 2009 (a.m.)

INSTRUCTIONS TO CANDIDATES

1. Answer ALL questions in Section I, and ANY TWO in Section II.
2. Write your answers in the booklet provided.
3. All working must be shown clearly.
4. A list of formulae is provided on page 2 of this booklet.

Examination Materials

Electronic calculator (non-programmable)
Geometry set
Mathematical tables
Graph paper (provided)

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

Copyright © 2007 Caribbean Examinations Council®.
All rights reserved.

LIST OF FORMULAE

Volume of a prism $V = Ah$ where A is the area of a cross-section and h is the perpendicular length.

Volume of cylinder $V = \pi r^2 h$ where r is the radius of the base and h is the perpendicular height.

Volume of a right pyramid $V = \frac{1}{3} Ah$ where A is the area of the base and h is the perpendicular height.

Circumference $C = 2\pi r$ where r is the radius of the circle.

Area of a circle $A = \pi r^2$ where r is the radius of the circle.

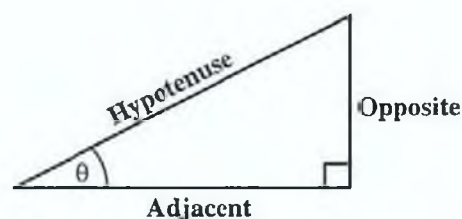
Area of trapezium $A = \frac{1}{2} (a + b) h$ where a and b are the lengths of the parallel sides and h is the perpendicular distance between the parallel sides.

Roots of quadratic equations If $ax^2 + bx + c = 0$,
then $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Trigonometric ratios

$$\sin \theta = \frac{\text{opposite side}}{\text{hypotenuse}}$$

$$\cos \theta = \frac{\text{adjacent side}}{\text{hypotenuse}}$$

$$\tan \theta = \frac{\text{opposite side}}{\text{adjacent side}}$$


Area of triangle Area of $\Delta = \frac{1}{2} bh$ where b is the length of the base and h is the perpendicular height

$$\text{Area of } \Delta ABC = \frac{1}{2} ab \sin C$$

$$\text{Area of } \Delta ABC = \sqrt{s(s-a)(s-b)(s-c)}$$

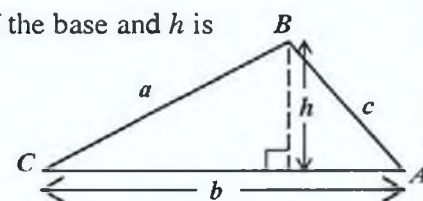
$$\text{where } s = \frac{a + b + c}{2}$$

Sine rule

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

Cosine rule

$$a^2 = b^2 + c^2 - 2bc \cos A$$



GO ON TO THE NEXT PAGE

SECTION I

Answer ALL the questions in this section.

All working must be clearly shown.

1. (a) Using a calculator, or otherwise, calculate the EXACT value of

$$(i) \quad \frac{2\frac{2}{3} + 1\frac{1}{5}}{6\frac{2}{5}}$$

giving your answer as a common fraction

(3 marks)

$$(ii) \quad \sqrt{\left(\frac{0.0256}{25}\right)}$$

giving your answer in standard form.

(3 marks)

- (b) The basic wage earned by a truck driver for a 40-hour week is \$560.00.

- (i) Calculate his hourly rate.

(1 mark)

For overtime work, the driver is paid one and a half times the basic hourly rate.

- (ii) Calculate his overtime wage for 10 hours of overtime.

(2 marks)

- (iii) Calculate the TOTAL wages earned by the truck driver for a 55-hour week.

(3 marks)

Total 12 marks

2. (a) Factorise completely:

(i) $2ax + 3ay - 2bx - 3by$

(2 marks)

(ii) $5x^2 - 20$

(2 marks)

(iii) $3x^2 + 4x - 15$

(2 marks)

- (b) One packet of biscuits costs \$x and one cup of ice cream costs \$y.

One packet of biscuits and two cups of ice cream cost \$8.00, while three packets of biscuits and one cup of ice cream cost \$9.00.

- (i) Write a pair of simultaneous equations in x and y to represent the given information above.

(2 marks)

- (ii) Solve the equations obtained in (b) (i) above to find the cost of one packet of biscuits and the cost of one cup of ice cream.

(4 marks)

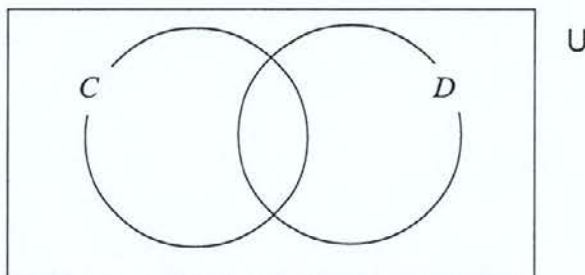
Total 12 marks

GO ON TO THE NEXT PAGE

3. (a) In a survey of 50 students,
 23 owned cellular phones
 18 owned digital cameras
 x owned cellular phones and digital cameras
 $2x$ owned neither.

Let C represent the set of students in the survey who owned cellular phones, and D the set of students who owned digital cameras.

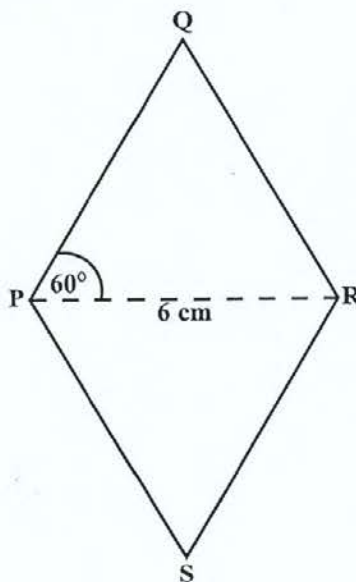
- (i) Copy and complete the Venn diagram below to represent the information obtained from the survey.



(2 marks)

- (ii) Write an expression in x for the TOTAL number of students in the survey. (1 mark)
- (iii) Calculate the value of x . (2 marks)

- (b) The diagram below, **not drawn to scale**, shows a rhombus, $PQRS$, with the diagonal $PR = 6$ cm, and the angle $RPQ = 60^\circ$.



- (i) Using a ruler, a pencil, and a pair of compasses, construct the rhombus $PQRS$ accurately. (4 marks)
- (ii) Join QS . Measure and state, in centimetres, the length of QS . (2 marks)

Total 11 marks

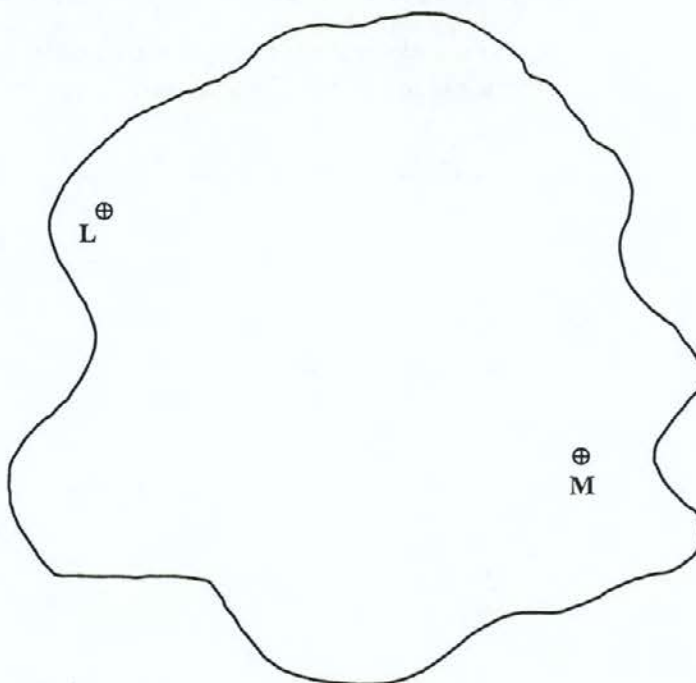
GO ON TO THE NEXT PAGE

4. (a) The table below shows two readings taken from an aircraft's flight record.

Time	Distance Travelled (km)
08:55	957
09:07	1083

For the period of time between the two readings, calculate

- (i) the distance travelled in kilometres (1 mark)
 - (ii) the average speed of the aircraft in km/h. (3 marks)
- (b) The map shown below is drawn to a scale of 1:50 000.



- (i) Measure and state, in centimetres, the distance on the map from *L* to *M* along a straight line. (2 marks)
- (ii) Calculate the actual distance, in kilometres, from *L* to *M*. (2 marks)
- (iii) The actual distance between two points is 4.5 km. Calculate the number of centimetres that should be used to represent this distance on the map. (3 marks)

Total 11 marks

GO ON TO THE NEXT PAGE

5. (a) Given that $f(x) = 2x - 5$ and $g(x) = x^2 - 31$, calculate the value of

(i) $f(-2)$ (1 mark)

(ii) $gf(1)$ (2 marks)

(iii) $f^{-1}(3)$. (2 marks)

- (b) Given that $y = x^2 + 2x - 3$

- (i) Copy and complete the table below.

x	-4	-3	-2	-1	0	1	2
y	5		-3	-4	-3		5

(2 marks)

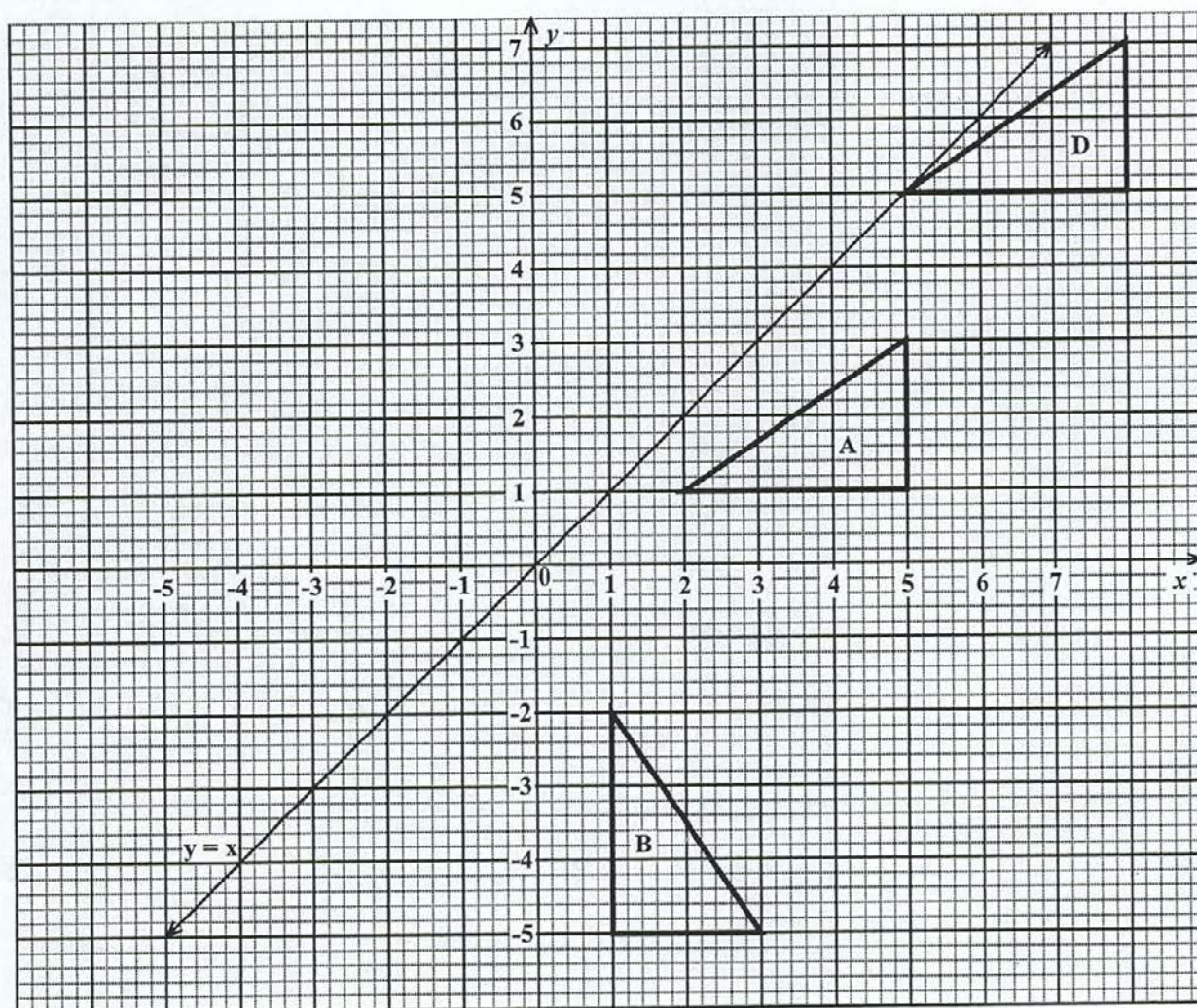
- (ii) Using a scale of **2 cm to represent 1 unit on the x-axis** and **1 cm to represent 1 unit on the y-axis**, draw the graph of $y = x^2 + 2x - 3$ for $-4 \leq x \leq 2$.

(5 marks)

Total 12 marks

GO ON TO THE NEXT PAGE

6. The diagram below shows triangles A, B and D. The line $y = x$ is also shown.



- (a) Describe, FULLY, the single transformation which maps triangle A onto
- triangle D (3 marks)
 - triangle B. (3 marks)
- (b) State the coordinates of the vertices of triangle C, the image of triangle A after a reflection in the line $y = x$. (4 marks)

Total 10 marks

GO ON TO THE NEXT PAGE

7. An answer sheet is provided for this question.

The table below shows the time, to the nearest minute, that 80 students waited to be served at a school's canteen.

Waiting Time (minutes)	No. of Students	Cumulative Frequency
1 – 5	4	4
6 – 10	7	11
11 – 15	11	22
16 – 20	18	
21 – 25	22	
26 – 30	10	
31 – 35	5	
36 – 40	3	

- (a) Copy and complete the table, showing the cumulative frequency. (2 marks)
- (b) On the answer sheet provided, use the values from your table to complete the cumulative frequency curve. (4 marks)
- (c) Use your graph from (b) above to estimate
- (i) the median for the data (2 marks)
 - (ii) the number of students who waited for **no more than** 29 minutes (2 marks)
 - (iii) the probability that a student, chosen at random from the group, waited for **no more than** 17 minutes. (2 marks)

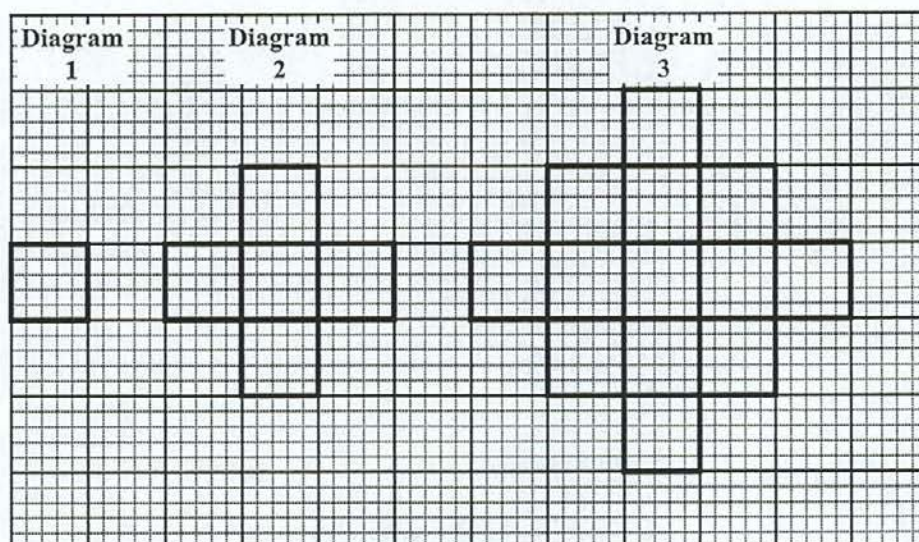
Total 12 marks

GO ON TO THE NEXT PAGE

8. An answer sheet is provided for this question.

The drawings below show the first three diagrams in a sequence. Each diagram in the sequence is obtained by drawing a 1-unit square on each side that forms the perimeter of the previous diagram.

For example, Diagram 2 is obtained by drawing a 1-unit square on each of the four sides of Diagram 1.



On the answer sheet provided:

- (a) Draw Diagram 4 in the sequence. (2 marks)
- (b) Complete the table by inserting the appropriate values at the rows marked (i), (ii) and (iii). (8 marks)

Total 10 marks

GO ON TO THE NEXT PAGE

SECTION II

Answer TWO questions in this section.

RELATIONS, FUNCTIONS AND GRAPHS

9. (a) Solve the pair of simultaneous equations

$$y = 4 - 2x$$

$$y = 2x^2 - 3x + 1.$$

(4 marks)

- (b) Express $2x^2 - 3x + 1$ in the form $a(x + h)^2 + k$, where a , h and k are real numbers.

(3 marks)

- (c) Using your answer from (b) above, or otherwise, calculate

(i) the minimum value of $2x^2 - 3x + 1$

(1 mark)

(ii) the value of x for which the minimum occurs.

(1 mark)

- (d) Sketch the graph of $y = 2x^2 - 3x + 1$, clearly showing

– the coordinates of the minimum point

– the value of the y -intercept

– the values of x where the graph cuts the x -axis.

(4 marks)

- (e) Sketch on your graph of $y = 2x^2 - 3x + 1$, the line which intersects the curve at the values of x and y calculated in (a) above.

(2 marks)

Total 15 marks

GO ON TO THE NEXT PAGE

10. (a) The owner of a shop wishes to buy x guitars and y violins. To satisfy the demands of his customers, the number of violins must be less than or equal to the number of guitars.

(i) Write an inequality to represent this information. (1 mark)

The cost of one guitar is \$150 and the cost of one violin is \$300. He has \$4 500 to spend on the purchase of these instruments.

(ii) Write an inequality to represent this information. (2 marks)

To get a good bargain, the owner of the shop must buy at least 5 violins.

(iii) Write an inequality to represent this information. (1 mark)

- (b) (i) Using a scale of **2 cm on the horizontal axis to represent 5 guitars**, and **2 cm on the vertical axis to represent 5 violins**, draw the graphs of the lines associated with the **THREE** inequalities written in (a) (i), (ii) and (iii) above. (4 marks)

(ii) Shade the region on your graph that satisfies all **THREE** inequalities. (1 mark)

(iii) State the coordinates of the vertices of the shaded region. (2 marks)

- (c) The owner of the shop sells the instruments to make a profit of \$60 on each guitar and \$100 on each violin.

(i) Express the **TOTAL** profit in terms of x and y . (1 mark)

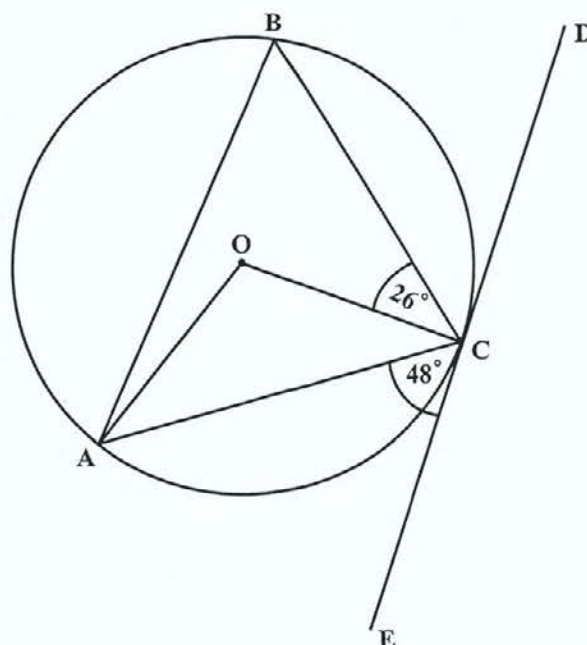
(ii) Calculate the **maximum** profit. (3 marks)

Total 15 marks

GO ON TO THE NEXT PAGE

GEOMETRY AND TRIGONOMETRY

11. (a) The diagram below, **not drawn to scale**, shows a circle, centre O . The line DCE is a tangent to the circle. Angle $ACE = 48^\circ$ and angle $OCB = 26^\circ$.

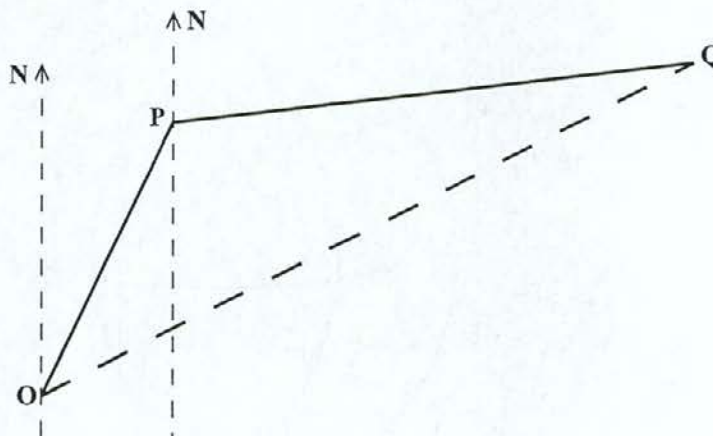


Calculate:

- | | | |
|-------|--------------|------------|
| (i) | $\angle ABC$ | (1 mark) |
| (ii) | $\angle AOC$ | (1 mark) |
| (iii) | $\angle BCD$ | (1 mark) |
| (iv) | $\angle BAC$ | (1 mark) |
| (v) | $\angle OAC$ | (1 mark) |
| (vi) | $\angle OAB$ | (1 mark) |

GO ON TO THE NEXT PAGE

- (b) The diagram below, **not drawn to scale**, shows the positions of two hurricane tracking stations, P and Q , relative to a point O . P is on a bearing of 025° from O , and $OP = 400$ km. Q is on a bearing of 080° from P and $PQ = 700$ km.



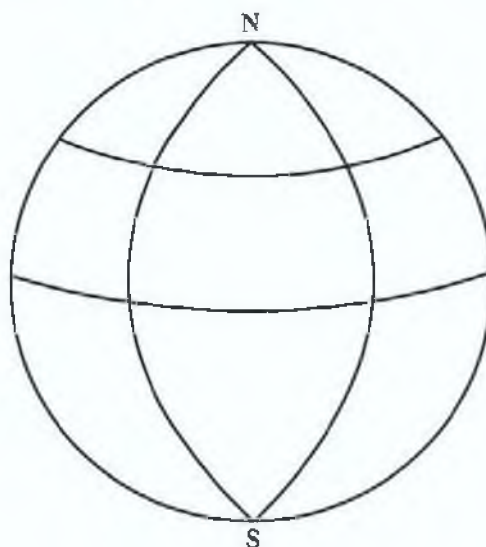
- (i) Copy the diagram above. On your diagram label the angles that show the bearings of 025° and 080° . (2 marks)
- (ii) Calculate
- $\angle OPQ$
 - the length, to the nearest kilometre, of OQ
 - the bearing of Q from O .
- (7 marks)

Total 15 marks

GO ON TO THE NEXT PAGE

12. In this question, use $\pi = \frac{22}{7}$, and assume that the earth is a sphere of radius 6370 km.

The diagram below, **not drawn to scale**, shows a sketch of the earth with the North and South Poles labelled N and S respectively.



Arcs representing circles of longitude 35°E and 15°W , and circles of latitude 0° and 60°N are drawn but not labelled.

- (a) Copy the sketch and
- (i) label the arc which represents:
 - a) 60°N
 - b) 35°E (2 marks)
 - (ii) insert the points:
 - a) J (60°N , 35°E)
 - b) K (60°N , 15°W) (2 marks)
- (b) Calculate, **to the nearest kilometre**, the SHORTEST distance from
- (i) J to the North Pole measured along the common circle of longitude (3 marks)
 - (ii) J to K measured along the common circle of latitude. (4 marks)
- (c) A point H is located 2002 km due south of K along the common circle of longitude. Calculate the latitude of H. (4 marks)

Total 15 marks

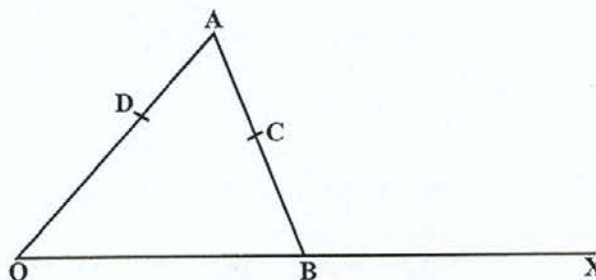
GO ON TO THE NEXT PAGE

VECTORS AND MATRICES

13. (a) The points A and B have position vectors $\vec{OA} = \begin{pmatrix} -2 \\ 5 \end{pmatrix}$ and $\vec{OB} = \begin{pmatrix} 4 \\ 2 \end{pmatrix}$ where O is the origin $(0, 0)$. The point G lies on the line AB such that $AG = \frac{1}{3}AB$.

Express in the form $\begin{pmatrix} x \\ y \end{pmatrix}$

- (i) the vectors $\vec{AB}$ and $\vec{AG}$ (4 marks)
- (ii) the position vector $\vec{OG}$. (2 marks)
- (b) In the diagram below, **not drawn to scale**, B is the midpoint of OX , C is the midpoint of AB , and D is such that $OD = 2DA$. The vectors $\mathbf{a}$ and $\mathbf{b}$ are such that $\vec{OA} = 3\mathbf{a}$ and $\vec{OB} = \mathbf{b}$.



- (i) Write in terms of $\mathbf{a}$ and $\mathbf{b}$:
- a) $\vec{AB}$
- b) $\vec{AC}$
- c) $\vec{DC}$
- d) $\vec{DX}$ (6 marks)
- (ii) State TWO geometrical relationships between DX and DC . (2 marks)
- (iii) State ONE geometrical relationship between the points D , C , and X . (1 mark)

Total 15 marks

GO ON TO THE NEXT PAGE

14. (a) The value of the determinant of $M = \begin{pmatrix} x & 4 \\ 3 & x \end{pmatrix}$ is 13.

Calculate the values of x .

(4 marks)

- (b) The transformation R is represented by the matrix $\begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$.

The transformation S is represented by the matrix $\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$.

- (i) Write a single matrix, in the form $\begin{pmatrix} a & b \\ c & d \end{pmatrix}$ to represent the combined transformation S followed by R .

(2 marks)

- (ii) Calculate the image of the point $(5, -2)$ under the combined transformation in (b) (i) above.

(3 marks)

- (c) The matrix $N = \begin{pmatrix} 3 & -1 \\ 2 & 5 \end{pmatrix}$.

- (i) Determine the inverse matrix of N .

(2 marks)

- (ii) Hence, calculate the value of x and the value of y for which

$$\begin{aligned} 3x - y &= 5 \\ 2x + 5y &= 9. \end{aligned}$$

(4 marks)

Total 15 marks

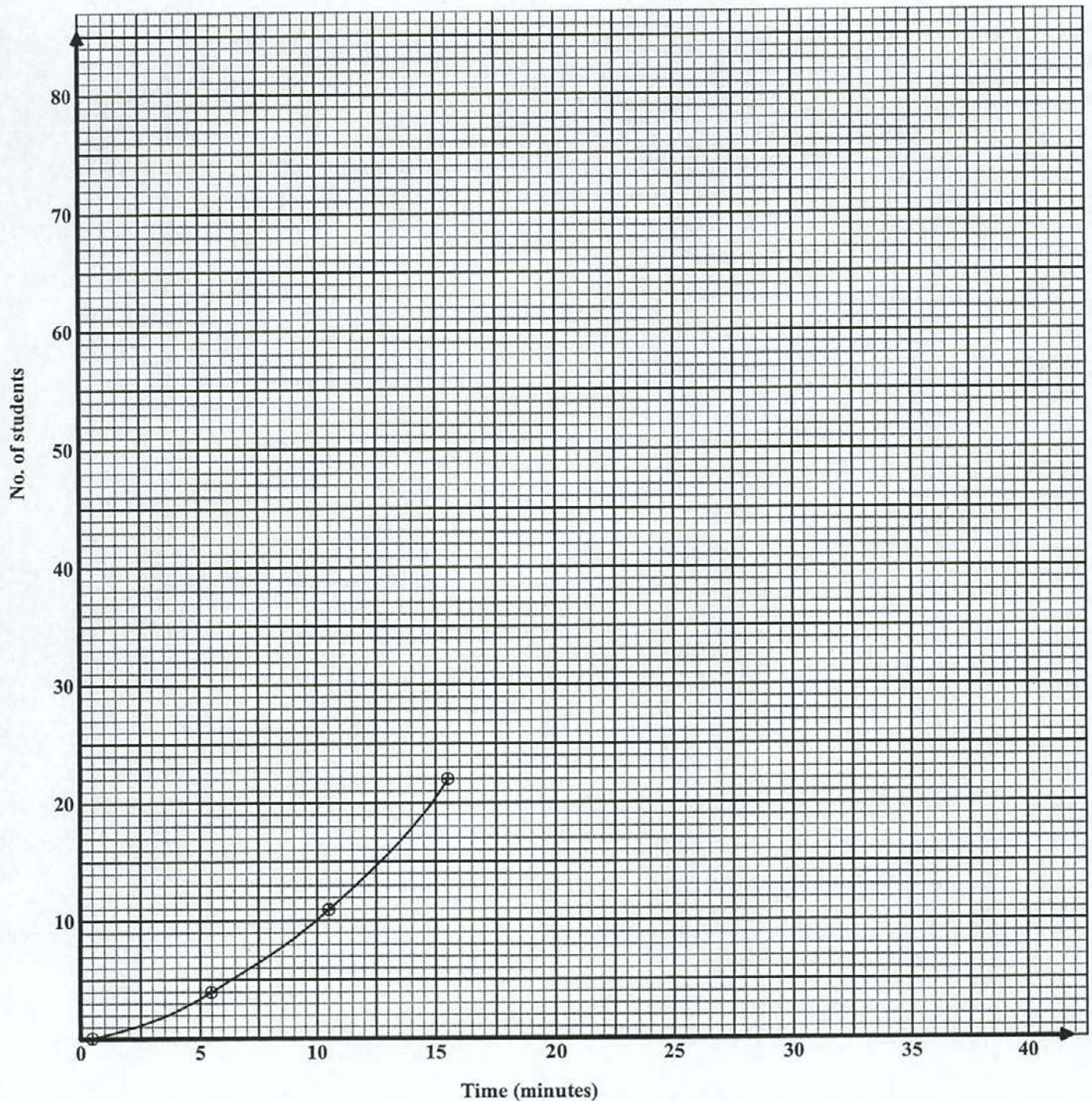
END OF TEST

CARIBBEAN EXAMINATIONS COUNCIL
SECONDARY EDUCATION CERTIFICATE
EXAMINATION
MATHEMATICS

Paper 02 – General Proficiency

Answer Sheet for Question 7 (b)

Candidate Number



ATTACH THIS ANSWER SHEET TO YOUR ANSWER BOOKLET

CARIBBEAN EXAMINATIONS COUNCIL
SECONDARY EDUCATION CERTIFICATE
EXAMINATION

Paper 02 – General Proficiency

Candidate Number

Diagram 1

Diagram 2

Diagram 3

	Diagram Number	Number of Unit Squares	Pattern for Calculating Number of Unit Squares
	1	1	$1^2 + 0^2$
	2	5	$2^2 + 1^2$
	3	13	$3^2 + 2^2$
(i)	4	_____	_____ + _____
(ii)	10	_____	_____ + _____
(iii)	_____	421	_____ + _____

01234020/F 2009

FORM TP 2009090

TEST CODE **01134020**

MAY/JUNE 2009

**CARIBBEAN EXAMINATIONS COUNCIL
SECONDARY EDUCATION CERTIFICATE
EXAMINATION
MATHEMATICS**

Paper 02 – Basic Proficiency

2 hours 40 minutes

20 MAY 2009 (a.m.)

B

INSTRUCTIONS TO CANDIDATES

1. Answer ALL questions.
2. Write your answers in the booklet provided.
3. All working must be shown clearly.
4. A list of formulae is provided on page 2 of this booklet.

Examination Materials

Electronic calculator (non-programmable)
Geometry set
Mathematical tables
Graph paper (provided)

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO

Copyright © 2008 Caribbean Examinations Council®.
All rights reserved.

01134020/F 2009

LIST OF FORMULAE

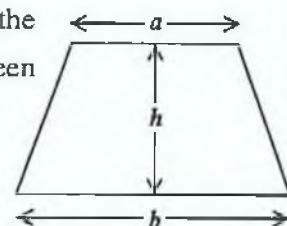
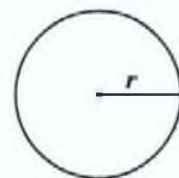
Volume of a prism $V = Ah$ where A is the area of a cross-section and h is the perpendicular length.

Volume of a right pyramid $V = \frac{1}{3}Ah$ where A is the area of the base and h is the perpendicular height.

Circumference $C = 2\pi r$ where r is the radius of the circle.

Area of a circle $A = \pi r^2$ where r is the radius of the circle.

Area of trapezium $A = \frac{1}{2}(a + b)h$ where a and b are the lengths of the parallel sides and h is the perpendicular distance between the parallel sides.

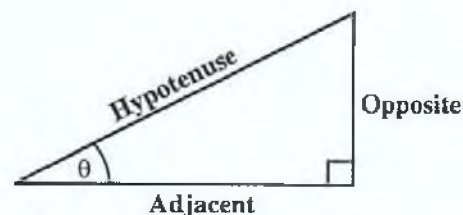


Roots of quadratic equations If $ax^2 + bx + c = 0$,
then $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

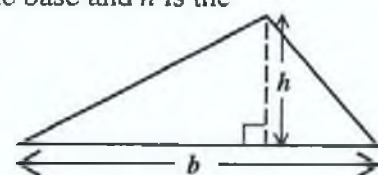
Trigonometric ratios $\sin \theta = \frac{\text{opposite side}}{\text{hypotenuse}}$

$\cos \theta = \frac{\text{adjacent side}}{\text{hypotenuse}}$

$\tan \theta = \frac{\text{opposite side}}{\text{adjacent side}}$

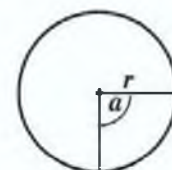


Area of triangle Area of $\Delta = \frac{1}{2}bh$ where b is the length of the base and h is the perpendicular height



Area of sector Area = $\frac{a}{360} \times \pi r^2$

where a is measured in degrees.



Length of Arc Arc length = $\frac{a}{360} \times 2\pi r$

GO ON TO THE NEXT PAGE

SECTION I

All working must be clearly shown.

1. (a) Calculate the EXACT value of

$$\frac{2\frac{1}{3} - \frac{5}{6}}{2\frac{1}{4}}$$

(3 marks)

- (b) A table shows the following rate of exchange.

US \$1.00 = JM \$70.50

Convert JM \$2000 to US \$, giving your answer to two decimal places. (3 marks)

- (c) The mean (average) mass of the 11 men on the West Indies cricket team is 70 kg.

- (i) Calculate the TOTAL mass, in kilograms, of the eleven-member team.

The captain of the team weighs 90 kg.

- (ii) Calculate the mean (average) mass of the other 10 members of the team.

(4 marks)

Total 10 marks

2. (a) Simplify

$$\frac{8x^5 \times 3x^2}{12x^4}$$

(3 marks)

- (b) If
- $m = 3$
- and
- $n = -4$
- , calculate the value of
- $mn + n^2$
- .

(3 marks)

- (c) Solve the equation

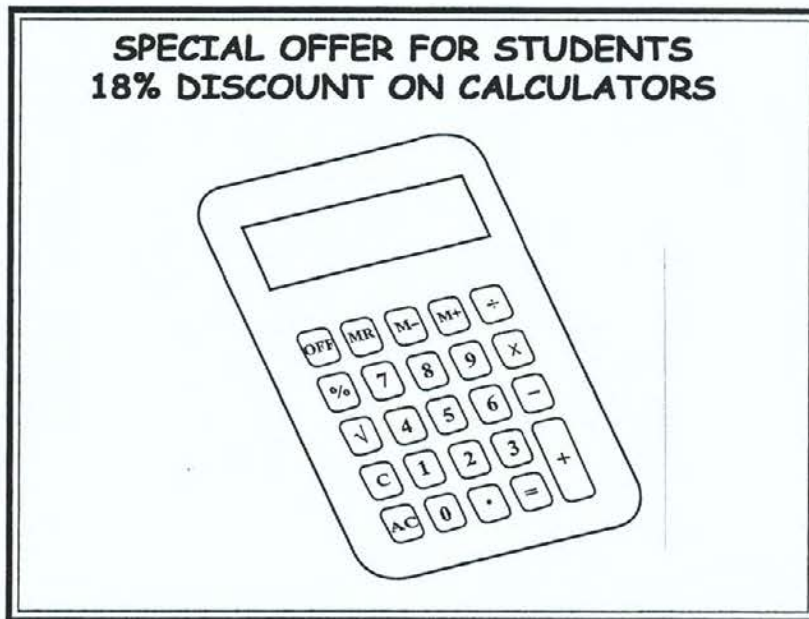
$$\frac{2}{3}x - 1 = \frac{1}{2}x$$

(4 marks)

Total 10 marks

GO ON TO THE NEXT PAGE

3. (a) A company buys calculators for \$70.00 each and sells them for \$110.00 each.
- (i) Calculate the profit made by selling one calculator. (1 mark)
 - (ii) Express your answer in (i) above as a percentage of the cost price. (2 marks)
 - (iii) The company offers 18% discount on the calculators to students, as shown in the advertisement below.



A student bought ONE calculator.

Calculate

- a) the discount on the purchase
 - b) the price paid for the calculator. (4 marks)
- (b) A customer can buy a stove on hire purchase by making a down payment of \$500.00 and repaying the balance in 24 equal monthly instalments.

If the TOTAL cost of the stove on hire purchase is \$4 064.00, calculate the amount of EACH monthly instalment. (3 marks)

Total 10 marks

GO ON TO THE NEXT PAGE

4. (a) Solve for x and y :
- $$\begin{aligned} 3x - y &= 5 \\ 2x + 5y &= 9 \end{aligned}$$
- (5 marks)
- (b) Amber was paid \$ x for a baby-sitting job. Pearl was paid \$24.00 MORE than Amber.
- (i) Write an expression in x to represent the amount of money paid to Pearl.
(1 mark)
- (ii) The TOTAL amount of money paid to Amber and Pearl was \$84.00.
- a) Write an equation in x to represent this information.
- b) Determine the value of x .
(4 marks)

Total 10 marks

5. (a) Kurt invested \$5000 in a Savings Account at a Credit Union at 8% simple interest per annum.
- Calculate
- (i) the interest earned at the end of 18 months (2 marks)
- (ii) the amount of time that is required to earn \$2000 in interest. (2 marks)
- (b) The table below shows Mr. John's electricity bill for the month of May.
- Calculate the missing values at (i), (ii), (iii), (iv), (v) and (vi).

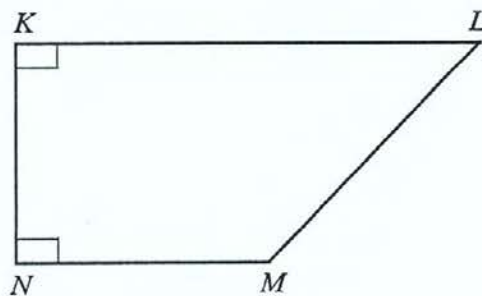
Previous Reading (i) _____ kWh	Present Reading 6129 kWh	kWh Used 216
Fixed Charge		\$25.00
Energy Charge	\$1.05 per kWh	(ii) _____
Fuel Charge	\$0.55 per kWh	(iii) _____
Total Charge		(iv) _____
5% Discount for Early Payment		(v) _____
Net Amount Due		(vi) _____

(6 marks)

Total 10 marks

GO ON TO THE NEXT PAGE

6. The diagram below, **not drawn to scale**, shows a quadrilateral $KLMN$.



- (a) Using **a pencil, a ruler and a protractor** only, draw accurately the quadrilateral $KLMN$ such that:

$$KN = MN = 6 \text{ cm}$$

$$\angle KNM = \angle NKL = 90^\circ$$

$$KL = 10 \text{ cm}$$

(5 marks)

- (b) Measure and state

(i) the length of LM

(ii) the size of angle NML .

(2 marks)

- (c) State ONE reason why KL is parallel to NM .

(2 marks)

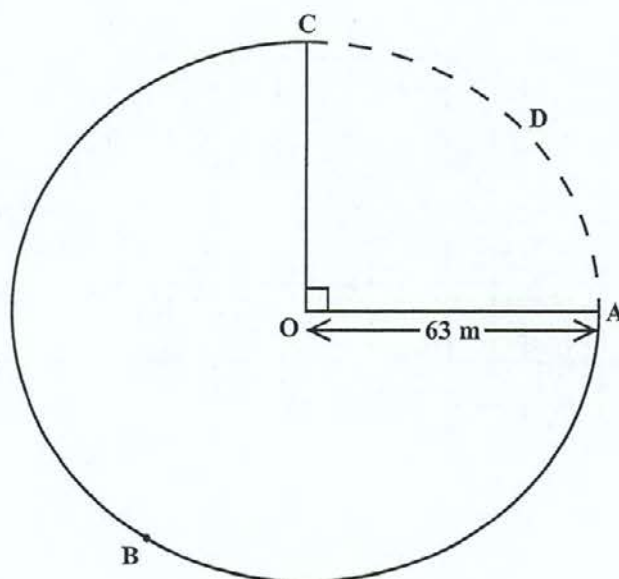
- (d) What type of quadrilateral is $KLMN$?

(1 mark)

Total 10 marks

GO ON TO THE NEXT PAGE

7. The diagram below, **not drawn to scale**, shows a field, $ABCO$, whose boundaries are an arc ABC and two radii OA and OC of a circle.



Use $\pi = \frac{22}{7}$

- (a) Calculate
- (i) the circumference of the complete circle $ABCD$ (2 marks)
 - (ii) the length of the minor arc ADC (2 marks)
 - (iii) the perimeter of the closed field $ABCO$. (3 marks)

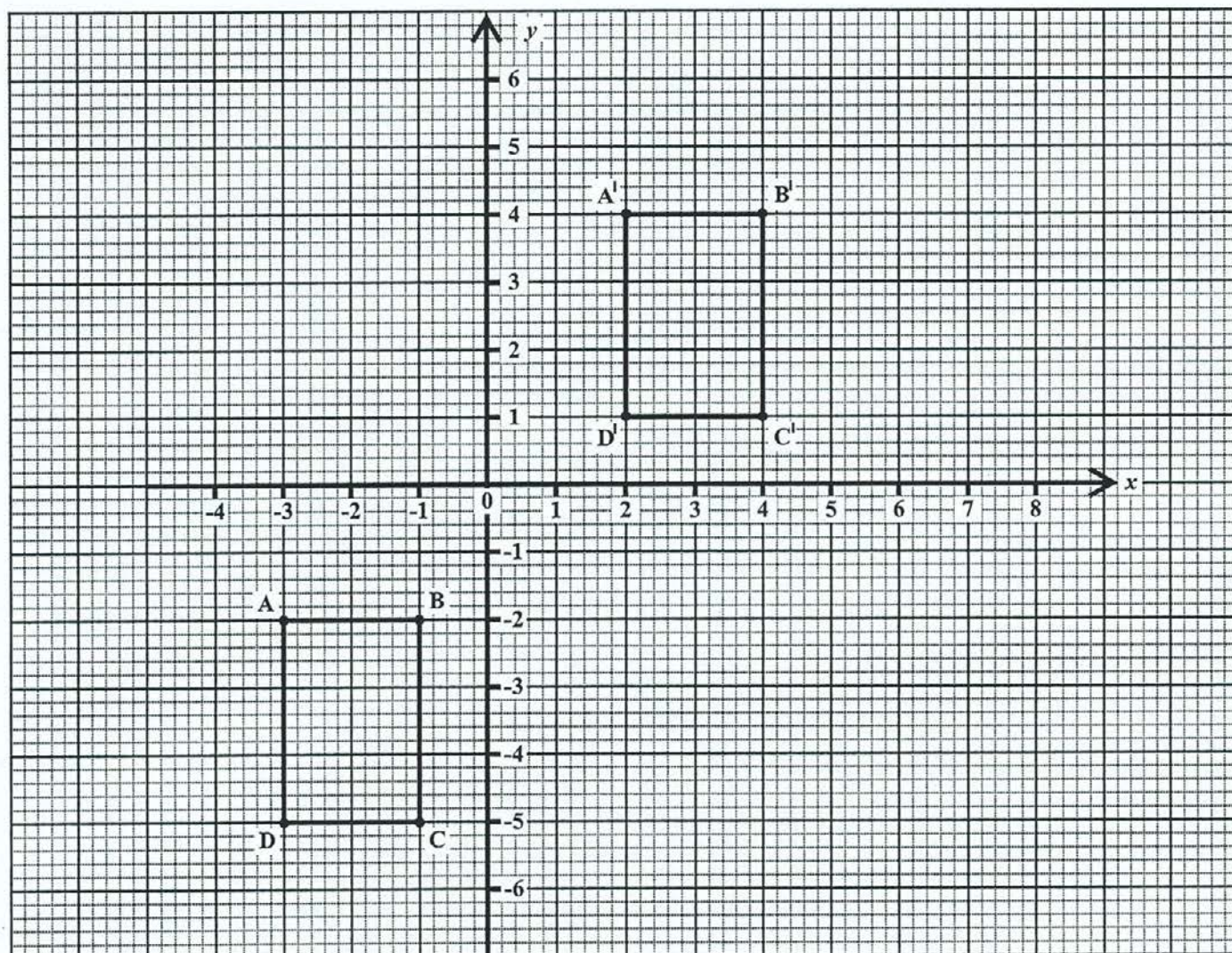
An athlete takes 1 minute and 30 seconds to run around the entire closed field, $ABCO$.

- (b) Calculate the speed of the athlete in ms^{-1} . (3 marks)

Total 10 marks

8. An answer sheet is provided for this question.

The graph below shows rectangle $ABCD$ and its image $A'B'C'D'$.

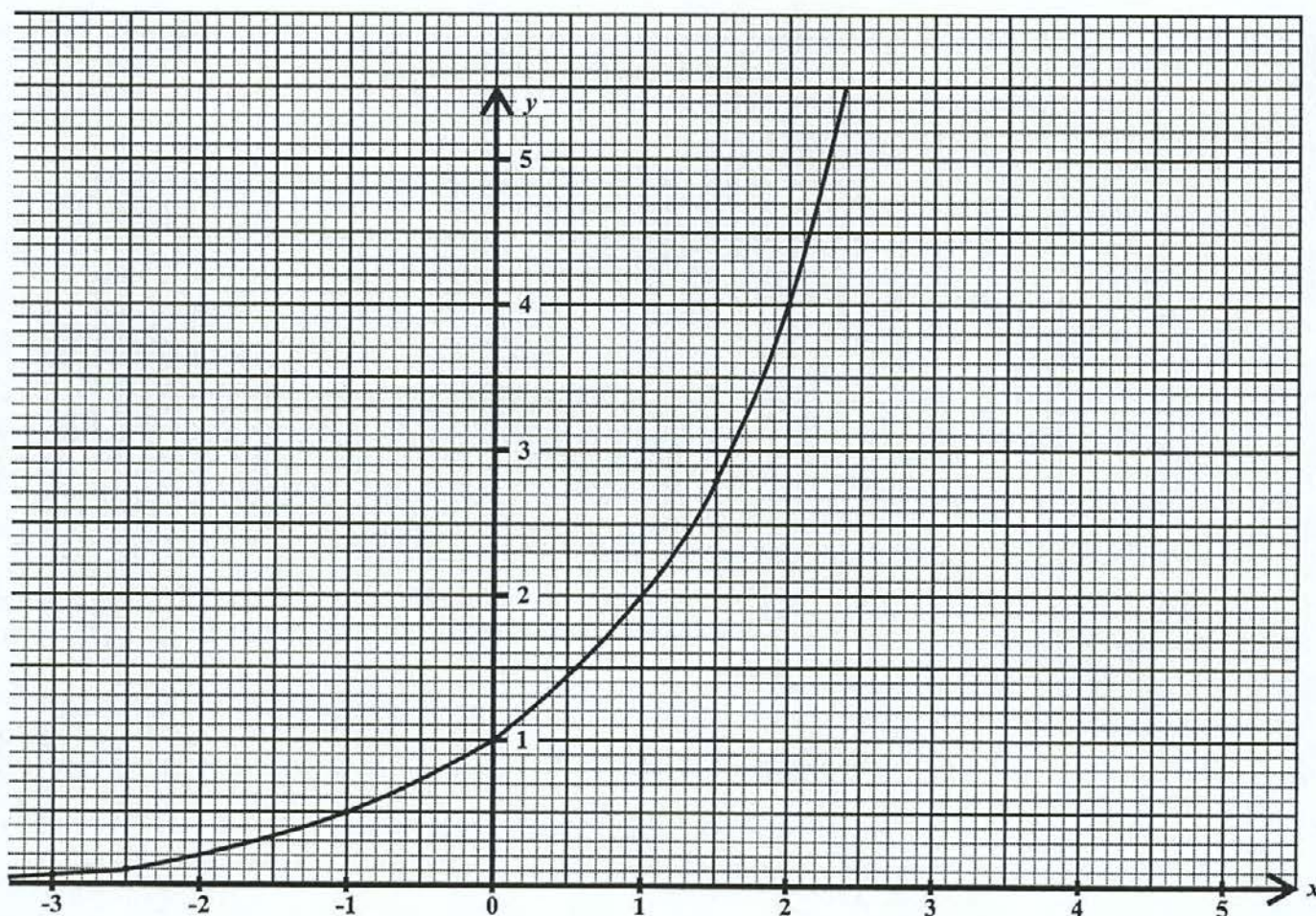


- (a) Write down the coordinates of A and A' . (2 marks)
- (b) Describe FULLY the transformation which maps $ABCD$ onto $A'B'C'D'$. (3 marks)
- (c) On the answer sheet provided, draw and label $A''B''C''D''$, the image of $A'B'C'D'$ after a reflection in the line $x = 5$. (5 marks)

Total 10 marks

GO ON TO THE NEXT PAGE

9. (a) The diagram below shows the graph of the function $y = 2^x$.



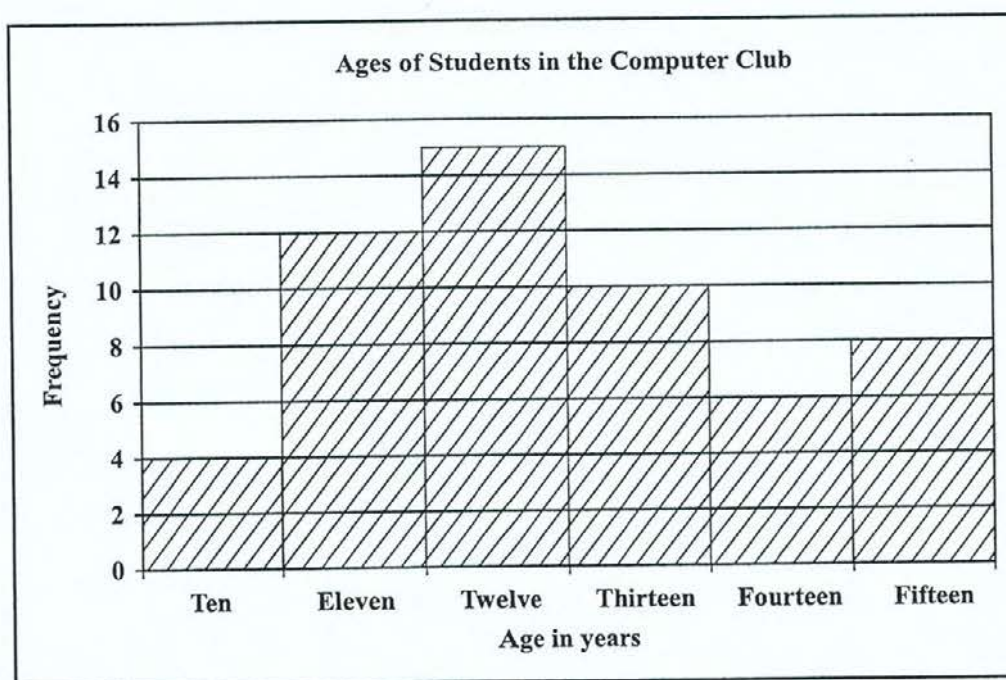
Using the graph, state the value of

- (i) y when $x = -1$
 - (ii) x when $y = 5$. (2 marks)
- (b) A straight line passes through the points $A (0, 3)$ and $B (-2, 5)$.
Determine
- (i) the gradient of the line segment AB (2 marks)
 - (ii) the equation of the line segment AB (2 marks)
 - (iii) the coordinates of the point where AB cuts the x axis (2 marks)
 - (iv) the equation of the line which is perpendicular to AB , and passes through the origin. (2 marks)

Total 10 marks

GO ON TO THE NEXT PAGE

10. The histogram below shows the ages of the students in a Computer Club.



- (a) Copy and complete the frequency table below to represent the data shown in the histogram.

Age (years)	10	11	12	13	14	15
Frequency		12		10	6	8

(2 marks)

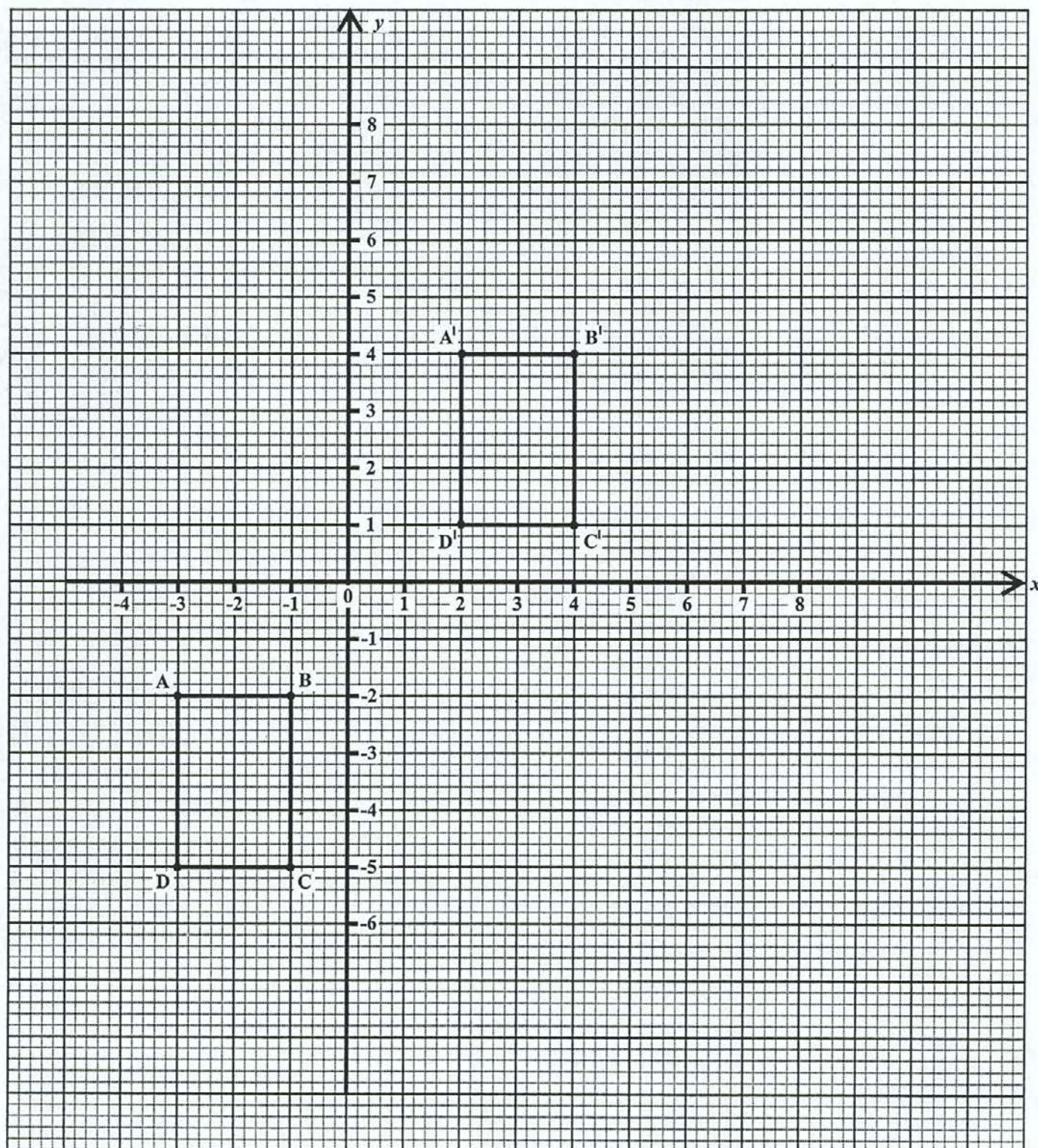
- (b) How many students are members of the Computer Club? (2 marks)
- (c) Calculate the mean age of the students in the Computer Club. (3 marks)

Javed is a member of the Computer Club. There are 14 students in the club who are older than he is.

- (d) How old is Javed? (1 mark)
- (e) Calculate the probability that a student chosen at random is twelve years old or younger. (2 marks)

Total 10 marks

END OF TEST

CARIBBEAN EXAMINATIONS COUNCIL**SECONDARY EDUCATION CERTIFICATE****EXAMINATION****MATHEMATICS****Paper 02 – Basic Proficiency****Answer Sheet for Question 8****Candidate Number****ATTACH THIS ANSWER SHEET TO YOUR ANSWER BOOKLET**

FORM TP 2010015



TEST CODE **01234020**

JANUARY 2010

C A R I B B E A N E X A M I N A T I O N S C O U N C I L

**SECONDARY EDUCATION CERTIFICATE
EXAMINATION**

MATHEMATICS

Paper 02 – General Proficiency

2 hours 40 minutes

05 JANUARY 2010 (a.m.)

INSTRUCTIONS TO CANDIDATES

1. Answer ALL questions in Section I, and ANY TWO in Section II.
2. Write your answers in the booklet provided.
3. All working must be clearly shown.
4. A list of formulae is provided on page 2 of this booklet.

Examination Materials

Electronic calculator (non-programmable)

Geometry set

Mathematical tables (provided)

Graph paper (provided)

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

Copyright © 2009 Caribbean Examinations Council®.

All rights reserved.

01234020/JANUARY/F 2010

LIST OF FORMULAE

Volume of a prism $V = Ah$ where A is the area of a cross-section and h is the perpendicular length.

Volume of cylinder $V = \pi r^2 h$ where r is the radius of the base and h is the perpendicular height.

Volume of a right pyramid $V = \frac{1}{3} Ah$ where A is the area of the base and h is the perpendicular height.

Circumference $C = 2\pi r$ where r is the radius of the circle.

Area of a circle $A = \pi r^2$ where r is the radius of the circle.

Area of trapezium $A = \frac{1}{2} (a + b) h$ where a and b are the lengths of the parallel sides and h is the perpendicular distance between the parallel sides.

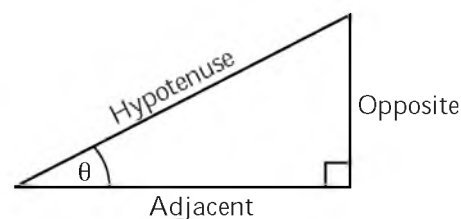
Roots of quadratic equations If $ax^2 + bx + c = 0$,

$$\text{then } x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Trigonometric ratios $\sin \theta = \frac{\text{opposite side}}{\text{hypotenuse}}$

$$\cos \theta = \frac{\text{adjacent side}}{\text{hypotenuse}}$$

$$\tan \theta = \frac{\text{opposite side}}{\text{adjacent side}}$$



Area of triangle Area of $\Delta = \frac{1}{2} bh$ where b is the length of the base and h is the perpendicular height

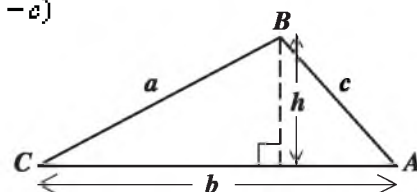
$$\text{Area of } \Delta ABC = \frac{1}{2} ab \sin C$$

$$\text{Area of } \Delta ABC = \sqrt{s(s-a)(s-b)(s-c)}$$

$$\text{where } s = \frac{a+b+c}{2}$$

$$\text{Sine rule } \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$\text{Cosine rule } a^2 = b^2 + c^2 - 2bc \cos A$$



GO ON TO THE NEXT PAGE

SECTION I

Answer ALL the questions in this section.

All working must be clearly shown.

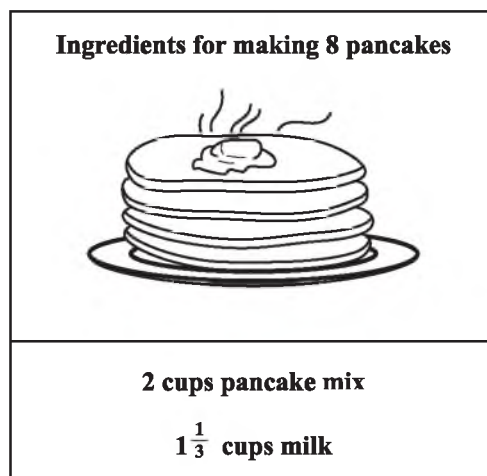
1. (a) Using a calculator, or otherwise, calculate the exact value of

$$\frac{2.76}{0.8} + 8.7^2 . \quad (3 \text{ marks})$$

- (b) In a certain company, a salesman is paid a fixed salary of \$3 140 per month plus an annual commission of 2% on the TOTAL value of cars sold for the year. If the salesman sold cars valued at \$720 000 in 2009, calculate

- (i) his fixed salary for the year (1 mark)
- (ii) the amount he received in commission for the year (1 mark)
- (iii) his TOTAL income for the year. (1 mark)

- (c) The ingredients for making pancakes are shown in the diagram below.



- (i) Ryan wishes to make 12 pancakes using the instructions given above. Calculate the number of cups of pancake mix he must use. (2 marks)
- (ii) Neisha used 5 cups of milk to make pancakes using the same instructions. How many pancakes did she make? (3 marks)

Total 11 marks

GO ON TO THE NEXT PAGE

2. (a) Given that $a = 6$, $b = -4$ and $c = 8$, calculate the value of

$$\frac{a^2 + b}{c - b} . \quad (3 \text{ marks})$$

- (b) Simplify the expression:

(i) $3(x - y) + 4(x + 2y)$ (2 marks)

(ii) $\frac{4x^2 \times 3x^4}{6x^3}$ (3 marks)

- (c) (i) Solve the inequality

$$x - 3 < 3x - 7 . \quad (3 \text{ marks})$$

- (ii) If x is an integer, determine the SMALLEST value of x that satisfies the inequality in (c) (i) above. (1 mark)

Total 12 marks

3. (a) T and E are subsets of a universal set, U , such that:

$$U = \{ 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 \}$$

$$T = \{ \text{multiples of } 3 \}$$

$$E = \{ \text{even numbers} \}$$

- (i) Draw a Venn diagram to represent this information. (4 marks)

- (ii) List the members of the set

a) $T \cap E$ (1 mark)

b) $(T \cup E)'$. (1 mark)

GO ON TO THE NEXT PAGE

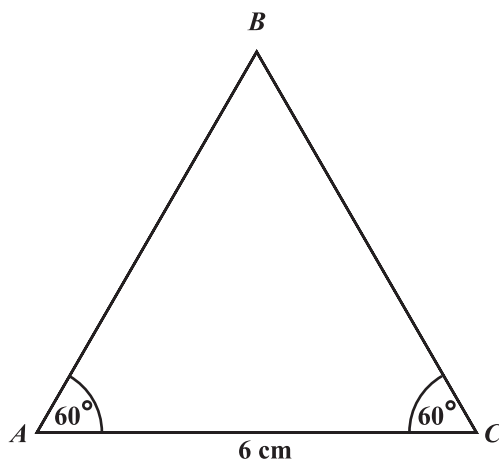
(b) Using a pencil, a ruler, and a pair of compasses only:

(i) Construct, accurately, the triangle ABC shown below, where,

$$AC = 6 \text{ cm}$$

$$\angle ACB = 60^\circ$$

$$\angle CAB = 60^\circ$$



(3 marks)

(ii) Complete the diagram to show the kite, $ABCD$, in which $AD = 5 \text{ cm}$.

(2 marks)

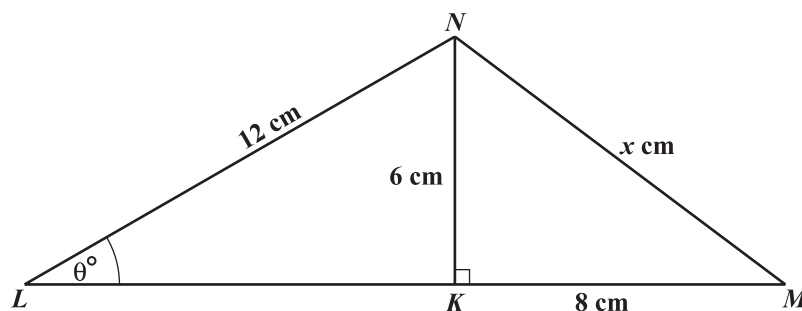
(iii) Measure and state the size of $\angle DAC$.

(1 mark)

Total 12 marks

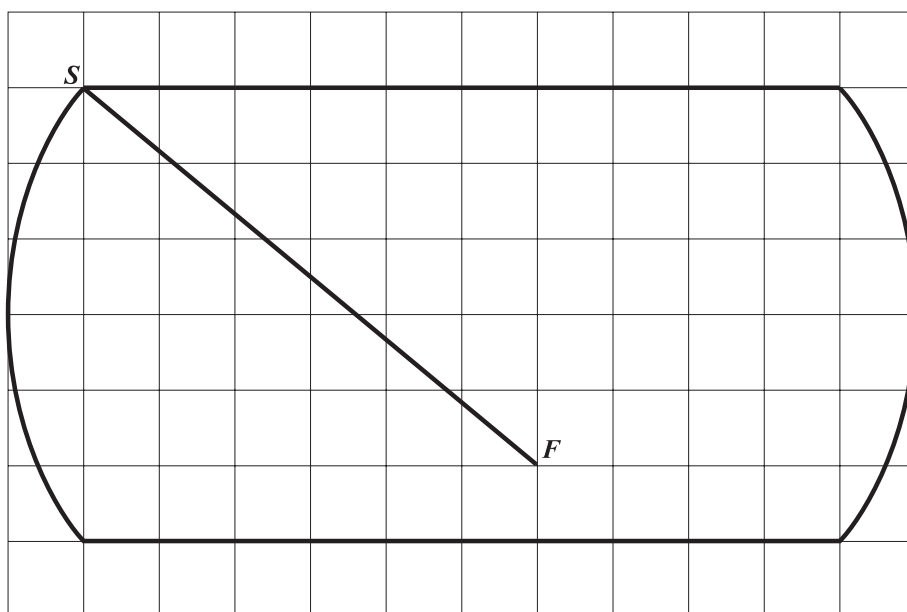
GO ON TO THE NEXT PAGE

4. (a) The diagram below, **not drawn to scale**, shows a triangle LMN with $LN = 12$ cm, $NM = x$ cm and $\angle NLM = \theta^\circ$. The point K on LM is such that NK is perpendicular to LM , $NK = 6$ cm, and $KM = 8$ cm.



Calculate the value of

- (i) x (2 marks)
- (ii) θ . (3 marks)
- (b) The diagram below shows a map of a playing field drawn on a grid of 1 cm squares. **The scale of the map is 1 : 1 250.**



- (i) Measure and state, in centimetres, the distance from S to F on the map. (1 mark)
- (ii) Calculate the distance, in metres, from S to F on the ACTUAL playing field. (2 marks)

GO ON TO THE NEXT PAGE

- (iii) Daniel ran the distance from S to F in 9.72 seconds. Calculate his average speed in

a) m/s

b) km/h

giving your answer correct to 3 significant figures.

(3 marks)

Total 11 marks

5. (a) A straight line passes through the point $T(4,1)$ and has a gradient of $\frac{3}{5}$. Determine the equation of this line. (3 marks)
- (b) (i) **Using a scale of 1 cm to represent 1 unit on both axes**, draw the triangle ABC with vertices $A(2,3)$, $B(5,3)$ and $C(3,6)$. (3 marks)
- (ii) On the same axes used in (b) (i), draw and label the line $y = 2$. (1 mark)
- (iii) Draw the image of triangle ABC under a reflection in the line $y = 2$. Label the image $A'B'C'$. (2 marks)
- (iv) Draw a new triangle $A''B''C''$ with vertices $A''(-7,4)$, $B''(-4,4)$ and $C''(-6,7)$. (1 mark)
- (v) Name and describe the single transformation that maps triangle ABC onto triangle $A''B''C''$. (2 marks)

Total 12 marks

GO ON TO THE NEXT PAGE

6. A class of 26 students each recorded the distance travelled to school. The distance, to the nearest km, is recorded below:

21 11 3 22 6 32 22 18 28
 26 16 17 34 12 25 8 19 14
 39 17 22 24 30 18 13 23

- (a) Copy and complete the frequency table to represent this data.

Distance in kilometres	Frequency
1 - 5	1
6 - 10	2
11 - 15	4
16 - 20	6
21 - 25	
26 - 30	
31 - 35	
36 - 40	

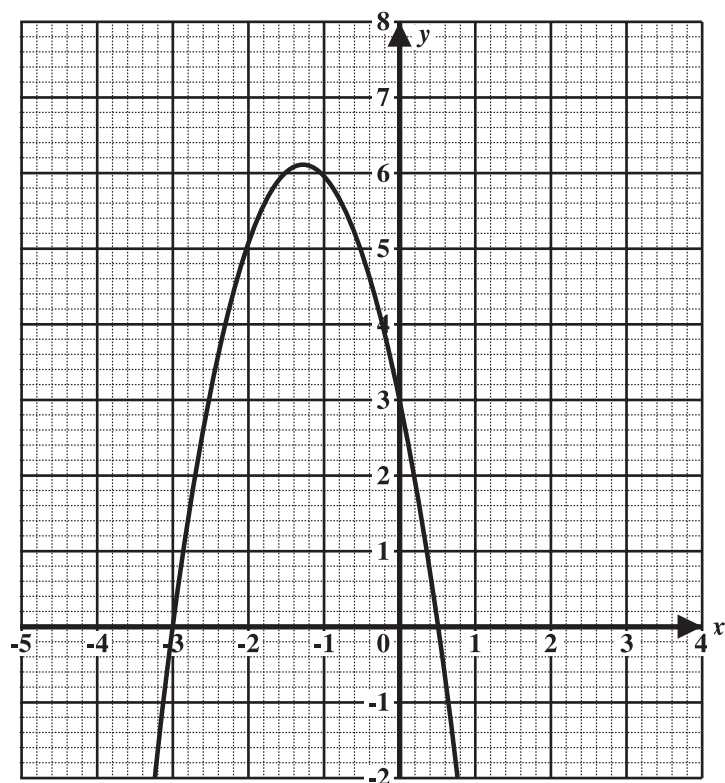
(2 marks)

- (b) Using a scale of 2 cm to represent 5 km on the horizontal axis and a scale of 1 cm to represent 1 student on the vertical axis, draw a histogram to represent the data.
(5 marks)
- (c) Calculate the probability that a student chosen at random from this class recorded the distance travelled to school as 26 km or **more**.
(2 marks)
- (d) The P.T.A. plans to set up a transportation service for the school. Which average, mean, mode or median, is MOST appropriate for estimating the cost of the service? Give a reason for your answer.
(2 marks)

Total 11 marks

GO ON TO THE NEXT PAGE

7. The graph shown below represents a function of the form: $f(x) = ax^2 + bx + c$.



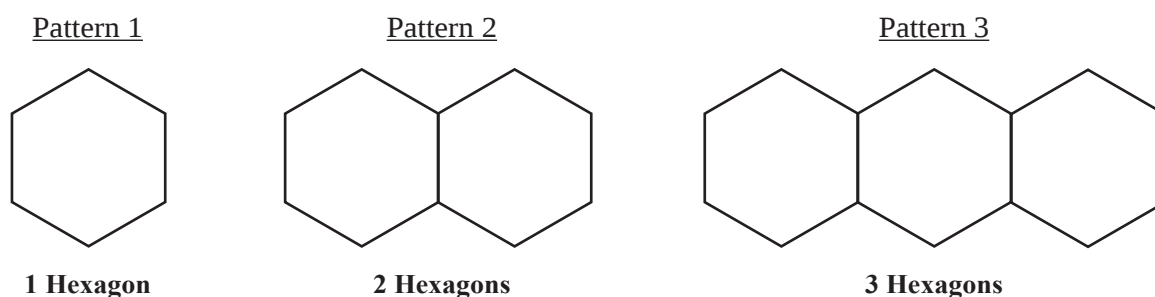
Using the graph above, determine

- (i) the value of $f(x)$ when $x = 0$ (1 mark)
- (ii) the values of x when $f(x) = 0$ (2 marks)
- (iii) the coordinates of the maximum point (2 marks)
- (iv) the equation of the axis of symmetry (2 marks)
- (v) the values of x when $f(x) = 5$ (2 marks)
- (vi) the interval within which x lies when $f(x) > 5$. Write your answer in the form $a < x < b$. (2 marks)

Total 11 marks

GO ON TO THE NEXT PAGE

8. Bianca makes hexagons using sticks of equal length. She then creates patterns by joining the hexagons together. Patterns 1, 2 and 3 are shown below:



The table below shows the number of hexagons in EACH pattern created and the number of sticks used to make EACH pattern.

Number of hexagons in the pattern	1	2	3	4	5	20	<i>n</i>
Number of sticks used for the pattern	6	11	16	<i>x</i>	<i>y</i>	<i>z</i>	<i>S</i>

- (a) Determine the values of
- (i) ***x*** (2 marks)
 - (ii) ***y*** (2 marks)
 - (iii) ***z***. (2 marks)
- (b) Write down an expression for ***S*** in terms of ***n***, where ***S*** represents the number of sticks used to make a pattern of ***n*** hexagons. (2 marks)
- (c) Bianca used a total of 76 sticks to make a pattern of ***h*** hexagons. Determine the value of ***h***. (2 marks)

Total 10 marks

GO ON TO THE NEXT PAGE

SECTION II

Answer TWO questions in this section.

RELATIONS, FUNCTIONS AND GRAPHS

9. (a) The relationship between kinetic energy, E , mass, m , and velocity, v , for a moving particle is

$$E = \frac{1}{2}mv^2.$$

- (i) Express v in terms of E and m . (3 marks)

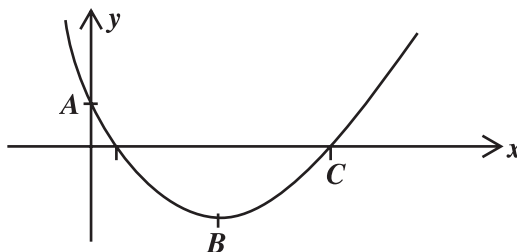
- (ii) Determine the value of v when $E = 45$ and $m = 13$. (2 marks)

- (b) Given $g(x) = 3x^2 - 8x + 2$,

- (i) write $g(x)$ in the form $a(x + b)^2 + c$, where a , b and $c \in \mathbf{R}$ (3 marks)

- (ii) solve the equation $g(x) = 0$, writing your answer(s) correct to 2 decimal places. (4 marks)

- (iii) A sketch of the graph of $g(x)$ is shown below.



Copy the sketch and state

- a) the y -coordinate of A
 b) the x -coordinate of C
 c) the x and y -coordinates of B . (3 marks)

Total 15 marks

GO ON TO THE NEXT PAGE

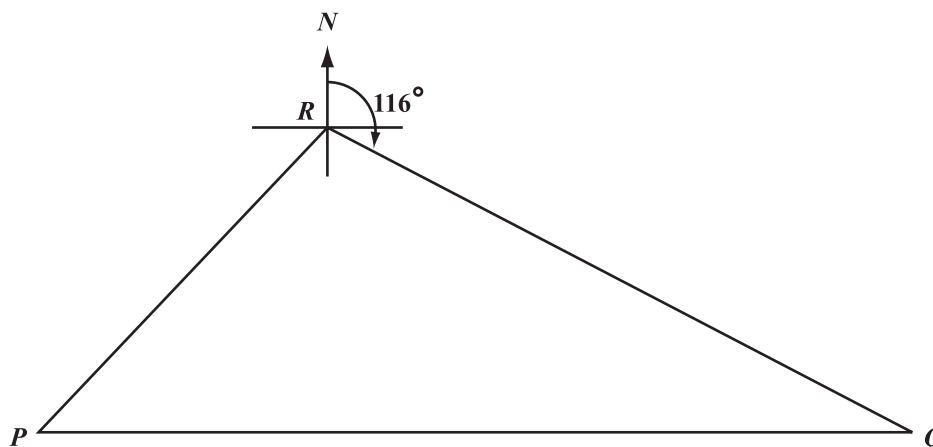
10. (a) The manager of a pizza shop wishes to make x small pizzas and y large pizzas. His oven holds no more than 20 pizzas.
- (i) Write an inequality to represent the given condition. (2 marks)
- The ingredients for each small pizza cost \$15 and for each large pizza \$30. The manager plans to spend no more than \$450 on ingredients.
- (ii) Write an inequality to represent this condition. (2 marks)
- (b) (i) **Using a scale of 2 cm on the x -axis to represent 5 small pizzas and 2 cm on the y -axis to represent 5 large pizzas**, draw the graphs of the lines associated with the inequalities at (a) (i) and (a) (ii) above. (4 marks)
- (ii) Shade the region which is defined by ALL of the following combined:
- the inequalities written at (a) (i) and (a) (ii)
 - the inequalities $x \geq 0$ and $y \geq 0$
- (1 mark)
- (iii) Using your graph, state the coordinates of the vertices of the shaded region. (2 marks)
- (c) The pizza shop makes a profit of \$8 on the sale of EACH small pizza and \$20 on the sale of EACH large pizza. All the pizzas that were made were sold.
- (i) Write an expression in x and y for the TOTAL profit made on the sale of the pizzas. (1 mark)
- (ii) Use the coordinates of the vertices given at (b) (iii) to determine the MAXIMUM profit. (3 marks)

Total 15 marks

GO ON TO THE NEXT PAGE

GEOMETRY AND TRIGONOMETRY

11. (a) The diagram below, **not drawn to scale**, shows three stations P , Q and R , such that the bearing of Q from R is 116° and the bearing of P from R is 242° . The vertical line at R shows the North direction.



- (i) Show that angle $PRQ = 126^\circ$. (2 marks)
- (ii) Given that $PR = 38$ metres and $QR = 102$ metres, calculate the distance PQ , giving your answer to the nearest metre. (3 marks)
- (b) K , L and M are points along a straight line on a horizontal plane, as shown below.



A vertical pole, SK , is positioned such that the angles of elevation of the top of the pole S from L and M are 21° and 14° respectively.

The height of the pole, SK , is 10 metres.

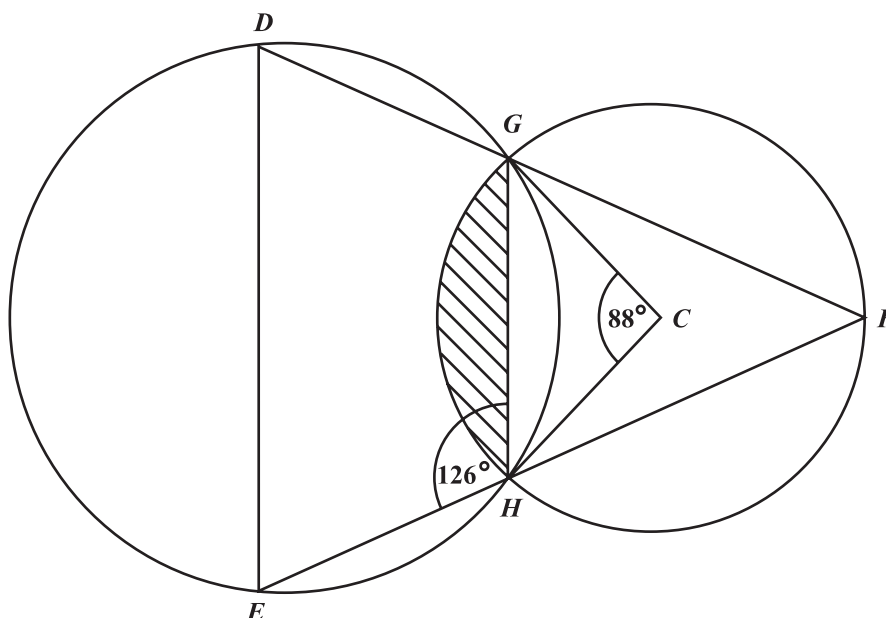
- (i) Copy and complete the diagram to show the pole SK and the angles of elevation of S from L and M . (4 marks)
- (ii) Calculate, correct to ONE decimal place,
- a) the length of KL
- b) the length of LM . (6 marks)

Total 15 marks

GO ON TO THE NEXT PAGE

12. (a) The diagram below, **not drawn to scale**, shows two circles. C is the centre of the smaller circle, GH is a common chord and DEF is a triangle.

Angle $GCH = 88^\circ$ and angle $GHE = 126^\circ$.



Calculate, **giving reasons for your answer**, the measure of angle

- (i) GFH (2 marks)
 - (ii) GDE (3 marks)
 - (iii) DEF . (2 marks)
- (b) Use $\pi = 3.14$ in this part of the question.

Given that $GC = 4$ cm, calculate the area of

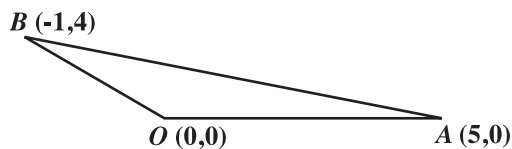
- (i) triangle GCH (3 marks)
- (ii) the minor sector bounded by arc GH and radii GC and HC (3 marks)
- (iii) the shaded segment. (2 marks)

Total 15 marks

GO ON TO THE NEXT PAGE

VECTORS AND MATRICES

13. (a) The figure below, **not drawn to scale**, shows the points $O (0,0)$, $A (5,0)$ and $B (-1,4)$ which are the vertices of a triangle OAB .



- (i) Express in the form $\begin{pmatrix} a \\ b \end{pmatrix}$ the vectors

a) $\vec{OB}$

b) $\vec{OA} + \vec{OB}$

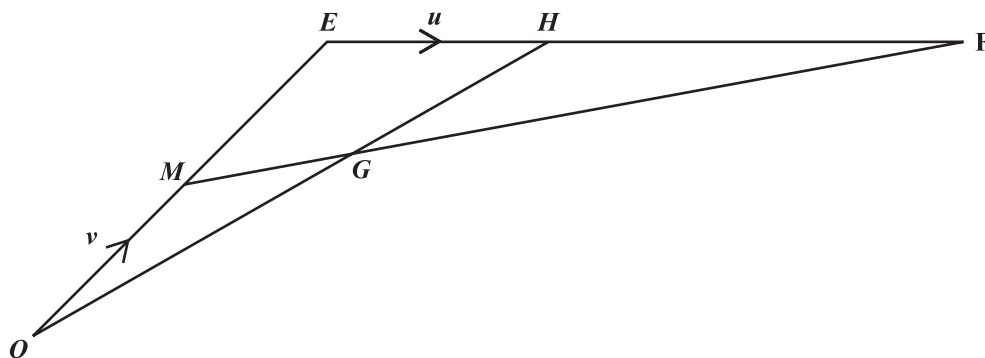
(3 marks)

- (ii) If $M (x,y)$ is the midpoint of AB , determine the values of x and y .

(2 marks)

- (b) In the figure below, **not drawn to scale**, OE , EF and MF are straight lines. The point H is such that $EF = 3EH$. The point G is such that $MF = 5MG$. M is the midpoint of OE .

The vector $\vec{OM} = \mathbf{v}$ and $\vec{EH} = \mathbf{u}$.



- (i) Write in terms of $\mathbf{u}$ and/or $\mathbf{v}$, an expression for:

a) $\vec{HF}$

(1 mark)

b) $\vec{MF}$

(2 marks)

c) $\vec{OH}$

(2 marks)

- (ii) Show that $\vec{OG} = \frac{3}{5} (2\mathbf{v} + \mathbf{u})$

(2 marks)

- (iii) Hence, prove that O , G and H lie on a straight line.

(3 marks)

Total 15 marks

GO ON TO THE NEXT PAGE

14. (a) L and N are two matrices where

$$L = \begin{bmatrix} 3 & 2 \\ 1 & 4 \end{bmatrix} \quad \text{and} \quad N = \begin{bmatrix} -1 & 3 \\ 0 & 2 \end{bmatrix}.$$

Evaluate $L - N^2$. (3 marks)

- (b) The matrix, M , is given as $M = \begin{bmatrix} x & 12 \\ 3 & x \end{bmatrix}$. Calculate the values of x for which M is singular. (2 marks)

- (c) A geometric transformation, R , maps the point $(2,1)$ onto $(-1,2)$.

Given that $R = \begin{bmatrix} 0 & p \\ q & 0 \end{bmatrix}$, calculate the values of p and q . (3 marks)

- (d) A translation, $T = \begin{bmatrix} r \\ s \end{bmatrix}$ maps the point $(5,3)$ onto $(1,1)$. Determine the values of r and s .

(3 marks)

- (e) Determine the coordinates of the image of $(8,5)$ under the combined transformation, R followed by T . (4 marks)

Total 15 marks

END OF TEST

FORM TP 2010087



TEST CODE **01234020**

MAY/JUNE 2010

C A R I B B E A N E X A M I N A T I O N S C O U N C I L
SECONDARY EDUCATION CERTIFICATE
EXAMINATION
MATHEMATICS

Paper 02 – General Proficiency

2 hours 40 minutes

19 MAY 2010 (a.m.)

INSTRUCTIONS TO CANDIDATES

1. This paper consists of **TWO** sections.
2. There are EIGHT questions in Section I and THREE questions in Section II.
3. Answer **ALL** questions in Section I, and any **TWO** questions from Section II.
4. Write your answers in the booklet provided.
5. All working must be clearly shown.
6. A list of formulae is provided on page 2 of this booklet.

Required Examination Materials

Electronic calculator
Geometry set
Graph paper (provided)

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

Copyright © 2008 Caribbean Examinations Council®.
All rights reserved.

01234020/F 2010

LIST OF FORMULAE

Volume of a prism $V = Ah$ where A is the area of a cross-section and h is the perpendicular length.

Volume of cylinder $V = \pi r^2 h$ where r is the radius of the base and h is the perpendicular height.

Volume of a right pyramid $V = \frac{1}{3} Ah$ where A is the area of the base and h is the perpendicular height.

Circumference $C = 2\pi r$ where r is the radius of the circle.

Area of a circle $A = \pi r^2$ where r is the radius of the circle.

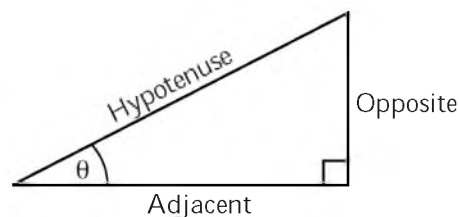
Area of trapezium $A = \frac{1}{2} (a + b) h$ where a and b are the lengths of the parallel sides and h is the perpendicular distance between the parallel sides.

Roots of quadratic equations If $ax^2 + bx + c = 0$,
then $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Trigonometric ratios

$$\sin \theta = \frac{\text{opposite side}}{\text{hypotenuse}}$$

$$\cos \theta = \frac{\text{adjacent side}}{\text{hypotenuse}}$$

$$\tan \theta = \frac{\text{opposite side}}{\text{adjacent side}}$$


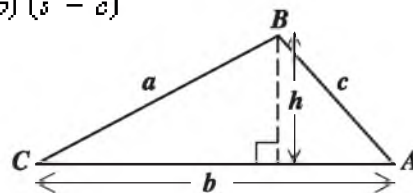
Area of triangle Area of $\Delta = \frac{1}{2} bh$ where b is the length of the base and h is the perpendicular height

$$\text{Area of } \Delta ABC = \frac{1}{2} ab \sin C$$

$$\text{Area of } \Delta ABC = \sqrt{s(s-a)(s-b)(s-c)}$$

$$\text{where } s = \frac{a+b+c}{2}$$

Sine rule
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$



Cosine rule
$$a^2 = b^2 + c^2 - 2bc \cos A$$

GO ON TO THE NEXT PAGE

SECTION I

Answer ALL the questions in this section.

All working must be clearly shown.

1. (a) Determine the EXACT value of:

(i)
$$\frac{1\frac{1}{2} - \frac{2}{5}}{4\frac{2}{5} \times \frac{3}{4}}$$
 (3 marks)

(ii) $2.5^2 - \frac{2.89}{17}$
giving your answer correct to 2 significant figures (3 marks)

- (b) Mrs. Jack bought 150 T-shirts for \$1 920 from a factory.

- (i) Calculate the cost of ONE T-shirt. (1 mark)



The T-shirts are sold at \$19.99 each.

Calculate

- (ii) the amount of money Mrs. Jack received after selling ALL of the T-shirts (1 mark)
- (iii) the TOTAL profit made (1 mark)
- (iv) the profit made as a percentage of the cost price, giving your answer correct to the nearest whole number. (2 marks)

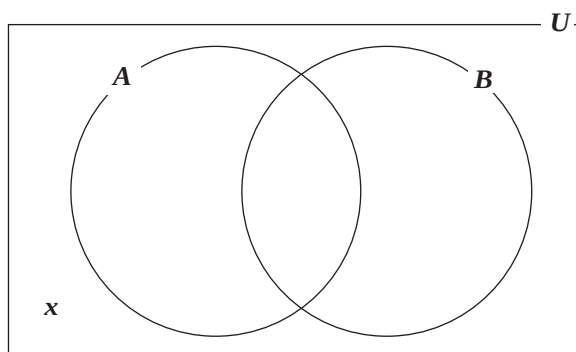
Total 11 marks

GO ON TO THE NEXT PAGE

2. (a) Given that $a = -1$, $b = 2$ and $c = -3$, find the value of:
- (i) $a + b + c$ (1 mark)
- (ii) $b^2 - c^2$ (1 mark)
- (b) Write the following phrases as algebraic expressions:
- (i) seven times the sum of x and y (1 mark)
- (ii) the product of TWO consecutive numbers when the smaller number is y (1 mark)
- (c) Solve the pair of simultaneous equations:
- $$\begin{aligned} 2x + y &= 7 \\ x - 2y &= 1 \end{aligned}$$
- (3 marks)
- (d) Factorise completely:
- (i) $4y^2 - z^2$ (1 mark)
- (ii) $2ax - 2ay - bx + by$ (2 marks)
- (iii) $3x^2 + 10x - 8$ (2 marks)

Total 12 marks

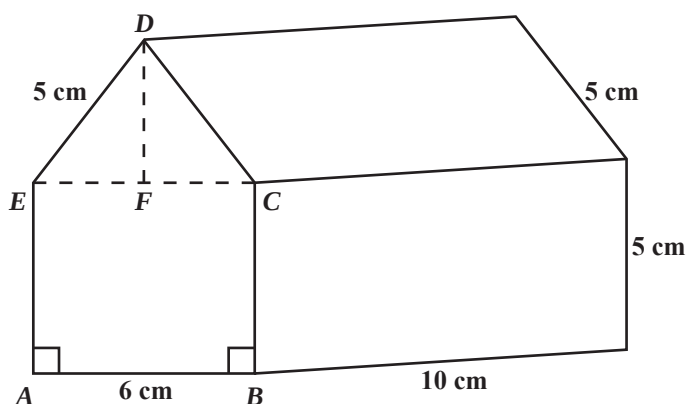
3. (a) A survey was conducted among 40 tourists. The results were:
- 28 visited Antigua (A)
- 30 visited Barbados (B)
- 3x visited both Antigua and Barbados
- x visited neither Antigua nor Barbados
- (i) Copy and complete the Venn diagram below to represent the given information above.



- (2 marks)
- (ii) Write an expression, in x , to represent the TOTAL number of tourists in the survey. (2 marks)
- (iii) Calculate the value of x . (2 marks)

GO ON TO THE NEXT PAGE

- (b) The diagram below, **not drawn to scale**, shows a wooden toy in the shape of a prism, with cross section $ABCDE$. F is the midpoint of EC , and $\angle BAE = \angle CBA = 90^\circ$.



Calculate

- (i) the length of EF (1 mark)
- (ii) the length of DF (2 marks)
- (iii) the area of the face $ABCDE$. (3 marks)

Total 12 marks

4. (a) When y varies directly as the square of x , the variation equation is written $y = kx^2$, where k is a constant.

- (i) Given that $y = 50$ when $x = 10$, find the value of k . (2 marks)
- (ii) Calculate the value of y when $x = 30$. (2 marks)

- (b) (i) **Using a ruler, a pencil and a pair of compasses**, construct triangle EFG with $EG = 6$ cm, $\angle FEG = 60^\circ$ and $\angle EGF = 90^\circ$. (5 marks)

- (ii) Measure and state

- a) the length of EF
- b) the size of $\angle EFG$. (2 marks)

Total 11 marks

GO ON TO THE NEXT PAGE

5. (a) The functions f and g are defined as $f(x) = 2x - 5$ and $g(x) = x^2 + 3$.

(i) Calculate the value of

a) $f(4)$

(1 mark)

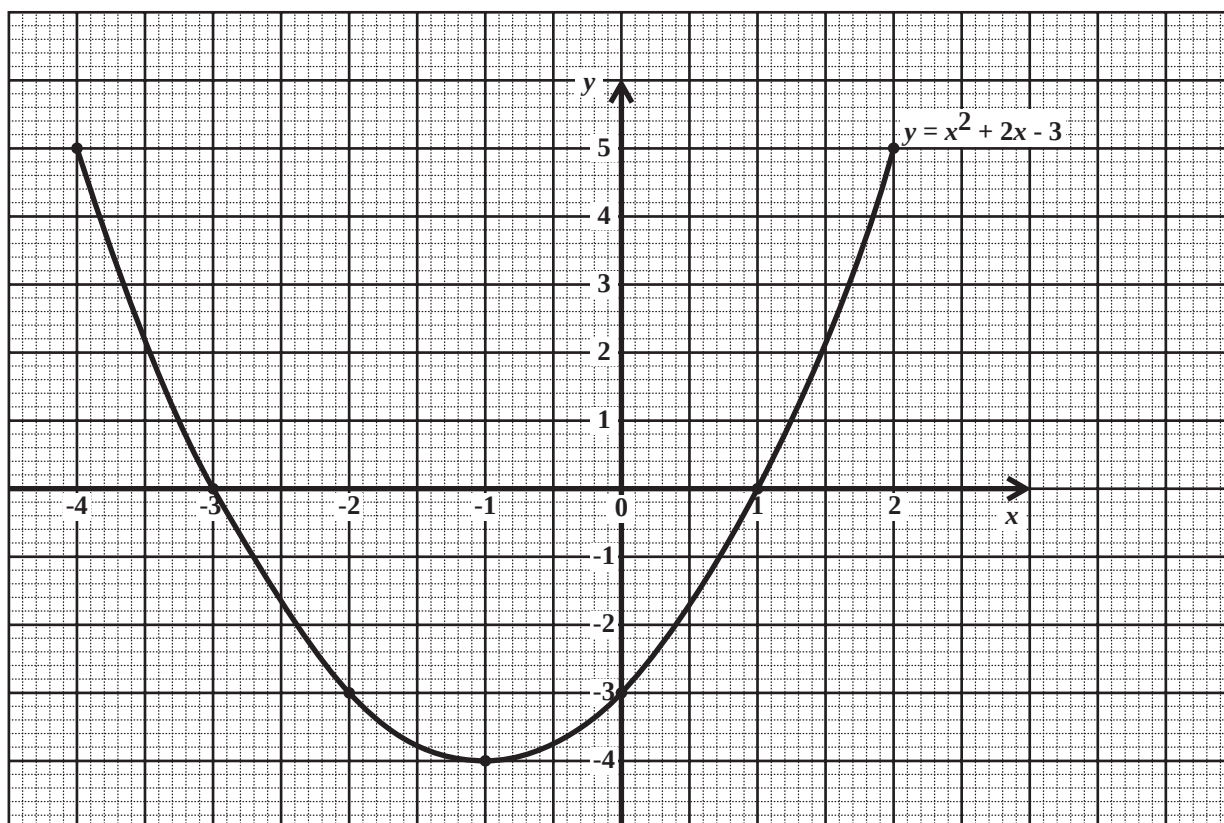
b) $gf(4)$.

(2 marks)

(ii) Find $f^{-1}(x)$.

(2 marks)

- (b) The diagram below shows the graph of $y = x^2 + 2x - 3$ for the domain $-4 \leq x \leq 2$.



Use the graph above to determine

(i) the scale used on the x -axis

(1 mark)

(ii) the value of y for which $x = -1.5$

(2 marks)

(iii) the values of x for which $y = 0$

(2 marks)

(iv) the range of values of y , giving your answer in the form $a \leq y \leq b$, where a and b are real numbers.

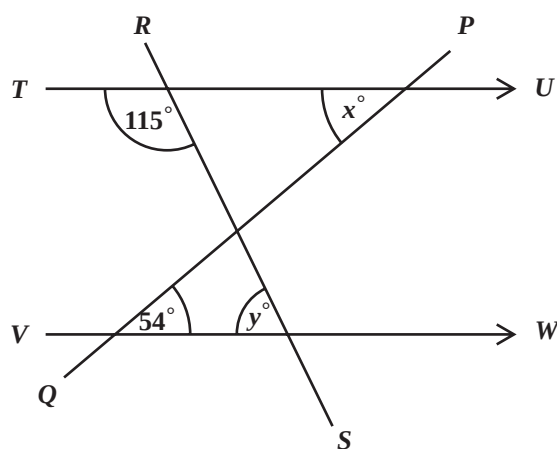
(2 marks)

Total 12 marks

GO ON TO THE NEXT PAGE

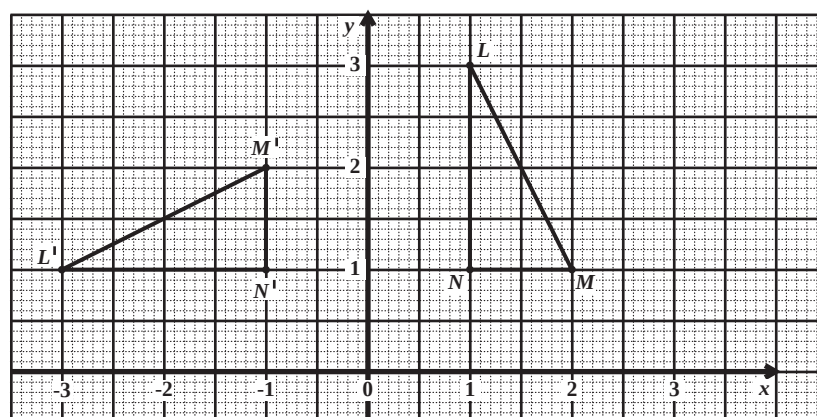
6. An answer sheet is provided for this question.

- (a) The diagram below, **not drawn to scale**, shows two straight lines, PQ and RS , intersecting a pair of parallel lines, TU and VW .



Determine, giving a reason for EACH of your answers, the value of

- (i) x (2 marks)
- (ii) y . (2 marks)
- (b) The diagram below shows triangle LMN , and its image, triangle $L'M'N'$, after undergoing a rotation.



- (i) Describe the rotation FULLY by stating
- the centre
 - the angle
 - the direction. (3 marks)
- (ii) State TWO geometric relationships between triangle LMN and its image, triangle $L'M'N'$. (2 marks)
- (iii) Triangle LMN is translated by the vector $\begin{pmatrix} 1 \\ -2 \end{pmatrix}$.

Determine the coordinates of the image of the point L under this transformation. (2 marks)

Total 11 marks

GO ON TO THE NEXT PAGE

7. A class of 24 students threw the cricket ball at sports. The distance thrown by each student was measured to the nearest metre. The results are shown below.

22	50	35	52	47	30
48	34	45	23	43	40
55	29	46	56	43	59
36	63	54	32	49	60

- (a) Copy and complete the frequency table for the data shown above.

Distance (m)	Frequency
20 – 29	3
30 – 39	5
_____	_____
_____	_____
_____	_____

(3 marks)

- (b) State the lower boundary for the class interval 20 – 29. (1 mark)

- (c) Using a scale of **1 cm on the x-axis to represent 5 metres**, and a scale of **1 cm on the y-axis to represent 1 student**, draw a histogram to illustrate the data.

(5 marks)

- (d) Determine

- (i) the number of students who threw the ball a distance recorded as 50 metres or more (1 mark)

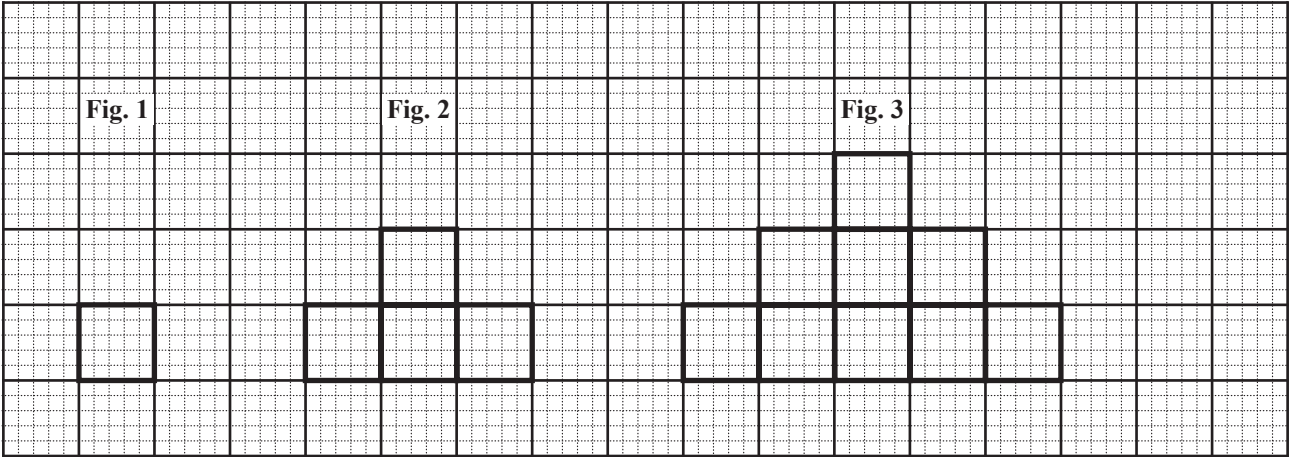
- (ii) the probability that a student, chosen at random, threw the ball a distance recorded as 50 metres or more. (1 mark)

Total 11 marks

GO ON TO THE NEXT PAGE

8. An answer sheet is provided for this question.

The diagram below shows the first three figures in a sequence of figures. Each figure is made up of squares of side 1 cm.



- (a) On your answer sheet, draw the FOURTH figure (Fig. 4) in the sequence. (2 marks)
- (b) Study the patterns in the table shown below, and on the answer sheet provided, complete the rows numbered (i), (ii), (iii) and (iv).

	Figure	Area of Figure (cm ²)	Perimeter of Figure (cm)	
	1	1	$1 \times 6 - 2 = 4$	
	2	4	$2 \times 6 - 2 = 10$	
	3	9	$3 \times 6 - 2 = 16$	
(i)	4	_____	_____	(2 marks)
(ii)	5	_____	_____	(2 marks)
(iii)	15	_____	_____	(2 marks)
(iv)	n	_____	_____	(2 marks)

Total 10 marks

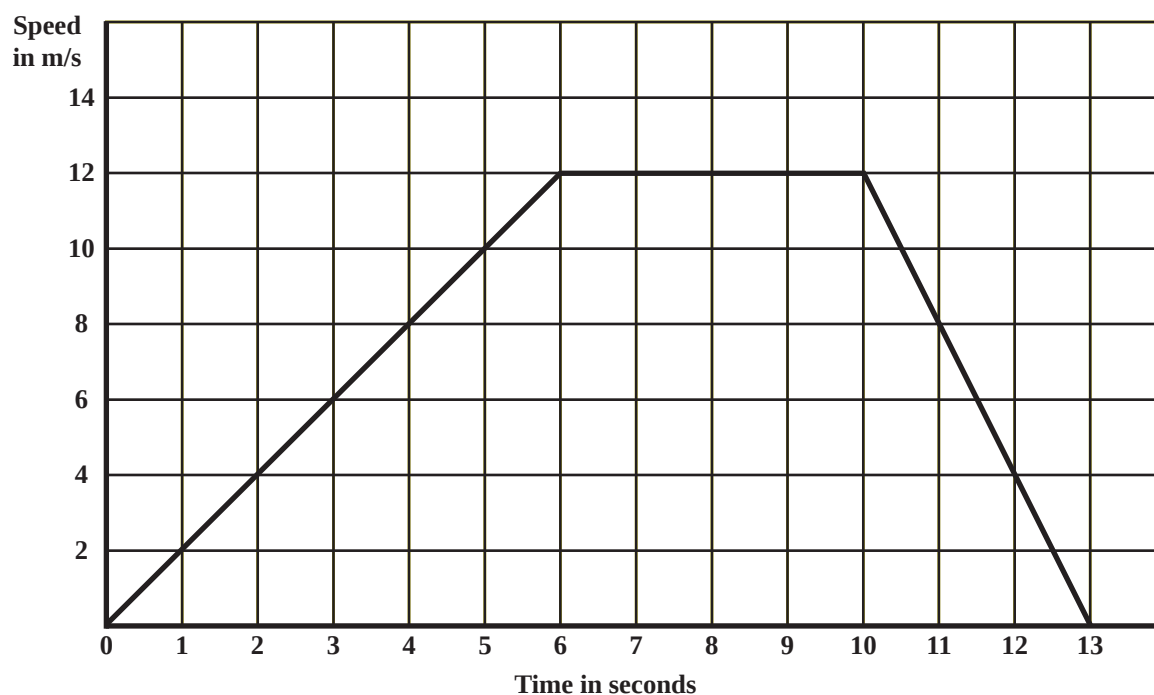
GO ON TO THE NEXT PAGE

SECTION II

Answer TWO questions in this section.

ALGEBRA AND RELATIONS, FUNCTIONS AND GRAPHS

9. (a) The diagram below shows the speed-time graph of the motion of an athlete during a race.



- (i) Using the graph, determine
- the MAXIMUM speed
 - the number of seconds for which the speed was constant
 - the TOTAL distance covered by the athlete during the race.
- (4 marks)
- (ii) During which time-period of the race was
- the speed of the athlete increasing
 - the speed of the athlete decreasing
 - the acceleration of the athlete zero?
- (3 marks)

GO ON TO THE NEXT PAGE

- (b) A farmer supplies his neighbours with x pumpkins and y melons daily, using the following conditions:

First condition : $y \geq 3$

Second condition : $y \leq x$

Third condition : the total number of pumpkins and melons must not exceed 12.

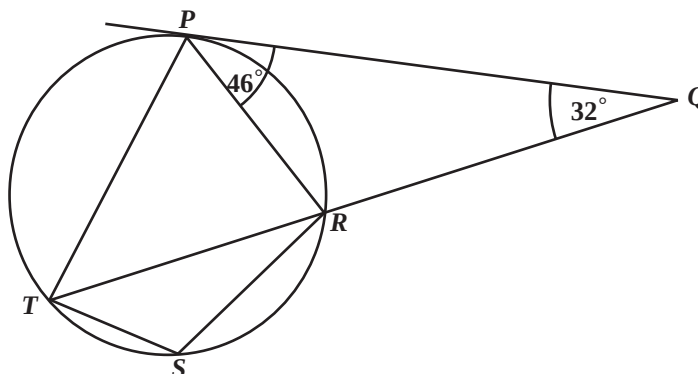
- (i) Write an inequality to represent the THIRD condition. (1 mark)
- (ii) Using a scale of **1 cm to represent one pumpkin** on the x -axis and **1 cm to represent one melon** on the y -axis, draw the graphs of the THREE lines associated with the THREE inequalities. (4 marks)
- (iii) Identify, by shading, the region which satisfies the THREE inequalities. (1 mark)
- (iv) Determine, from your graph, the **minimum** values of x and y which satisfy the conditions. (2 marks)

Total 15 marks

GO ON TO THE NEXT PAGE

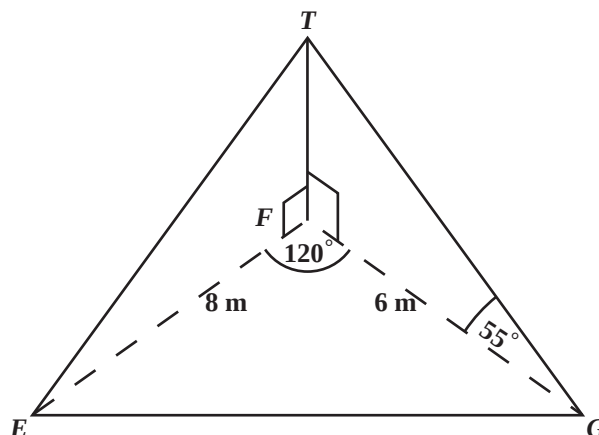
MEASUREMENT, GEOMETRY AND TRIGONOMETRY

10. (a) In the diagram below, **not drawn to scale**, PQ is a tangent to the circle $PTSR$, so that
 $\angle RPQ = 46^\circ$
 $\angle RQP = 32^\circ$
 and TRQ is a straight line.



Calculate, giving a reason for EACH step of your answer,

- (i) $\angle PTR$ (2 marks)
 - (ii) $\angle TPR$ (3 marks)
 - (iii) $\angle TSR$. (2 marks)
- (b) The diagram below, **not drawn to scale**, shows a vertical flagpole, FT , with its foot, F , on the horizontal plane EFG . ET and GT are wires which support the flagpole in its position. The angle of elevation of T from G is 55° , $EF = 8$ m, $FG = 6$ m and $\angle EFG = 120^\circ$.



Calculate, giving your answer correct to 3 significant figures

- (i) the height, FT , of the flagpole (2 marks)
- (ii) the length of EG (3 marks)
- (iii) the angle of elevation of T from E . (3 marks)

Total 15 marks

GO ON TO THE NEXT PAGE

VECTORS AND MATRICES

11. (a) **A** and **B** are two 2×2 matrices such that

$$\mathbf{A} = \begin{pmatrix} 1 & 2 \\ 2 & 5 \end{pmatrix} \quad \text{and} \quad \mathbf{B} = \begin{pmatrix} 5 & -2 \\ -2 & 1 \end{pmatrix}.$$

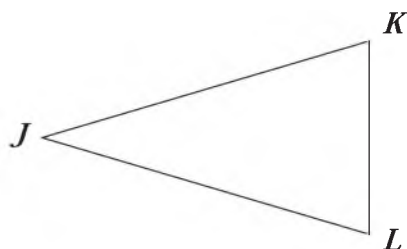
- (i) Find **AB**. (2 marks)
 (ii) Determine $\mathbf{B}^{-1}$, the inverse of **B**. (1 mark)
 (iii) Given that

$$\begin{pmatrix} 5 & -2 \\ -2 & 1 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 2 \\ 3 \end{pmatrix},$$

write $\begin{pmatrix} x \\ y \end{pmatrix}$ as the product of TWO matrices. (2 marks)

- (iv) Hence, calculate the values of x and y . (2 marks)

- (b) The diagram below, **not drawn to scale**, shows triangle JKL .



M and N are points on JK and JL respectively, such that

$$JM = \frac{1}{3} JK \quad \text{and} \quad JN = \frac{1}{3} JL.$$

- (i) Copy the diagram in your answer booklet and show the points M and N . (2 marks)
 (ii) Given that $\vec{JM} = \mathbf{u}$ and $\vec{JN} = \mathbf{v}$,
 write, in terms of $\mathbf{u}$ and $\mathbf{v}$, an expression for
 a) $\vec{JK}$
 b) $\vec{MN}$
 c) $\vec{KL}$. (4 marks)
 (iii) Using your findings in (b) (ii), deduce TWO geometrical relationships between KL and MN (2 marks)

Total 15 marks

END OF TEST

CARIBBEAN EXAMINATIONS COUNCIL
SECONDARY EDUCATION CERTIFICATE
EXAMINATION
MATHEMATICS

Paper 02 – General Proficiency

Answer Sheet for Question 8

Candidate Number

(a)

[illegible]

(b)

	Figure	Area of Figure (cm ²)	Perimeter of Figure (cm)
(i)	1	1	$1 \times 6 - 2 = 4$
	2	4	$2 \times 6 - 2 = 10$
	3	9	$3 \times 6 - 2 = 16$
	4	_____	_____
(ii)	5	_____	_____
(iii)	15	_____	_____
(iv)	n	_____	_____

ATTACH THIS ANSWER SHEET TO YOUR ANSWER BOOKLET

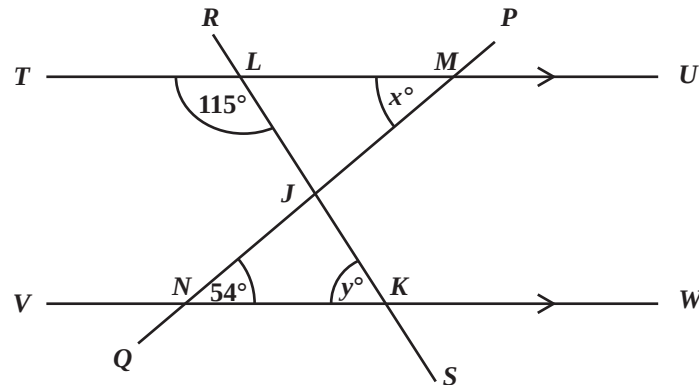
CARIBBEAN EXAMINATIONS COUNCIL
SECONDARY EDUCATION CERTIFICATE
EXAMINATION
MATHEMATICS

Paper 02 – General Proficiency

Answer Sheet for Question 6

Candidate Number

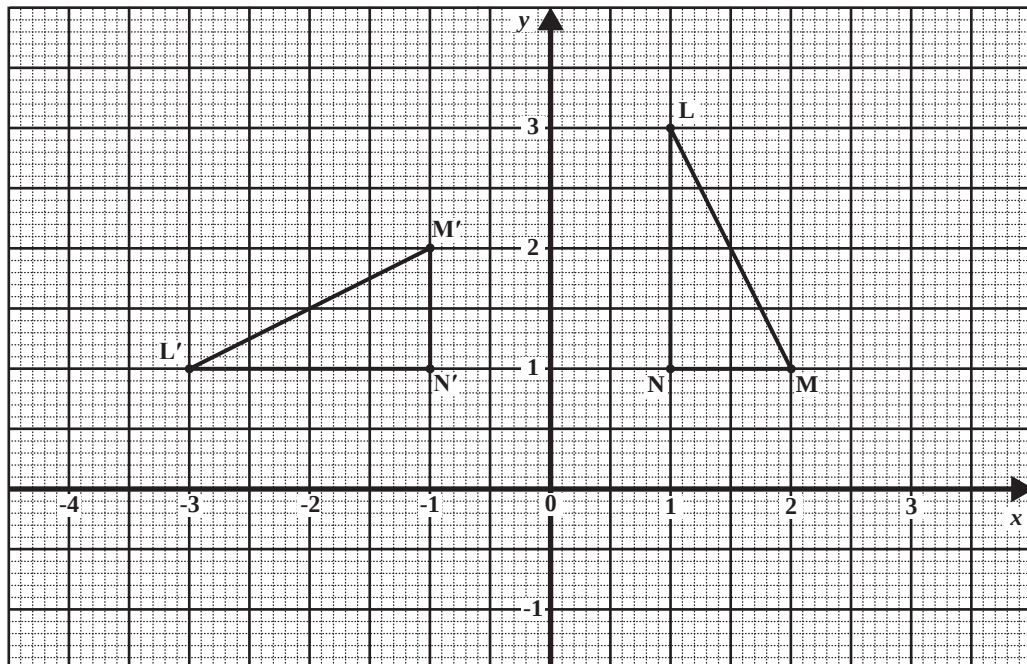
(a)



(i) $x =$ _____

(ii) $y =$ _____

(b)



(i) a) centre of rotation _____

b) angle of rotation _____

c) direction of rotation _____

(ii) LMN and $L'M'N'$ are _____ and _____

(iii) Image of L under the translation is (,)

ATTACH THIS ANSWER SHEET TO YOUR ANSWER BOOKLET



TEST CODE **01234020**

FORM TP 2011017

JANUARY 2011

**CARIBBEAN EXAMINATIONS COUNCIL
SECONDARY EDUCATION CERTIFICATE
EXAMINATION
MATHEMATICS**

Paper 02 – General Proficiency

2 hours 40 minutes

04 JANUARY 2011 (a.m.)

INSTRUCTIONS TO CANDIDATES

1. This paper consists of **TWO** sections.
2. There are EIGHT questions in Section I and THREE questions in Section II.
3. Answer **ALL** questions in Section I, and any **TWO** questions from Section II.
4. Write your answers in the booklet provided.
5. All working must be clearly shown.
6. A list of formulae is provided on page 2 of this booklet.

Required Examination Materials

Electronic calculator
Geometry set
Graph paper (provided)

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

Copyright © 2009 Caribbean Examinations Council®.
All rights reserved.

01234020/JANUARY/F 2011

LIST OF FORMULAE

Volume of a prism	$V = Ah$ where A is the area of a cross-section and h is the perpendicular length.
Volume of cylinder	$V = \pi r^2 h$ where r is the radius of the base and h is the perpendicular height.
Volume of a right pyramid	$V = \frac{1}{3} Ah$ where A is the area of the base and h is the perpendicular height.
Circumference	$C = 2\pi r$ where r is the radius of the circle.
Arc length	$S = \frac{\theta}{360} \times 2\pi r$ where θ is the angle subtended by the arc, measured in degrees.
Area of a circle	$A = \pi r^2$ where r is the radius of the circle.
Area of a sector	$A = \frac{\theta}{360} \times \pi r^2$ where θ is the angle of the sector, measured in degrees.
Area of trapezium	$A = \frac{1}{2} (a + b) h$ where a and b are the lengths of the parallel sides and h is the perpendicular distance between the parallel sides.
Roots of quadratic equations	If $ax^2 + bx + c = 0$,

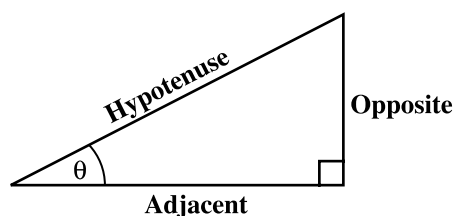
$$\text{then } x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Trigonometric ratios

$$\sin \theta = \frac{\text{opposite side}}{\text{hypotenuse}}$$

$$\cos \theta = \frac{\text{adjacent side}}{\text{hypotenuse}}$$

$$\tan \theta = \frac{\text{opposite side}}{\text{adjacent side}}$$



Area of triangle

Area of $\Delta = \frac{1}{2} bh$ where b is the length of the base and h is the perpendicular height

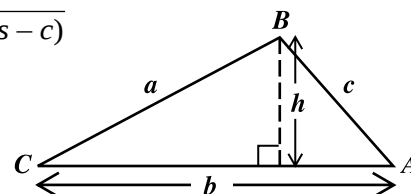
$$\text{Area of } \Delta ABC = \frac{1}{2} ab \sin C$$

$$\text{Area of } \Delta ABC = \sqrt{s(s-a)(s-b)(s-c)}$$

$$\text{where } s = \frac{a+b+c}{2}$$

Sine rule

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$



Cosine rule

$$a^2 = b^2 + c^2 - 2bc \cos A$$

GO ON TO THE NEXT PAGE

SECTION I

Answer ALL the questions in this section.

All working must be clearly shown.

1. (a) Calculate the exact value of
- (i) $(5.8^2 + 1.02) \times 2.5$ (2 marks)
- (ii) $\frac{2\frac{4}{9}}{4\frac{2}{3}} - \frac{3}{7}$. (3 marks)
- (b) A company pays its employees a basic wage of \$9.50 per hour for a 40-hour week.
- (i) Calculate the basic weekly wage for ONE employee. (1 mark)
- Overtime is paid at a rate of time and a half.
- (ii) Calculate the overtime wage for an employee who works 6 hours overtime in a certain week. (2 marks)
- In a certain week, the company paid its 30 employees a total of \$12 084.00 in basic and overtime wages. Calculate for that week:
- (iii) The TOTAL paid in overtime wages (2 marks)
- (iv) The TOTAL number of overtime hours worked by employees (1 mark)

Total 11 marks

2. (a) Simplify
- $$\frac{2x}{5} - \frac{x}{3}$$
- expressing your answer as a single fraction. (2 marks)
- (b) Factorise completely
- $$a^2b + 2ab$$
- (1 mark)
- (c) Express p as the subject of the formula
- $$q = \frac{p^2 - r}{t}$$
- (3 marks)

GO ON TO THE NEXT PAGE

- (d) The students in a class sell donuts to raise money for their school project. The donuts are sold in small and large boxes. The number of donuts in EACH type of box is given in the table below:

Type of Box	Number of Donuts per Box
Small box	x
Large box	$2x + 3$

The students sold 8 small boxes and 5 large boxes in all.

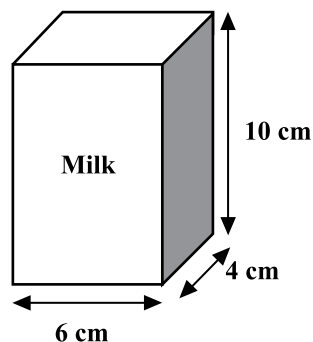
- (i) Write an expression in terms of x to represent the TOTAL number of donuts sold.
(2 marks)
- (ii) The total number of donuts sold was 195. Calculate the number of donuts in a
a) small box
b) large box. (4 marks)

Total 12 marks

3. (a) Simplify the expression

$$7p^5q^3 \times 2p^2q. \quad (2 \text{ marks})$$

- (b) Fresh Farms Dairy sells milk in cartons in the shape of a cuboid with internal dimensions 6 cm by 4 cm by 10 cm.



- (i) Calculate, in cm^3 , the volume of milk in EACH carton. (2 marks)
- (ii) A recipe for making ice-cream requires 3 litres of milk. How many cartons of milk should be bought to make the ice-cream? (3 marks)
- (iii) One carton of milk is poured into a cylindrical cup of internal diameter 5 cm. What is the height of milk in the cup? Give your answer to 3 significant figures. [Use $\pi = 3.14$] (4 marks)

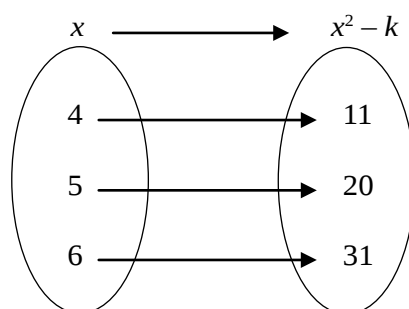
Total 11 marks

GO ON TO THE NEXT PAGE

4. (a) The Universal set, U , is given as
 $U = \{ \text{Whole numbers from 1 to 12} \}$
- H is a subset of U , such that $H = \{ \text{Odd numbers between 4 and 12} \}$.
- (i) List the members of the set H . (1 mark)
- J is a subset of U , such that $J = \{ \text{Prime numbers} \}$.
- (ii) List the members of the set J . (1 mark)
- (iii) Draw a Venn diagram to represent the sets U , H and J , showing ALL the elements in the subsets. (3 marks)
- (b) (i) **Using a pencil, ruler and a pair of compasses only**, construct a triangle LMN with angle $LMN = 60^\circ$, $MN = 9$ cm and $LM = 7$ cm.
ALL construction lines MUST be clearly shown. (4 marks)
- (ii) Measure and state the size of $\angle MNL$. (1 mark)
- (iii) On the diagram, show the point, K , such that $KLMN$ is a parallelogram. (2 marks)

Total 12 marks

5. (a) The equation of a straight line is given by:
- $$3y = 2x - 6$$
- Determine
- (i) the gradient of the line (2 marks)
- (ii) the equation of the line which is perpendicular to $3y = 2x - 6$, and passes through the point $(4,7)$. (3 marks)
- (b) The arrow diagram shown below represents the relation $f: x \rightarrow x^2 - k$, where $x \in \{3, 4, 5, 6, 7, 8, 9, 10\}$



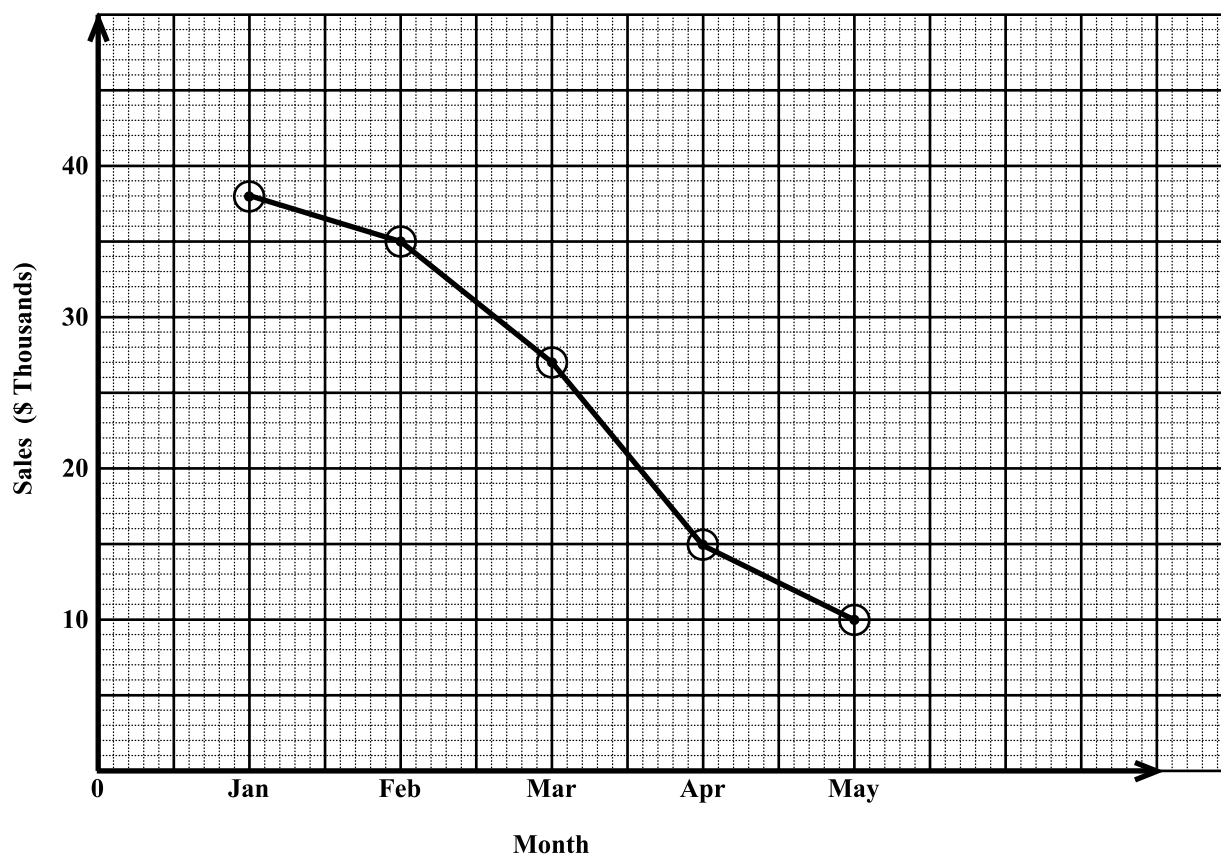
Calculate the value of

- (i) k (2 marks)
- (ii) $f(3)$ (2 marks)
- (iii) x when $f(x) = 95$. (2 marks)

Total 11 marks

GO ON TO THE NEXT PAGE

6. The line graph below shows the monthly sales, in thousands of dollars, at a school cafeteria for the period January to May 2010.



- (i) Copy and complete the table below to show the sales for EACH month.

Month	Jan	Feb	Mar	Apr	May
Sales in \$Thousands	38		27		

(3 marks)

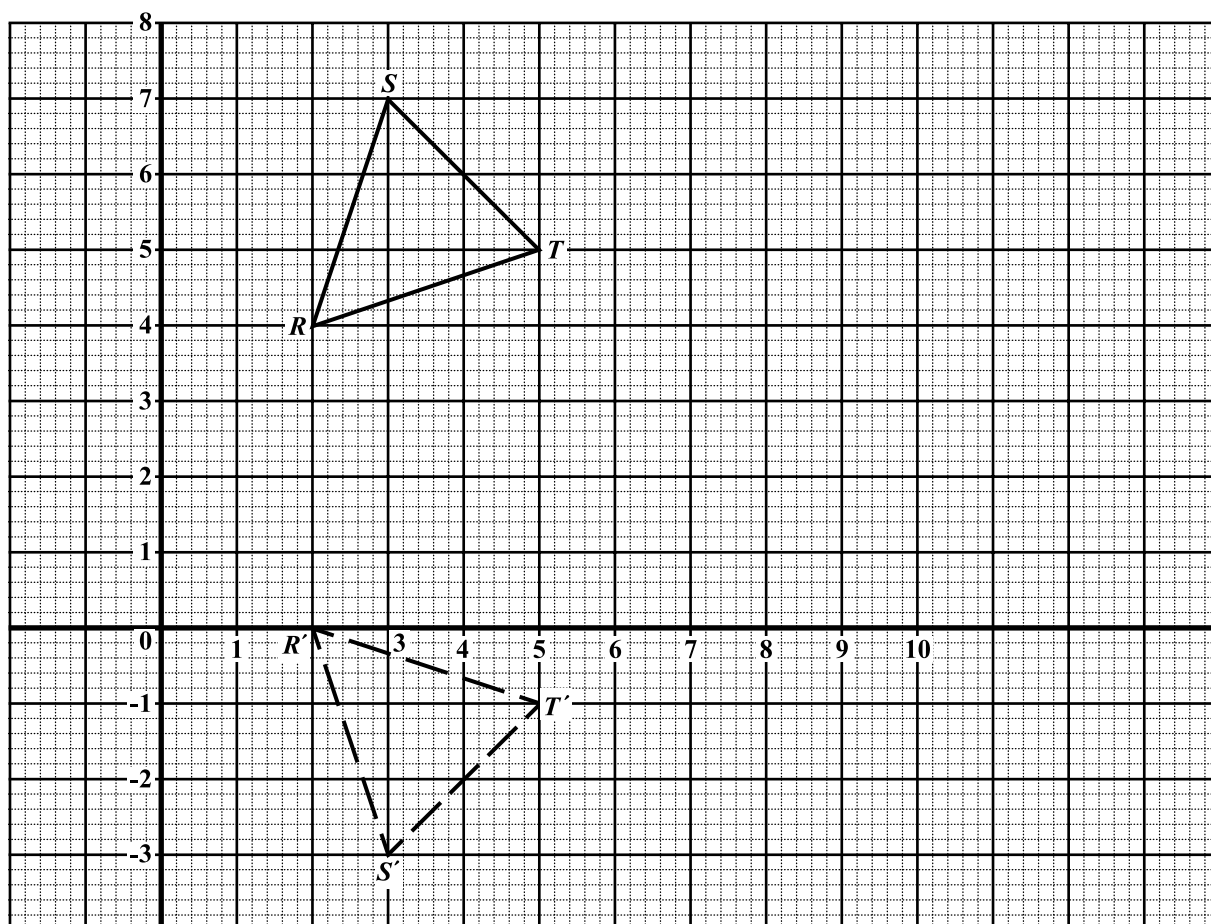
- (ii) Between which TWO consecutive months was there the GREATEST decrease in sales?
(1 mark)
- (iii) Calculate the mean monthly sales for the period January to May 2010. (3 marks)
- (iv) The TOTAL sales for the period January to June was \$150 000. Calculate the sales, in dollars, for the month of June. (2 marks)
- (v) Comment on how the sales in June compared with the sales in the previous five months. (2 marks)

Total 11 marks

GO ON TO THE NEXT PAGE

7. An answer sheet is provided for this question.

The diagram below shows triangle RST and its image $R'S'T'$ after a transformation.



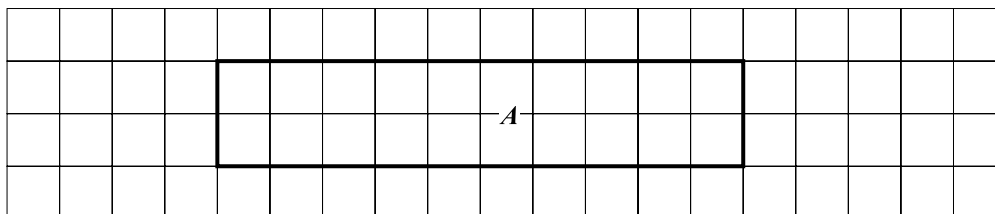
- (i) Write down the coordinates of R and R' . (2 marks)
- (ii) Describe completely the transformation which maps triangle RST onto triangle $R'S'T'$. (3 marks)
- (iii) RST undergoes an enlargement, centre, $(0,4)$, scale factor, 3.
 - a) **On your answer sheet**, draw triangle $R''S''T''$, the image of triangle RST under the enlargement.
 - b) Given that the area of triangle RST is 4 square units, calculate the area of triangle $R''S''T''$.
 - c) State TWO geometrical relationships between triangles RST and $R''S''T''$. (7 marks)

Total 12 marks

GO ON TO THE NEXT PAGE

8. An answer sheet is provided for this question.

The answer sheet shows a rectangle, *A*, of area 20 square units and perimeter 24 units.



Use the information below to complete the table on the answer sheet, which shows the length, width, area and perimeter of rectangles *B*, *C*, *D* and *E*.

(a) **On your answer sheet,**

(i) draw and label

a) rectangle *B* of area 27 square units and perimeter 24 units

b) rectangle *C* of area 32 square units and perimeter 24 units.

(4 marks)

(ii) Complete the table to show the dimensions of rectangles *B* and *C*, drawn at (a) (i) above.

(2 marks)

(b) Rectangle *D* has a perimeter of 24 cm, with length, *l*, and width, *w*. If the area of the rectangle *D* is to be as large as possible, determine the values of *l* and *w*. In the table, write the values of *l*, *w* and the area of rectangle *D*.

(2 marks)

(c) Rectangle *E* has a perimeter of 36 cm, length, *l*, and width, *w*. If the area of the rectangle *E* is to be as large as possible, determine the values of *l* and *w*. In the table, write the values of *l*, *w* and the area of the rectangle *E*.

(2 marks)

Total 10 marks

GO ON TO THE NEXT PAGE

SECTION II

Answer TWO questions in this section.

ALGEBRA AND RELATIONS, FUNCTIONS AND GRAPHS

9. (a) The functions $f(x)$ and $g(x)$ are defined as:

$$f(x) = \frac{2x-7}{x} \quad \text{and} \quad g(x) = \sqrt{x+3}$$

- (i) Evaluate $f(5)$. (1 mark)

- (ii) Write expressions in x for

a) $f^{-1}(x)$

b) $gf(x)$. (6 marks)

- (b) (i) Express the quadratic function $1 - 6x - x^2$, in the form $k - a(x + h)^2$, where a , h and k are constants. (3 marks)

- (ii) Hence state

a) the maximum value of $1 - 6x - x^2$

b) the equation of the axis of symmetry of the quadratic function. (2 marks)

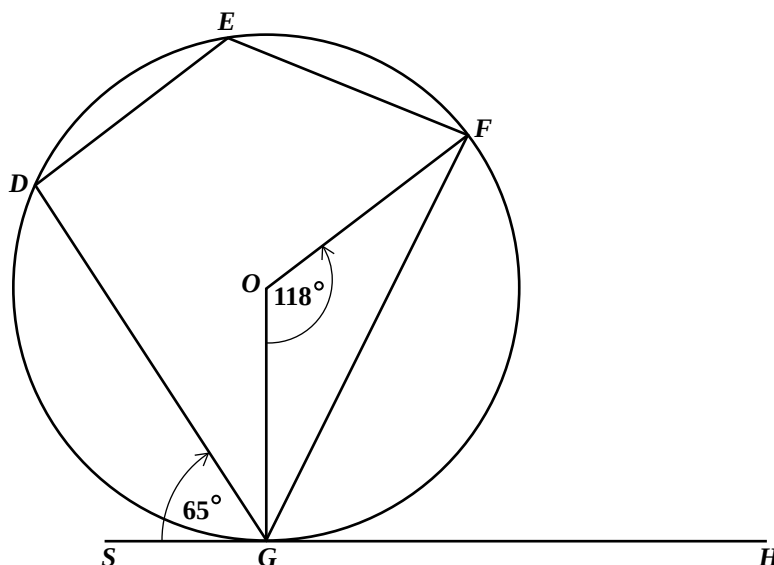
- (iii) Determine the roots of $1 - 6x - x^2 = 0$, giving your answers to 2 decimal places. (3 marks)

Total 15 marks

GO ON TO THE NEXT PAGE

MEASUREMENT AND GEOMETRY AND TRIGONOMETRY

10. (a) The diagram, below, **not drawn to scale**, shows a circle, centre, O . SGH is a tangent to the circle, $\angle FOG = 118^\circ$ and $\angle DGS = 65^\circ$.



Calculate, **giving reasons for EACH step of your answer**, the measure of:

- (i) $\angle OGF$ (2 marks)
 - (ii) $\angle DEF$ (3 marks)
- (b) J , K and L are three sea ports. A ship began its journey at J , sailed to K , then to L and returned to J .
- The bearing of K from J is 054° and L is due east of K .
- $JK = 122$ km and $KL = 60$ km.
- (i) Draw a clearly labelled diagram to represent the above information. Show on the diagram
 - a) the north/south direction
 - b) the bearing 054°
 - c) the distances 122 km and 60 km. (3 marks)
 - (ii) Calculate
 - a) the measure of angle JKL
 - b) the distance JL
 - c) the bearing of J from L . (7 marks)

Total 15 marks

GO ON TO THE NEXT PAGE

VECTORS AND MATRICES

11. (a) Under a matrix transformation, $M = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$, the points, V and W are mapped onto V' and W' such that:

$$\begin{array}{lcl} V(3,5) & \rightarrow & V'(5,-3) \\ W(7,2) & \rightarrow & W'(2,-7) \end{array}$$

- (i) Determine the values of a , b , c and d . (3 marks)
- (ii) State the coordinates of Z such that $Z(x, y) \rightarrow Z'(5, 1)$ under the transformation, M . (2 marks)
- (iii) Describe FULLY the geometric transformation, M . (2 marks)
- (b) $\vec{OP}$ and $\vec{OR}$ are position vectors with respect to the origin, O .
 P is the point $(2, 7)$ and $\vec{PR} = \begin{pmatrix} 4 \\ -3 \end{pmatrix}$.
- (i) Write in the form $\begin{pmatrix} a \\ b \end{pmatrix}$ the vectors:
- a) $\vec{OP}$
- b) $\vec{OR}$ (3 marks)
- (ii) A point S has coordinates $(14, -2)$.
- a) Find $\vec{RS}$.
- b) Show that P , R and S are collinear. (5 marks)

Total 15 marks

END OF TEST

CARIBBEAN EXAMINATIONS COUNCIL

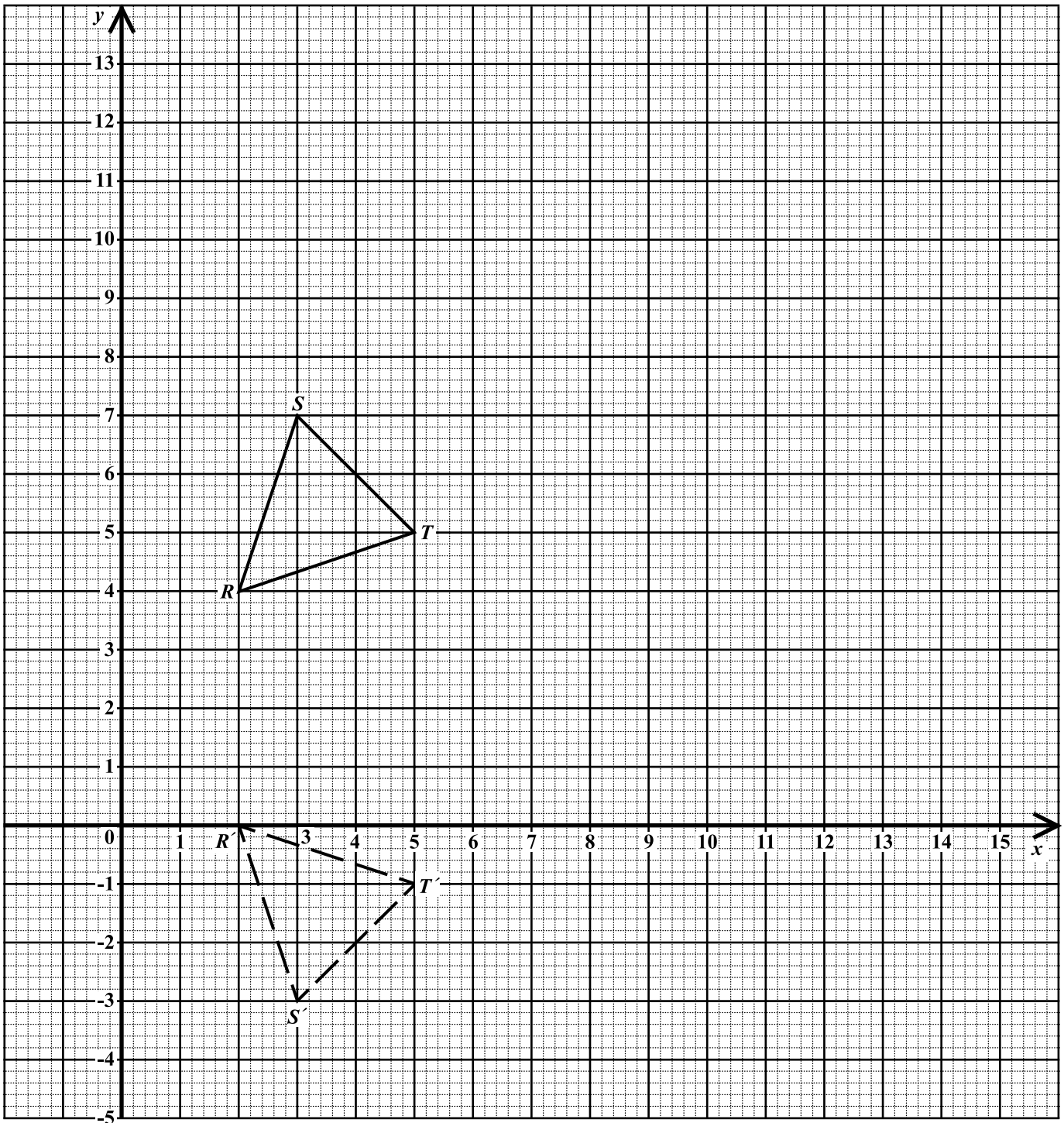
SECONDARY EDUCATION CERTIFICATE
EXAMINATION

MATHEMATICS

Paper 02 – General Proficiency

Answer Sheet for Question 7

Candidate Number



ATTACH THIS ANSWER SHEET TO YOUR ANSWER BOOKLET

CARIBBEAN EXAMINATIONS COUNCIL
SECONDARY EDUCATION CERTIFICATE
EXAMINATION
MATHEMATICS

Paper 02 – General Proficiency

Answer Sheet for Question 8

Candidate Number

A 15x15 grid with a rectangle labeled 'A' in the top-left corner. The rectangle is 10 units wide and 2 units high, spanning from the first to the eleventh column and the first to the second row. The letter 'A' is centered within the rectangle.

Rectangle	Length	Width	Area (square units)	Perimeter (units)
A	10	2	20	24
B	_____	_____	27	24
C	_____	_____	32	24
D	_____	_____	_____	24
E	_____	_____	_____	36

ATTACH THIS ANSWER SHEET TO YOUR ANSWER BOOKLET

FORM TP 2011092



TEST CODE **01234020**

MAY/JUNE 2011

**CARIBBEAN EXAMINATIONS COUNCIL
SECONDARY EDUCATION CERTIFICATE
EXAMINATION
MATHEMATICS**

Paper 02 – General Proficiency

2 hours 40 minutes

18 MAY 2011 (a.m.)

INSTRUCTIONS TO CANDIDATES

1. This paper consists of **TWO** sections.
2. There are EIGHT questions in Section I and THREE questions in Section II.
3. Answer **ALL** questions in Section I, and any **TWO** questions from Section II.
4. Write your answers in the booklet provided.
5. All working must be clearly shown.
6. A list of formulae is provided on page 2 of this booklet.

Required Examination Materials

Electronic calculator
Geometry set
Graph paper (provided)

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

Copyright © 2009 Caribbean Examinations Council
All rights reserved.

01234020/F 2011

LIST OF FORMULAE

Volume of a prism $V = Ah$ where A is the area of a cross-section and h is the perpendicular length.

Volume of cylinder $V = \pi r^2 h$ where r is the radius of the base and h is the perpendicular height.

Volume of a right pyramid $V = \frac{1}{3} Ah$ where A is the area of the base and h is the perpendicular height.

Circumference $C = 2\pi r$ where r is the radius of the circle.

Arc length $S = \frac{\theta}{360} \times 2\pi r$ where θ is the angle subtended by the arc, measured in degrees.

Area of a circle $A = \pi r^2$ where r is the radius of the circle.

Area of a sector $A = \frac{\theta}{360} \times \pi r^2$ where θ is the angle of the sector, measured in degrees.

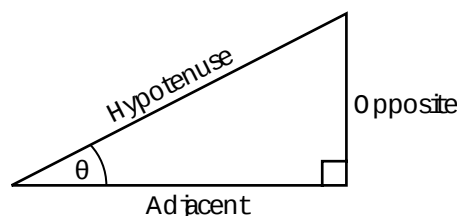
Area of trapezium $A = \frac{1}{2} (a + b) h$ where a and b are the lengths of the parallel sides and h is the perpendicular distance between the parallel sides.

Roots of quadratic equations If $ax^2 + bx + c = 0$,
then $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Trigonometric ratios $\sin \theta = \frac{\text{opposite side}}{\text{hypotenuse}}$

$\cos \theta = \frac{\text{adjacent side}}{\text{hypotenuse}}$

$\tan \theta = \frac{\text{opposite side}}{\text{adjacent side}}$

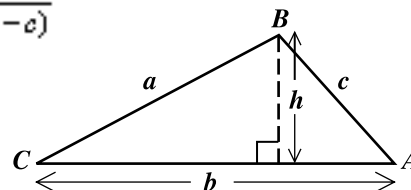


Area of triangle $\text{Area of } \Delta = \frac{1}{2} bh$ where b is the length of the base and h is the perpendicular height

$\text{Area of } \Delta ABC = \frac{1}{2} ab \sin C$

$\text{Area of } \Delta ABC = \sqrt{s(s-a)(s-b)(s-c)}$

where $s = \frac{a+b+c}{2}$



Sine rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

Cosine rule $a^2 = b^2 + c^2 - 2bc \cos A$

GO ON TO THE NEXT PAGE

SECTION I

Answer ALL the questions in this section.

All working must be clearly shown.

1. (a) Using a calculator, or otherwise, determine the EXACT value of:

(i) $\frac{2\frac{1}{4} + 1\frac{1}{8}}{4\frac{1}{2}}$ expressing your answer as a fraction (3 marks)

(ii) $3.96 \times 0.25 - \sqrt{0.0256}$ (3 marks)

- (b) The table below shows Pamela's shopping bill. Some of the information was not included.

Items	Quantity	Unit Price \$	Total Cost \$
Rice	$6\frac{1}{2}$ kg	2.40	W
Potatoes	4 bags	X	52.80
Milk	Y cartons	2.35	14.10
Sub Total			82.50
Z % VAT			9.90
TOTAL			92.40

Calculate the values of W, X, Y and Z. (5 marks)

Total 11 marks

GO ON TO THE NEXT PAGE

2. (a) Write as a single fraction in its lowest terms

$$\frac{x-2}{3} + \frac{x+1}{4} . \quad (3 \text{ marks})$$

- (b) The binary operation $*$ is defined by

$$a * b = (a + b)^2 - 2ab.$$

Calculate the value of $3 * 4$. (2 marks)

- (c) Factorise completely

(i) $xy^3 + x^2y$ (2 marks)

(ii) $2mh - 2nh - 3mk + 3nk$. (2 marks)

- (d) The table below shows corresponding values of the variables x and y , where y varies directly as x .

x	2	5	b
y	12	a	48

Calculate the values of a and b . (3 marks)

Total 12 marks

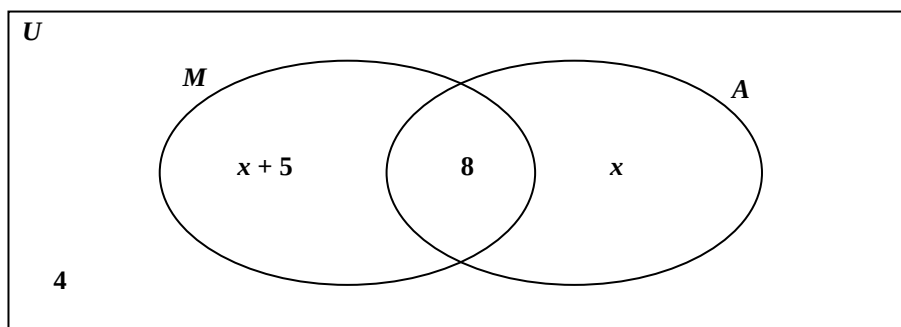
GO ON TO THE NEXT PAGE

3. (a) The Venn diagram below shows the number of students who study Music and Art in a class of 35 students.

U = {students in the class}

M = {students who study Music}

A = {students who study Art}



- (i) How many students study neither Art nor Music? (1 mark)
- (ii) Calculate the value of x . (3 marks)
- (iii) Hence, state the number of students who study Music only. (1 mark)
- (b) (i) **Using a ruler, pencil, a pair of compasses and a protractor**, draw accurately a quadrilateral $EFGH$ using the following measurements:
- $EF = 8 \text{ cm}$ $\angle EFG = 125^\circ$ $FG = 4 \text{ cm}$ $\angle HEF = 70^\circ$ $EH = 7 \text{ cm}$
- (5 marks)
- (ii) Measure and state in centimetres, the length of GH . (1 mark)

Total 11 marks

GO ON TO THE NEXT PAGE

4. (a) (i) Solve the inequality: $5 - 2x < 9$ (2 marks)
- (ii) If x is an integer, determine the SMALLEST value of x that satisfies the inequality in (a) (i) above. (1 mark)

(b) In this question, use $\pi = \frac{22}{7}$.

- (i) A piece of wire is bent to form a square of area 121 cm^2 .

Calculate:

- a) The length of each side of the square
- b) The perimeter of the square (3 marks)

- (ii) The same piece of wire is bent to form a circle.

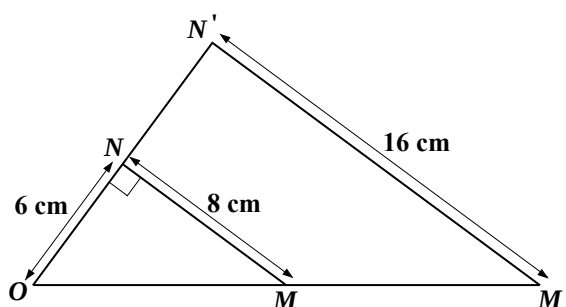
Calculate:

- a) The radius of the circle
- b) The area of the circle (4 marks)

Total 10 marks

GO ON TO THE NEXT PAGE

5. (a) The diagram below, **not drawn to scale**, shows $\triangle OMN$, and its image, $\triangle OM'N'$ under an enlargement with centre, O , and scale factor, k . Angle $ONM = 90^\circ$.



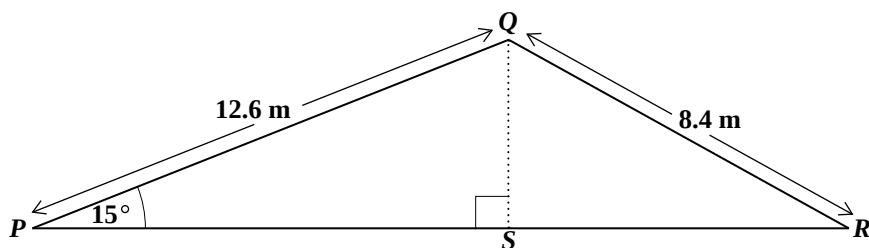
Using the dimensions shown on the diagram, calculate

- (i) the value of k , the scale factor of the enlargement (1 mark)
 - (ii) the length of OM (1 mark)
 - (iii) the length of OM' . (2 marks)
- (b) The diagram below, **not drawn to scale**, shows $\triangle PQR$, which represents the cross section of a roof. QS is perpendicular to PSR .

$PQ = 12.6$ metres

$QR = 8.4$ metres

$\angle QPR = 15^\circ$



Using the dimensions shown on the diagram, calculate, correct to 3 significant figures

- (i) the length of QS (2 marks)
- (ii) the measure of $\angle RQS$ (3 marks)
- (iii) the area of $\triangle PQR$. (3 marks)

Total 12 marks

GO ON TO THE NEXT PAGE

6. (a) The functions f and g are defined by

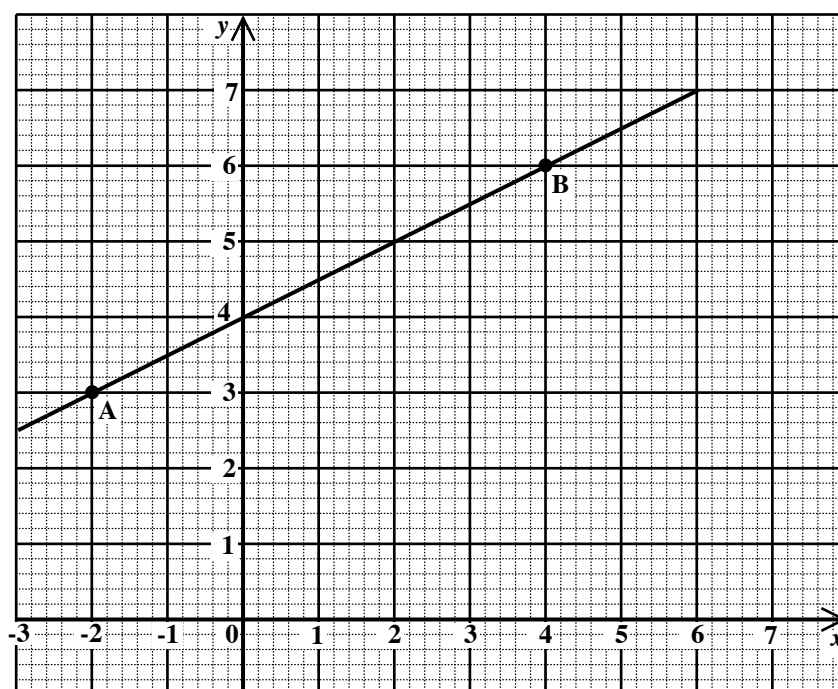
$$f(x) = 6x + 8 \quad ; \quad g(x) = \frac{x-2}{3} .$$

- (i) Calculate the value of $g\left(\frac{1}{2}\right)$. (2 marks)

- (ii) Write an expression for $gf(x)$ in its simplest form. (2 marks)

- (iii) Find the inverse function $f^{-1}(x)$. (2 marks)

- (b) The diagram below shows the line segment which passes through the points A and B .



Determine

- (i) the coordinates of A and B (2 marks)
- (ii) the gradient of the line segment AB (2 marks)
- (iii) the equation of the line which passes through A and B . (2 marks)

Total 12 marks

GO ON TO THE NEXT PAGE

7. The table below shows the distribution of the masses of 100 packages.

Mass (kg)	No. of Packages	Cumulative Frequency
1 – 10	12	12
11 – 20	28	40
21 – 30	30	
31 – 40	22	
41 – 50	8	

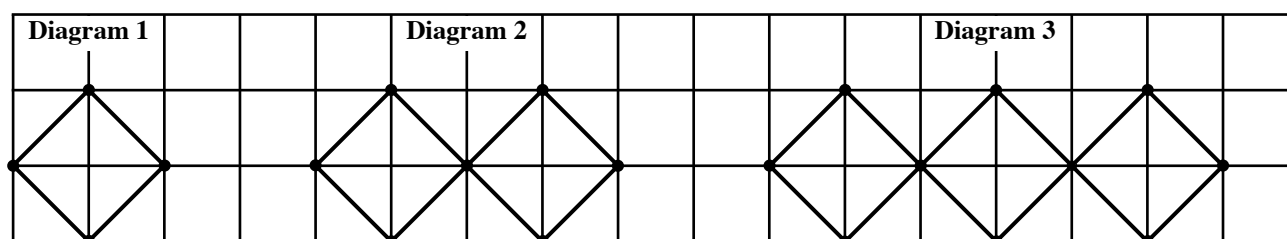
- (a) Copy and complete the table to show the cumulative frequency for the distribution.
(2 marks)
- (b) Using a scale of 2 cm to represent 10 kg on the x-axis and 1 cm to represent 10 packages on the y-axis, draw the cumulative frequency curve for the data.
(5 marks)
- (c) Estimate from the graph
- (i) the median mass of the packages (2 marks)
- (ii) the probability that a package, chosen at random, has a mass which is LESS than 35 kg.
(3 marks)

Total 12 marks

GO ON TO THE NEXT PAGE

8. An answer sheet is provided for this question.

The figure below shows the first three diagrams in a sequence. Each diagram is made up of sticks joined at the ends by thumb tacks. The sticks are represented by lines and the thumb tacks by dots. In each diagram, there are t thumb tacks and s sticks.



On the answer sheet provided:

- (a) Draw the FOURTH diagram in the sequence. (2 marks)
- (b) (i) How many sticks are in the SIXTH diagram? (1 mark)
- (ii) How many thumb tacks are in the SEVENTH diagram? (1 mark)
- (c) Complete the table by inserting the missing values at the rows marked (i) and (ii).

	No. of Sticks s	Rule Connecting t and s	No. of Thumb Tacks t	
	4	$1 + \left(\frac{3}{4} \times 4\right)$	4	
	8	$1 + \left(\frac{3}{4} \times 8\right)$	7	
	12	$1 + \left(\frac{3}{4} \times 12\right)$	10	
(i)	52	_____	_____	(2 marks)
(ii)	_____	_____	55	(2 marks)

- (d) Write the rule, in terms of s and t , to show how t is related to s . (2 marks)

Total 10 marks

GO ON TO THE NEXT PAGE

SECTION II

Answer TWO questions in this section.

ALGEBRA AND RELATIONS, FUNCTIONS AND GRAPHS

9. (a) Solve the pair of simultaneous equations

$$\begin{aligned} y &= x^2 - x + 3 \\ y &= 6 - 3x \end{aligned} \quad (5 \text{ marks})$$

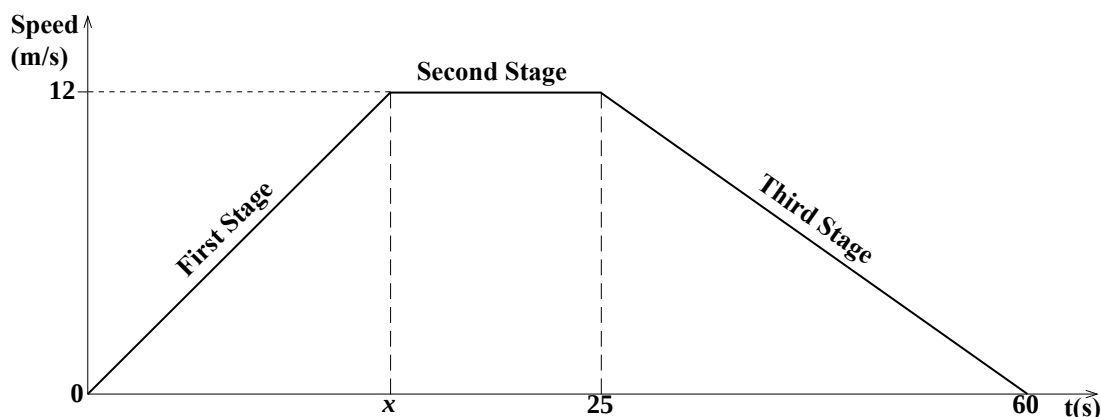
- (b) (i) Express the function $f(x) = 4x^2 - 8x - 2$ in the form $a(x + h)^2 + k$, where a , h and k are constants. (2 marks)

State

- (ii) the minimum value of $f(x)$ (1 mark)

- (iii) the value of x for which $f(x)$ is a minimum. (1 mark)

- (c) The speed-time graph below, **not drawn to scale**, shows the three-stage journey of a racing car over a period of 60 seconds.



During the FIRST stage of the journey, the car increased its speed from 0 m/s to 12 m/s in x seconds accelerating at 0.6 m/s^2 .

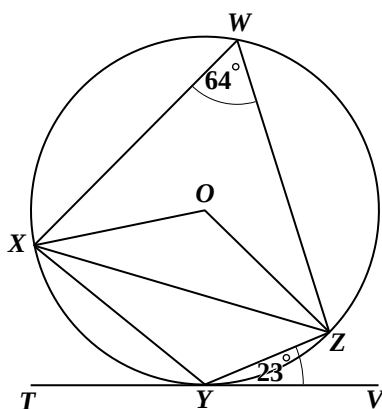
- (i) Calculate the value of x . (2 marks)
- (ii) What is the gradient of the graph during the SECOND stage? Explain, in one sentence, what the car is doing during this stage. (2 marks)
- (iii) Calculate the distance travelled by the car on the THIRD stage of the journey. (2 marks)

Total 15 marks

GO ON TO THE NEXT PAGE

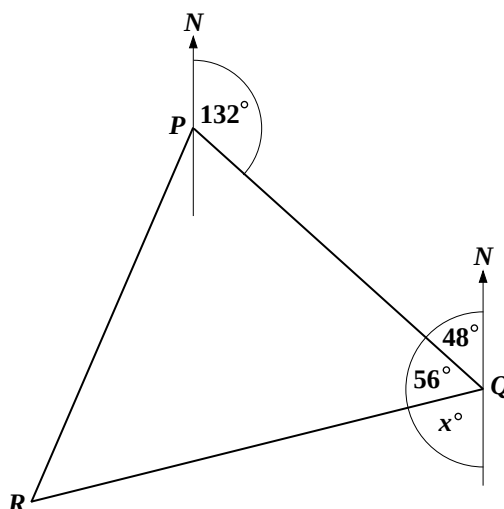
MEASUREMENT, GEOMETRY AND TRIGONOMETRY

10. (a) In the diagram below, **not drawn to scale**, W, X, Y and Z are points on the circumference of a circle, centre O . TYV is a tangent to the circle at Y , $\angle XWZ = 64^\circ$ and $\angle ZYV = 23^\circ$.



Calculate, **giving reasons for your answer**, the measure of angle

- (i) XYZ (2 marks)
 - (ii) YXZ (2 marks)
 - (iii) OXZ . (3 marks)
- (b) The diagram below, **not drawn to scale**, shows the route of an aeroplane flying from Portcity (P) to Queenstown (Q) and then to Riversdale (R). The bearing of Q from P is 132° and the angle PQR is 56° .



- (i) Calculate the value of x , as shown in the diagram. (2 marks)
- (ii) The distance from Portcity (P) to Queenstown (Q) is 220 kilometres and the distance from Queenstown to Riversdale (R) is 360 kilometres. Calculate the distance RP . (3 marks)
- (iii) Determine the bearing of R from P . (3 marks)

Total 15 marks

GO ON TO THE NEXT PAGE

VECTORS AND MATRICES

11. (a) Determine the inverse of the matrix $\begin{pmatrix} 3 & 5 \\ 2 & 4 \end{pmatrix}$. (2 marks)

- (b) The transformation, $M = \begin{pmatrix} 0 & a \\ b & 0 \end{pmatrix}$, maps the points R and T onto R' and T' such that:

$$R(7, 2) \longrightarrow R'(2, -7) \text{ and}$$

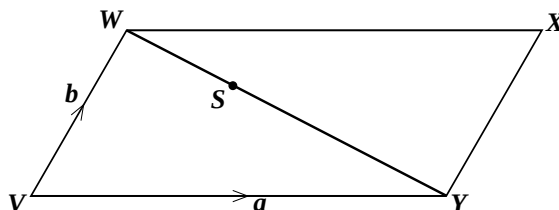
$$T(-5, 4) \longrightarrow T'(4, 5)$$

- (i) Determine the values of a and b . (2 marks)
- (ii) Describe fully the transformation, M . (3 marks)

- (c) $WXYV$ is a parallelogram in which

$$\vec{VY} = \mathbf{a} \text{ and } \vec{VW} = \mathbf{b}.$$

S is a point on WY such that $WS : SY = 1 : 2$.



- (i) Write in terms of $\mathbf{a}$ and $\mathbf{b}$, an expression for:
- $\vec{WY}$
 - $\vec{WS}$
 - $\vec{SX}$
- (5 marks)
- (ii) R is the mid-point of VW . Prove that R , S and X are collinear. (3 marks)

Total 15 marks

END OF TEST

CARIBBEAN EXAMINATIONS COUNCIL
SECONDARY EDUCATION CERTIFICATE
EXAMINATION
MATHEMATICS

Paper 02 – General Proficiency

Answer Sheet for Question 8

Candidate Number

(a)

(b) (i) _____

(ii) _____

(c)

No. of Sticks s	Rule Connecting t and s	No. of Thumb Tacks t
4	$1 + \left(\frac{3}{4} \times 4\right)$	4
8	$1 + \left(\frac{3}{4} \times 8\right)$	7
12	$1 + \left(\frac{3}{4} \times 12\right)$	10
(i) 52	_____	_____
(ii) _____	_____	55

(d) _____

ATTACH THIS ANSWER SHEET TO YOUR ANSWER BOOKLET

FORM TP 2012017



TEST CODE **01234020**

JANUARY 2012

**CARIBBEAN EXAMINATIONS COUNCIL
SECONDARY EDUCATION CERTIFICATE
EXAMINATION
MATHEMATICS**

Paper 02 – General Proficiency

2 hours 40 minutes

04 JANUARY 2012 (a.m.)

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of **TWO** sections.
2. There are **EIGHT** questions in Section I and **THREE** questions in Section II.
3. Answer **ALL** questions in Section I, and any **TWO** questions from Section II.
4. Write your answers in the booklet provided.
5. All working must be clearly shown.
6. A list of formulae is provided on page 2 of this booklet.

Required Examination Materials

Electronic calculator
Geometry set
Graph paper (provided)

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

Copyright © 2009 Caribbean Examinations Council
All rights reserved.

01234020/JANUARY/F 2012

LIST OF FORMULAE

Volume of a prism	$V = Ah$ where A is the area of a cross-section and h is the perpendicular length.
Volume of cylinder	$V = \pi r^2 h$ where r is the radius of the base and h is the perpendicular height.
Volume of a right pyramid	$V = \frac{1}{3} Ah$ where A is the area of the base and h is the perpendicular height.
Circumference	$C = 2\pi r$ where r is the radius of the circle.
Arc length	$S = \frac{\theta}{360} \times 2\pi r$ where θ is the angle subtended by the arc, measured in degrees.
Area of a circle	$A = \pi r^2$ where r is the radius of the circle.
Area of a sector	$A = \frac{\theta}{360} \times \pi r^2$ where θ is the angle of the sector, measured in degrees.
Area of trapezium	$A = \frac{1}{2} (a + b) h$ where a and b are the lengths of the parallel sides and h is the perpendicular distance between the parallel sides.

Roots of quadratic equations If $ax^2 + bx + c = 0$,

$$\text{then } x = \frac{-a \pm \sqrt{b^2 - 4ac}}{2a}$$

Trigonometric ratios

$$\sin \theta = \frac{\text{opposite side}}{\text{hypotenuse}}$$

$$\cos \theta = \frac{\text{adjacent side}}{\text{hypotenuse}}$$

$$\tan \theta = \frac{\text{opposite side}}{\text{adjacent side}}$$

Area of triangle

Area of $\Delta = \frac{1}{2} bh$ where b is the length of the base and h is the perpendicular height.

$$\text{Area of } \Delta ABC = \frac{1}{2} ab \sin C$$

$$\text{Area of } \Delta ABC = \sqrt{s(s-a)(s-b)(s-c)}$$

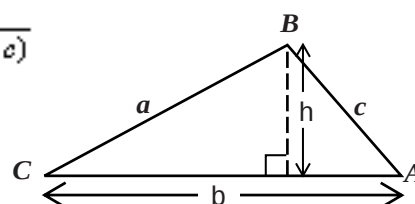
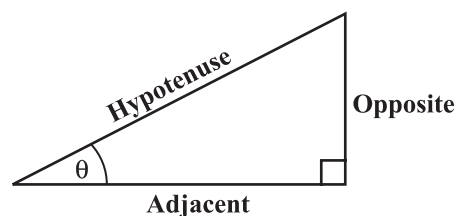
$$\text{where } s = \frac{a+b+c}{2}$$

Sine rule

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

Cosine rule

$$a^2 = b^2 + c^2 - 2bc \cos A$$



GO ON TO THE NEXT PAGE

SECTION I

Answer ALL the questions in this section.

All working must be clearly shown.

1. (a) Using a calculator, or otherwise, calculate the EXACT value of
- (i) $\left(1\frac{3}{4}\right)^2 \div 3\frac{1}{2}$, expressing your answer as a fraction (3 marks)
- (ii) $\sqrt{0.0529} + 0.216$, expressing your answer in standard form. (3 marks)
- (b) A typist is paid a basic wage of \$22.50 per hour for a 40-hour week.
- (i) Calculate the typist's basic weekly wage. (1 mark)
- Overtime is paid at one and a half times the basic hourly rate.
- (ii) Calculate the overtime wage for ONE hour of overtime work. (1 mark)
- To earn some extra money, the typist decided to work overtime.
- Calculate
- (iii) the wage she would earn for overtime if she worked for a TOTAL of 52 hours during a given week. (2 marks)
- (iv) the number of overtime hours she must work during a given week to earn a TOTAL wage of \$1440. (2 marks)

Total 12 marks

GO ON TO THE NEXT PAGE

2. (a) Solve the pair of simultaneous equations

$$\begin{aligned} 3x + 2y &= 13 \\ x - 2y &= -1. \end{aligned}$$

(3 marks)

- (b) Factorise completely

(i) $x^2 - 16$

(1 mark)

(ii) $2x^2 - 3x + 8x - 12.$

(2 marks)

- (c) Tickets for a football match are sold at \$30 for EACH adult and \$15 for EACH child. A company bought 28 tickets.

- (i) If x of these tickets were for adults, write in terms of x ,

a) the number of tickets for children (1 mark)

b) the amount spent on tickets for adults (1 mark)

c) the amount spent on tickets for children. (1 mark)

- (ii) Show that the TOTAL amount spent on the 28 tickets is $\$(15x + 420)$.

(1 mark)

- (iii) Given that the cost of the 28 tickets was \$660, calculate the number of adult tickets bought by the company. (2 marks)

Total 12 marks

3. (a) A universal set, U , is defined as:

$$U = \{ 51, 52, 53, 54, 55, 56, 57, 58, 59 \}$$

A and B are subsets of U , such that:

$$A = \{ \text{odd numbers} \}$$

$$B = \{ \text{prime numbers} \}$$

- (i) List the members of the set A . (1 mark)

- (ii) List the members of the set B . (1 mark)

- (iii) Draw a Venn diagram to represent the sets A , B and U . (3 marks)

- (b) (i) **Using a pair of compasses, a ruler and a pencil**

a) construct a triangle CDE in which $DE = 10$ cm, $DC = 8$ cm and $\angle CDE = 45^\circ$. (4 marks)

b) construct a line, CF , perpendicular to DE such that F lies on DE . (2 marks)

- (ii) Using a protractor, measure and state the size of $\angle DCE$. (1 mark)

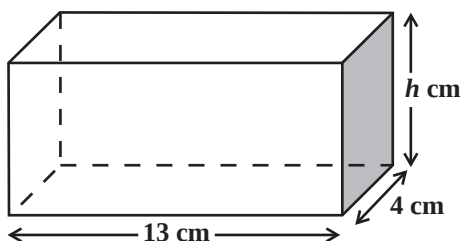
Total 12 marks

GO ON TO THE NEXT PAGE

4. (a) The following is an extract from a bus schedule. The bus begins its journey at Bellevue, travels to Chagville and ends its journey at St. Andrews.

Town	Arrive	Depart
Bellevue	—	6:40 a.m.
Chagville	7:35 a.m.	7:45 a.m.
St. Andrews	8:00 a.m.	—

- (i) How long did the bus spend at Chagville? (1 mark)
- (ii) How long did the bus take to travel from Bellevue to Chagville? (1 mark)
- (iii) The bus travelled at an average speed of 54 km/hour from Bellevue to Chagville. Calculate, in kilometres, the distance from Bellevue to Chagville. (2 marks)
- (b) Water is poured into a cylindrical bucket with a base area of 300 cm^2 . If 4.8 litres of water was poured into the bucket, what is the height of the water in the bucket? (3 marks)
- (c) The diagram below, **not drawn to scale**, shows a cuboid with length 13 cm, width 4 cm and height h cm.

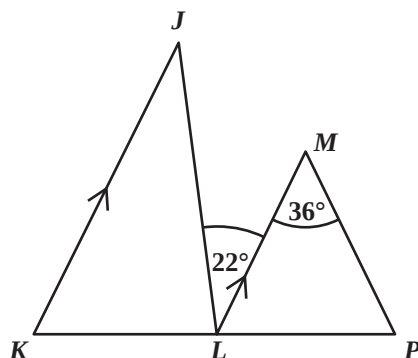


- (i) State, in terms of h , the area of the shaded face of the cuboid. (1 mark)
- (ii) Write an expression, in terms of h , for the volume of the cuboid. (1 mark)
- (iii) If the volume of the cuboid is 286 cm^3 calculate the height, h , of the cuboid. (2 marks)

Total 11 marks

GO ON TO THE NEXT PAGE

5. (a) The diagram below, **not drawn to scale**, shows TWO triangles, JKL and MLP , with JK parallel to ML . $LM = MP$, KLP is a straight line, angle $JLM = 22^\circ$ and angle $LMP = 36^\circ$.

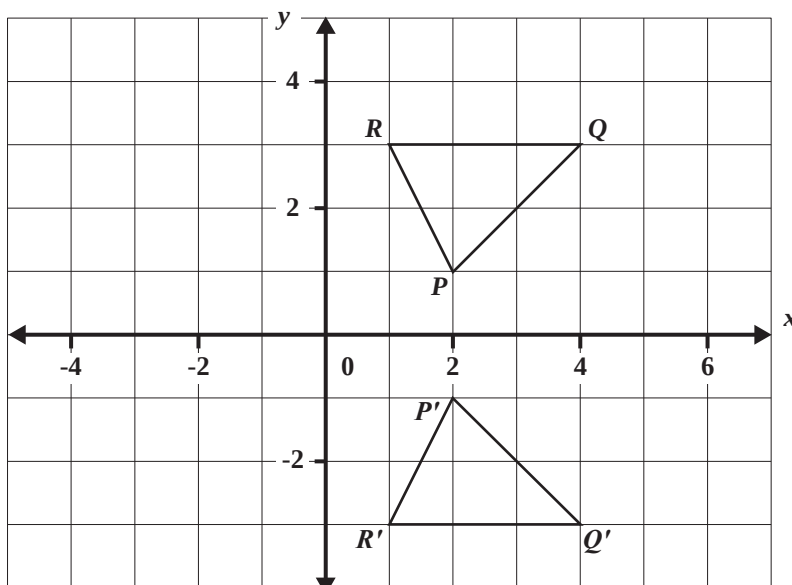


Calculate, giving reasons for your answers, the measure of EACH of the following:

- (i) $\angle MLP$
- (ii) $\angle LJK$
- (iii) $\angle JKL$
- (iv) $\angle KLJ$

(4 marks)

- (b) The diagram below shows a triangle, PQR , and its image, $P'Q'R'$.



- (i) State the coordinates of P and Q . (2 marks)
- (ii) Describe fully the transformation that maps triangle PQR onto triangle $P'Q'R'$. (2 marks)
- (iii) Write down the coordinates of the images of P and Q under the translation

$$\begin{pmatrix} 3 \\ -6 \end{pmatrix}.$$

(2 marks)

Total 10 marks

GO ON TO THE NEXT PAGE

6. The table below shows corresponding values of x and y for the function $y = x^2 - 2x - 3$, for integer values of x from -2 to 4 .

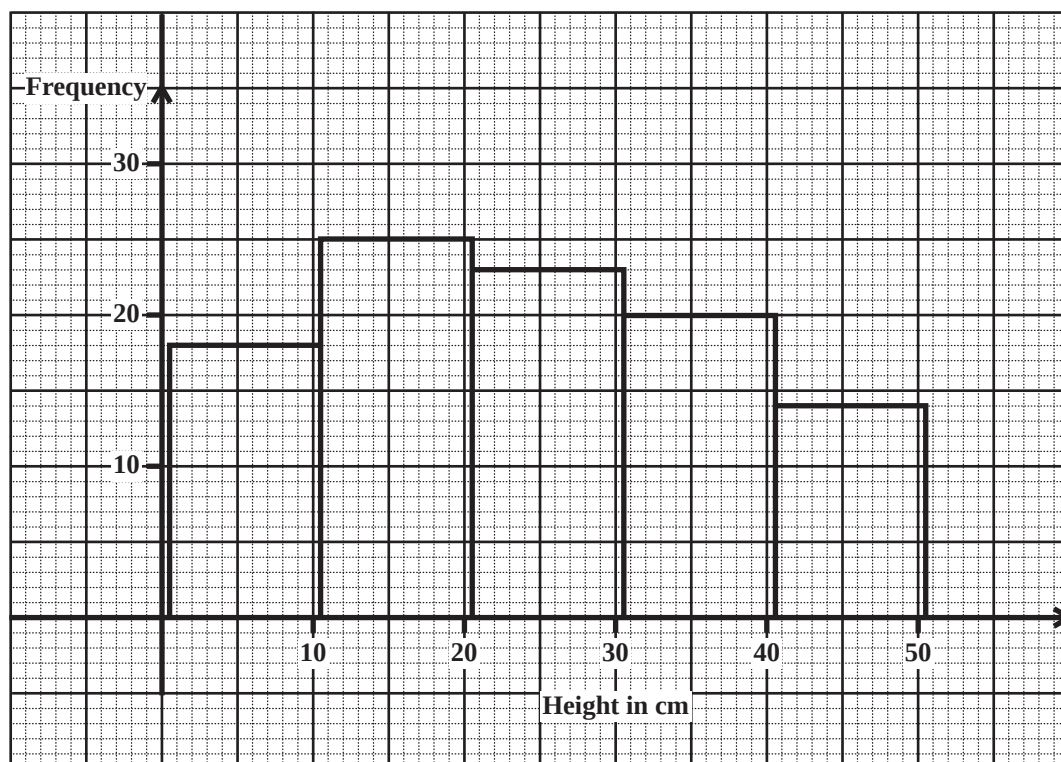
x	-2	-1	0	1	2	3	4
y	5		-3	-4		0	5

- (a) Copy and complete the table. (2 marks)
- (b) Using a scale of 2 cm to represent 1 unit on the x -axis, and 1 cm to represent 1 unit on the y -axis, plot the points whose x and y values are recorded in your table, and draw a smooth curve through your points. (4 marks)
- (c) Using your graph, estimate the value of y when $x = 3.5$. Show on your graph how the value was obtained. (2 marks)
- (d) Without further calculations,
- (i) write the equation of the axis of symmetry of the graph (1 mark)
 - (ii) estimate the minimum value of the function y (1 mark)
 - (iii) state the values of the solutions of the equation: $x^2 - 2x - 3 = 0$. (1 mark)

Total 11 marks

GO ON TO THE NEXT PAGE

7. The histogram below shows the distribution of heights of seedlings in a sample.



- (a) Copy and complete the frequency table for the data in the sample.

Height in cm	Mid-point	Frequency
1 - 10	5.5	18
11 - 20	15.5	25
21 - 30		
31 - 40		
41 - 50		

(3 marks)

- (b) Determine

- (i) the modal class interval (1 mark)
- (ii) the number of seedlings in the sample (2 marks)
- (iii) the mean height of the seedlings (4 marks)
- (iv) the probability that a seedling chosen at random has a height that is GREATER than 30 cm. (2 marks)

Total 12 marks

GO ON TO THE NEXT PAGE

8. An answer sheet is provided for this question.

Sarah is making a pattern of squares using straws. She uses four straws for the sides and two longer straws for the diagonals. The first three figures in her sequence of shapes are shown below:

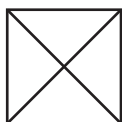


Figure 1

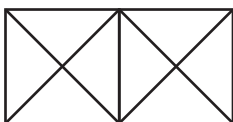


Figure 2

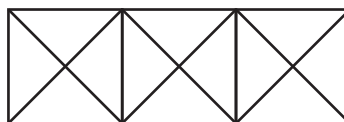


Figure 3

- (a) On your answer sheet, draw Figure 4, the FOURTH shape in the pattern. (2 marks)

- (b) On your answer sheet, complete the TWO rows in the table for

(i) Figure 4

(ii) Figure 10.

Figure	Total Number of Straws	
	Formula	Number
1	$1(6) - 0$	6
2	$2(6) - 1$	11
3	$3(6) - 2$	16
(i) 4		
(ii) 10		

(4 marks)

- (c) Which figure in the sequence uses 106 straws? (2 marks)
- (d) Obtain an expression in n , for the total number of straws used in the n^{th} pattern. (2 marks)

Total 10 marks

GO ON TO THE NEXT PAGE

SECTION II

Answer TWO questions in this section.

ALGEBRA AND RELATIONS, FUNCTIONS AND GRAPHS

9. (a) (i) Make
- x
- the subject of the formula

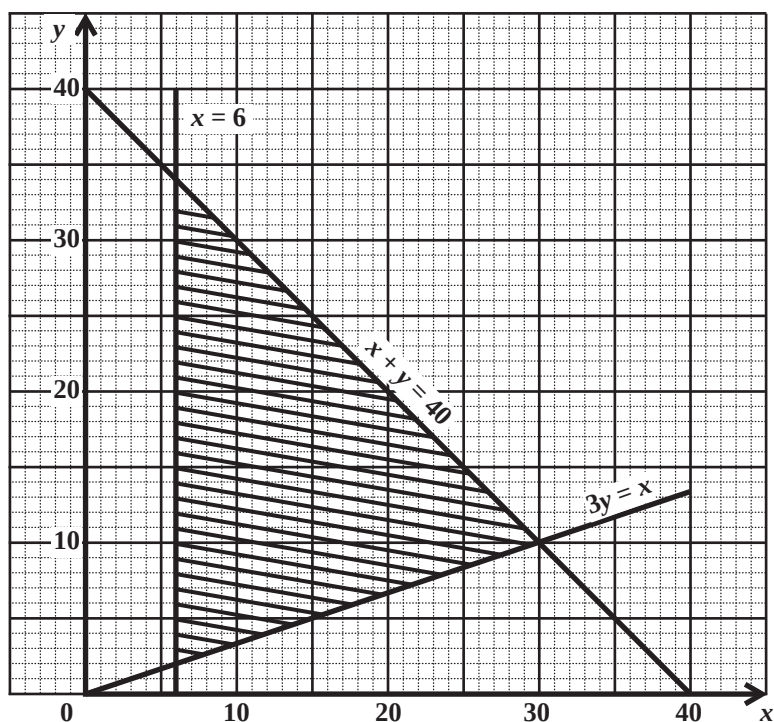
$$y = \frac{2x+3}{x-4} \quad (2 \text{ marks})$$

- (ii) Hence, determine the inverse of $f(x) = \frac{2x+3}{x-4}$, where $x \neq 4$. (2 marks)

- (iii) Find the value of x for which $f(x) = 0$. (2 marks)

- (b) The diagram below shows the graphs of three lines and a shaded region defined by three inequalities associated with these lines.

The inequality associated with the line $3y = x$ is $3y \geq x$.



- (i) State the other TWO inequalities which define the shaded region. (2 marks)

The function $p = 4x + 3y$ satisfies the solution set represented by the closed triangular region.

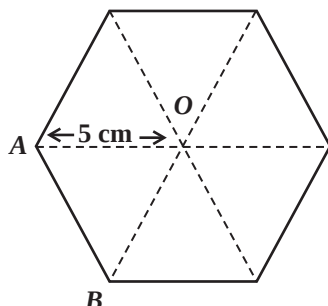
- (ii) Identify the three pairs of (x, y) values for which p has a maximum or a minimum value. (3 marks)
- (iii) Which pair of (x, y) values makes p a maximum? Justify your answer. (4 marks)

Total 15 marks

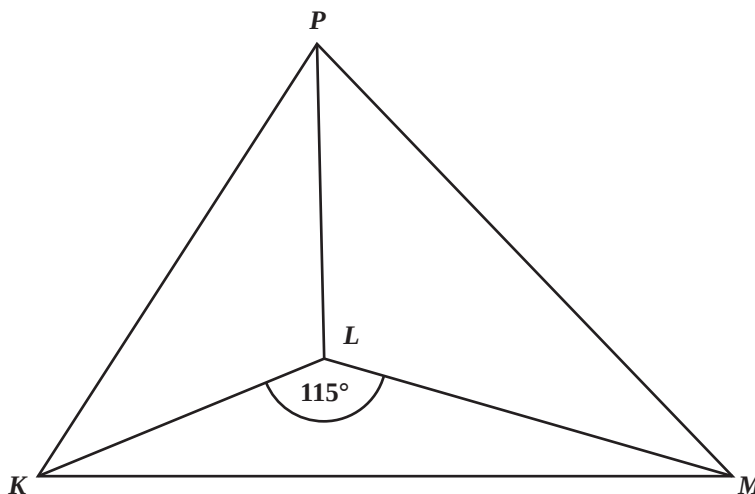
GO ON TO THE NEXT PAGE

MEASUREMENT, GEOMETRY AND TRIGONOMETRY

10. (a) The diagram below, **not drawn to scale**, shows a regular hexagon with centre, O , and $AO = 5$ cm.



- (i) Determine the size of angle AOB . (2 marks)
- (ii) Calculate, to the nearest whole number, the area of the hexagon. (3 marks)
- (b) The diagram below, **not drawn to scale**, shows a vertical pole, PL , standing on a horizontal plane, KLM . The angle of elevation of P from K is 28° , $KL = 15$ m, $LM = 19$ m and $\angle KLM = 115^\circ$.

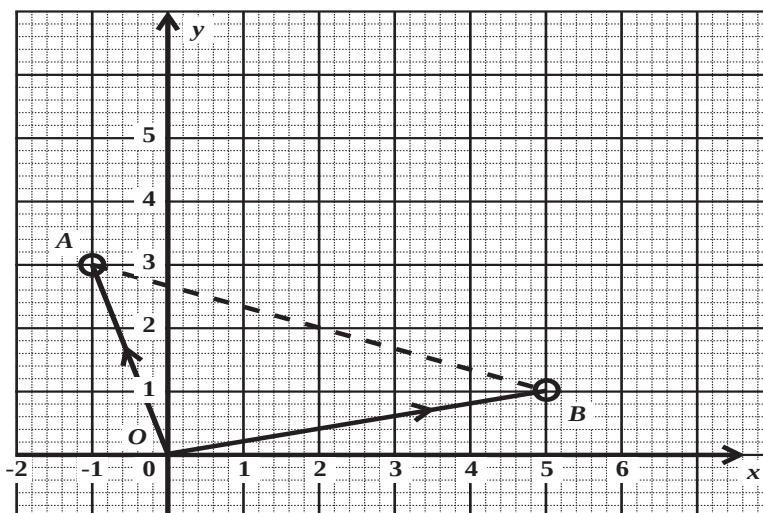


- (i) Copy the diagram. Show the angle of elevation, 28° and ONE right angle. (2 marks)
- (ii) Calculate, giving your answer to 2 significant figures, the measure of
- a) PL (2 marks)
- b) KM (3 marks)
- c) the angle of elevation of P from M . (3 marks)

Total 15 marks

GO ON TO THE NEXT PAGE

11. (a) The diagram below shows two position vectors $\vec{OA}$ and $\vec{OB}$.



- (i) Write as a column vector, in the form $\begin{pmatrix} x \\ y \end{pmatrix}$:
- $\vec{OA}$ (1 mark)
 - $\vec{OB}$ (1 mark)
 - $\vec{BA}$ (2 marks)
- (ii) Given that G is the mid-point of the line AB , write as a column vector in the form $\begin{pmatrix} x \\ y \end{pmatrix}$:
- $\vec{BG}$ (1 mark)
 - $\vec{OG}$ (1 mark)

- (b) L and M are two matrices where
- $$L = \begin{pmatrix} 3 & 2 \\ 1 & 4 \end{pmatrix} \text{ and } M = \begin{pmatrix} -1 & 3 \\ 0 & 2 \end{pmatrix}.$$

Evaluate

- $L + 2M$ (2 marks)
 - LM (2 marks)
- (c) The matrix, Q , is such that $Q = \begin{pmatrix} 4 & 2 \\ 1 & 1 \end{pmatrix}$.
- Find Q^{-1} . (2 marks)
 - Using a matrix method, find the values of x and y in the equation $\begin{pmatrix} 4 & 2 \\ 1 & 1 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 8 \\ 3 \end{pmatrix}$. (3 marks)

Total 15 marks

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.

CARIBBEAN EXAMINATIONS COUNCIL
SECONDARY EDUCATION CERTIFICATE
EXAMINATION
MATHEMATICS

Paper 02 – General Proficiency

Answer Sheet for Question 8

Candidate Number

(a) Draw the FOURTH shape in the pattern:

(b) Complete the table for Figure 4 and Figure 10.

	Total Number of Straws		
	Figure	Formula	Number
(i)	1	$1(6) - 0$	6
	2	$2(6) - 1$	11
	3	$3(6) - 2$	16
	4		
(ii)			
	10		

(c) Which figure in the sequence uses 106 straws?

(d) Obtain an expression in n , for the total number of straws used in the n^{th} pattern.

ATTACH THIS ANSWER SHEET TO YOUR ANSWER BOOKLET



TEST CODE **01234020**

FORM TP 2012092

MAY/JUNE 2012

C A R I B B E A N E X A M I N A T I O N S C O U N C I L

SECONDARY EDUCATION CERTIFICATE

EXAMINATION

MATHEMATICS

Paper 02 – General Proficiency

2 hours 40 minutes

18 MAY 2012 (a.m.)

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of **TWO** sections.
2. There are **EIGHT** questions in Section I and **THREE** questions in Section II.
3. Answer **ALL** questions in Section I, and any **TWO** questions from Section II.
4. Write your answers in the booklet provided.
5. All working must be shown clearly.
6. A list of formulae is provided on page 2 of this booklet.

Required Examination Materials

Electronic calculator
Geometry set
Graph paper (provided)

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

Copyright © 2010 Caribbean Examinations Council
All rights reserved.

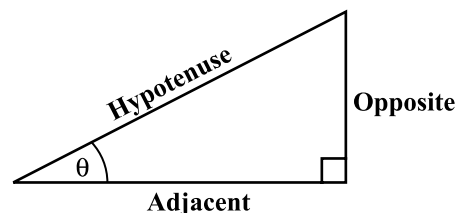
01234020/F 2012

LIST OF FORMULAE

Volume of a prism	$V = Ah$ where A is the area of a cross-section and h is the perpendicular length.
Volume of cylinder	$V = \pi r^2 h$ where r is the radius of the base and h is the perpendicular height.
Volume of a right pyramid	$V = \frac{1}{3} Ah$ where A is the area of the base and h is the perpendicular height.
Circumference	$C = 2\pi r$ where r is the radius of the circle.
Arc length	$S = \frac{\theta}{360} \times 2\pi r$ where θ is the angle subtended by the arc, measured in degrees
Area of a circle	$A = \pi r^2$ where r is the radius of the circle.
Area of a sector	$A = \frac{\theta}{360} \times \pi r^2$ where θ is the angle of the sector, measured in degrees.
Area of trapezium	$A = \frac{1}{2} (a + b) h$ where a and b are the lengths of the parallel sides and h is the perpendicular distance between the parallel sides.

Roots of quadratic equations	If $ax^2 + bx + c = 0$, then $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$.
------------------------------	---

Trigonometric ratios	$\sin \theta = \frac{\text{opposite side}}{\text{hypotenuse}}$
	$\cos \theta = \frac{\text{adjacent side}}{\text{hypotenuse}}$
	$\tan \theta = \frac{\text{opposite side}}{\text{adjacent side}}$

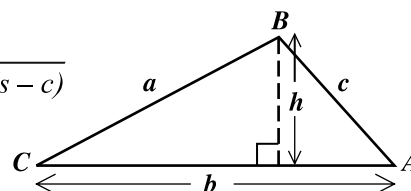


Area of triangle	Area of $\Delta = \frac{1}{2} bh$ where b is the length of the base and h is the perpendicular height.
------------------	--

$$\text{Area of } \Delta ABC = \frac{1}{2} ab \sin C$$

$$\text{Area of } \Delta ABC = \sqrt{s(s-a)(s-b)(s-c)}$$

$$\text{where } s = \frac{a+b+c}{2}$$



Sine rule	$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$
-----------	--

Cosine rule	$a^2 = b^2 + c^2 - 2bc \cos A$
-------------	--------------------------------

GO ON TO THE NEXT PAGE

SECTION I

Answer ALL the questions in this section.

All working must be clearly shown.

1. (a) Calculate the EXACT value of

$$\frac{3\frac{1}{5} - \frac{2}{3}}{2\frac{4}{5}}$$

giving your answer as a fraction in its lowest terms.

(3 marks)

- (b) The table below shows the cost price, selling price and profit or loss as a percentage of the cost price.

Copy and complete the table below, inserting the missing values at (i) and (ii).

	Cost Price	Selling Price	Percentage Profit or Loss
(i)	\$55.00	\$44.00	_____
(ii)	_____	\$100.00	25% profit

(4 marks)

- (c) The table below shows some rates of exchange:

US \$1.00 = EC \$2.70
TT \$1.00 = EC \$0.40

Calculate the value of

- (i) EC \$1 in TT \$ **(1 mark)**
- (ii) US \$80 in EC \$ **(1 mark)**
- (iii) TT \$648 in US \$. **(3 marks)**

Total 12 marks

GO ON TO THE NEXT PAGE

2. (a) Factorise completely:

(i) $2x^3y + 6x^2y^2$ (2 marks)

(ii) $9x^2 - 4$ (1 mark)

(iii) $4x^2 + 8xy - xy - 2y^2$ (2 marks)

(b) Solve for x :

$$\frac{2x - 3}{3} + \frac{5 - x}{2} = 3 \quad (3 \text{ marks})$$

(c) Solve the simultaneous equations:

$$\begin{aligned} 3x - 2y &= 10 \\ 2x + 5y &= 13 \end{aligned} \quad (4 \text{ marks})$$

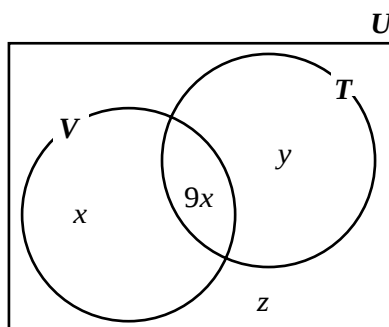
Total 12 marks

3. (a) In a survey of 36 students, it was found that
 30 play tennis,
 x play volleyball ONLY,
 $9x$ play BOTH tennis and volleyball
 4 play neither tennis nor volleyball.

(i) Given that:

$U = \{\text{students in the survey}\}$
 $V = \{\text{students who play Volleyball}\}$
 $T = \{\text{students who play Tennis}\}$

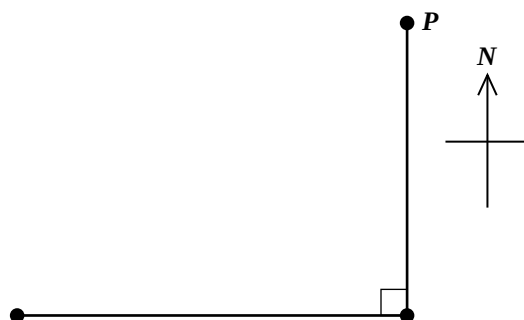
Copy and complete the Venn diagram below to show the number of students in the subsets marked y and z .



(2 marks)

GO ON TO THE NEXT PAGE

- (ii) a) Write an **expression** in x to represent the TOTAL number of students in the survey. **(1 mark)**
- b) Write an **equation** in x to represent the total number of students in the survey and hence solve for x . **(2 marks)**
- (b) The diagram below, **not drawn to scale**, shows the journey of a ship which started at port P , sailed 15 km due south to port Q , and then a further 20 km due west to port R .



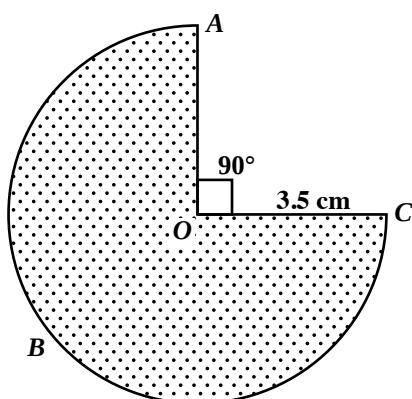
- (i) Copy the diagram and label it to show the points Q and R , and the distances 20 km and 15 km. **(2 marks)**
- (ii) Calculate PR , the **shortest** distance of the ship from the port where the journey started. **(2 marks)**
- (iii) Calculate the measure of angle QPR , giving your answer to the nearest degree. **(3 marks)**

Total 12 marks

GO ON TO THE NEXT PAGE

4. The diagram below, **not drawn to scale**, shows the cross section of a prism in the shape of a sector of a circle, centre O , and radius 3.5 cm. The angle at the centre is 270° .

Use $\pi = \frac{22}{7}$



- (a) Calculate
- (i) the length of the arc ABC (2 marks)
 - (ii) the perimeter of the sector $OABC$ (2 marks)
 - (iii) the area of the sector $OABC$. (2 marks)
- (b) The prism is 20 cm long and is a solid made of tin. Calculate
- (i) the volume of the prism (2 marks)
 - (ii) the mass of the prism, **to the nearest kg**, given that 1 cm^3 of tin has a mass of 7.3 kg. (2 marks)

Total 10 marks

GO ON TO THE NEXT PAGE

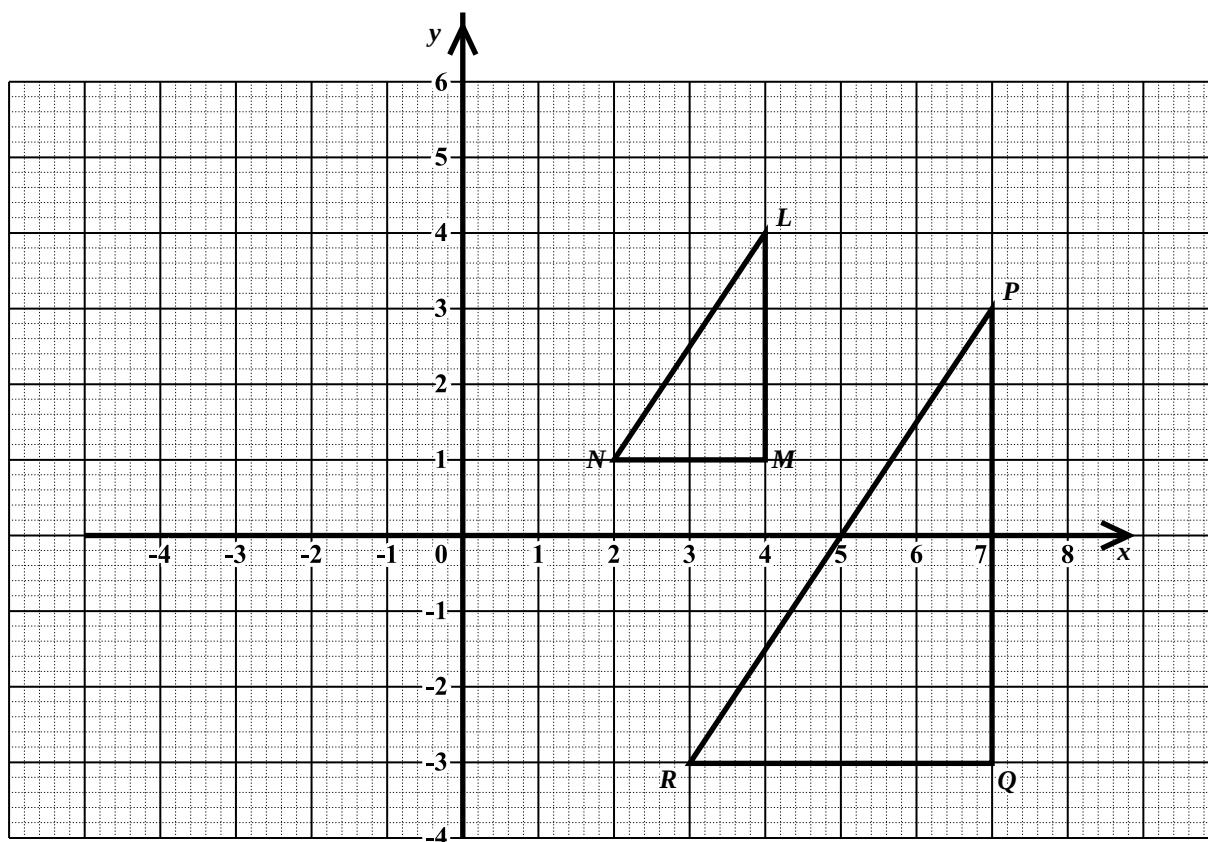
5. (a) (i) Using a ruler, a pencil and a pair of compasses, construct triangle PQR with $PQ = 8$ cm, $\angle PQR = 60^\circ$ and $\angle QPR = 45^\circ$. **(4 marks)**
- (ii) Measure and state the length of RQ . **(1 mark)**
- (b) The line ℓ passes through the points $S(6, 6)$ and $T(0, -2)$.
- Determine
- (i) the gradient of the line, ℓ **(2 marks)**
- (ii) the equation of the line, ℓ **(2 marks)**
- (iii) the midpoint of the line segment, TS **(1 mark)**
- (iv) the length of the line segment, TS . **(2 marks)**

Total 12 marks

GO ON TO THE NEXT PAGE

6. An answer sheet is provided for this question.

The graph below shows triangle LMN and its image PQR after an enlargement.



On the answer sheet provided

- Locate the centre of enlargement, showing your method clearly. (2 marks)
- State the scale factor and the coordinates of the centre of the enlargement. (2 marks)
- Determine the value of $\frac{\text{Area of } PQR}{\text{Area of } LMN}$. (2 marks)
- Draw and label triangle ABC with coordinates $(-4, 4)$, $(-1, 4)$ and $(-1, 2)$ respectively. (2 marks)
- Describe fully the single transformation which maps triangle LMN on to triangle ABC . (3 marks)

Total 11 marks

GO ON TO THE NEXT PAGE

7. The table below shows the ages, to the nearest year, of the persons who visited the clinic during a particular week.

Age (yrs)	Number of persons	Cumulative Frequency
40 – 49	4	4
50 – 59	11	15
60 – 69	20	—
70 – 79	12	—
80 – 89	3	50

- (a) Copy and complete the table to show the cumulative frequency. **(2 marks)**
- (b) **Using a scale of 2 cm to represent 10 years on the x-axis and 1 cm to represent 5 persons on the y-axis**, draw the cumulative frequency curve for the data. **(5 marks)**
- (c) Use your graph drawn at (b) above to estimate
- (i) the median age for the data **(2 marks)**
- (ii) the probability that a person who visited the clinic was 75 years or younger. **(2 marks)**

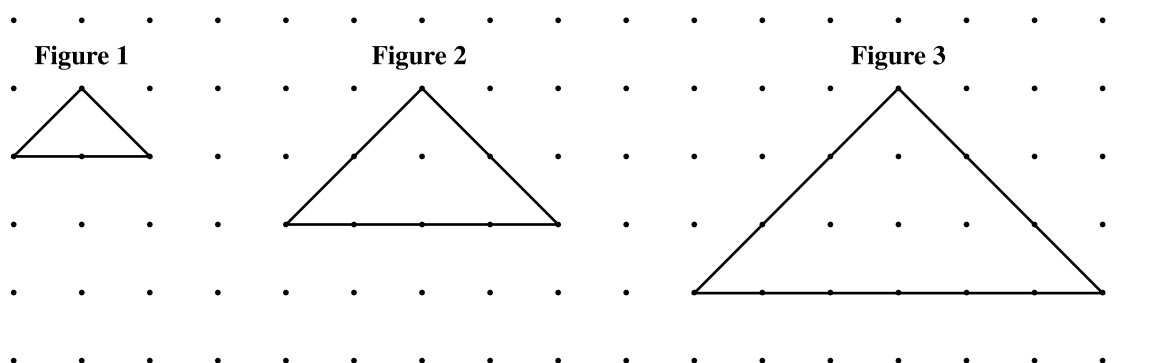
Draw lines on your graph to show how these estimates were obtained.

Total 11 marks

GO ON TO THE NEXT PAGE

8. An answer sheet is provided for this question.

The diagram below shows the first three figures in a sequence of figures. Each figure is an isosceles triangle made of a rubber band stretched around pins on a geo-board. The pins are arranged in rows and columns, one unit apart.



- (a) On the answer sheet provided, draw the fourth figure (Figure 4) in the sequence. (2 marks)
- (b) Study the patterns in the table below, and on your answer sheet, complete the rows numbered (i), (ii), (iii) and (iv). The breaks in the columns are to indicate that the rows do not follow one after the other.

Figure	Area of Triangle	No. of Pins on Base
1	1	$2 \times 1 + 1 = 3$
2	4	$2 \times 2 + 1 = 5$
3	9	$2 \times 3 + 1 = 7$
(i) 4	_____	_____

(2 marks)

(ii)	_____	100	_____
------	-------	-----	-------

(2 marks)

(iii)	20	_____	_____
-------	----	-------	-------

(2 marks)

(iv)	n	_____	_____
------	---	-------	-------

(2 marks)

Total 10 marks

GO ON TO THE NEXT PAGE

SECTION II

There are **THREE** questions in this section.

Answer **TWO** questions in this section

ALGEBRA AND RELATIONS, FUNCTIONS AND GRAPHS

9. (a) (i) Solve the pair of simultaneous equations:
- $$y = 8 - x$$
- $$2x^2 + xy = -16$$
- (5 marks)**
- (ii) State, giving the reason for your answer, whether the line $y = 8 - x$ is a tangent to the curve $2x^2 + xy = -16$. **(2 marks)**

- (b) **An answer sheet is provided for this question.**

A florist makes bouquets of flowers, each consisting of x roses and y orchids. For each bouquet, she applies the following constraints:

- the number of orchids must be at least half the number of roses
- there must be at least 2 roses
- there must be no more than 12 flowers

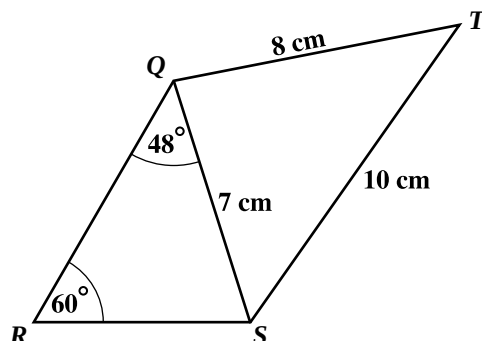
- (i) Write **THREE** inequalities for the constraints given. **(3 marks)**
- (ii) **On the answer sheet provided**, shade the region of the graph which represents the solution set for the inequalities in (b) (i). **(1 mark)**
- (iii) State the coordinates of the points which represent the vertices of the region showing the solution set. **(1 mark)**
- (iv) The florist sells a bouquet of flowers to make a profit of \$3 on each rose and \$4 on each orchid. Determine the **MAXIMUM** possible profit on the sale of a bouquet. **(3 marks)**

Total 15 marks

GO ON TO THE NEXT PAGE

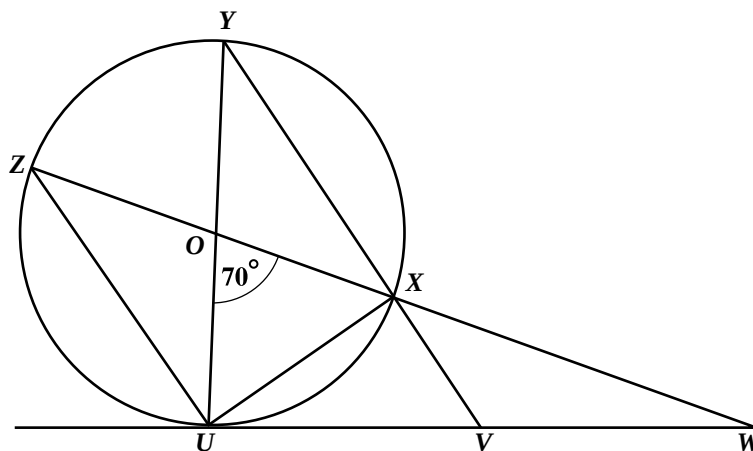
MEASUREMENT, GEOMETRY AND TRIGONOMETRY

10. (a) The diagram below, **not drawn to scale**, shows a quadrilateral $QRST$ in which $QS = 7$ cm, $ST = 10$ cm, $QT = 8$ cm, $\angle SRQ = 60^\circ$ and $\angle RQS = 48^\circ$.



Calculate

- (i) the length of RS (3 marks)
 - (ii) the measure of $\angle QTS$. (3 marks)
- (b) The diagram below, **not drawn to scale**, shows a circle, centre O . The line UVW is a tangent to the circle, $ZOXW$ is a straight line and angle $UOX = 70^\circ$.



- (i) Calculate, showing working where necessary, the measure of angle
 - a) $\angle OUZ$ (2 marks)
 - b) $\angle UVY$ (3 marks)
 - c) $\angle UWO$. (2 marks)
- (ii) Name the triangle in the diagram which is congruent to triangle
 - a) $\triangle ZOU$ (1 mark)
 - b) $\triangle YXU$. (1 mark)

Total 15 marks

GO ON TO THE NEXT PAGE

VECTORS AND MATRICES

11. (a) The points A , B and C have position vectors $\vec{OA} = \begin{pmatrix} 6 \\ 2 \end{pmatrix}$, $\vec{OB} = \begin{pmatrix} 3 \\ 4 \end{pmatrix}$ and $\vec{OC} = \begin{pmatrix} 12 \\ -2 \end{pmatrix}$ respectively.

- (i) Express in the form $\begin{pmatrix} x \\ y \end{pmatrix}$ the vector

a) $\vec{BA}$ (2 marks)

b) $\vec{BC}$. (2 marks)

- (ii) State ONE geometrical relationship between BA and BC . (1 mark)

- (iii) Draw a sketch to show the relative positions of A , B and C . (2 marks)

- (b) (i) Calculate the values of a and b such that $\begin{pmatrix} a & -4 \\ 1 & b \end{pmatrix} \begin{pmatrix} 2 & -4 \\ 1 & -3 \end{pmatrix} = \begin{pmatrix} 2 & 0 \\ 0 & 2 \end{pmatrix}$. (3 marks)

- (ii) Hence, or otherwise, write down the inverse of $\begin{pmatrix} 2 & -4 \\ 1 & -3 \end{pmatrix}$. (2 marks)

- (iii) Use the inverse of $\begin{pmatrix} 2 & -4 \\ 1 & -3 \end{pmatrix}$ to solve for x and y in the matrix equation

$$\begin{pmatrix} 2 & -4 \\ 1 & -3 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 12 \\ 7 \end{pmatrix}. \quad (3 \text{ marks})$$

Total 15 marks

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.

CARIBBEAN EXAMINATIONS COUNCIL

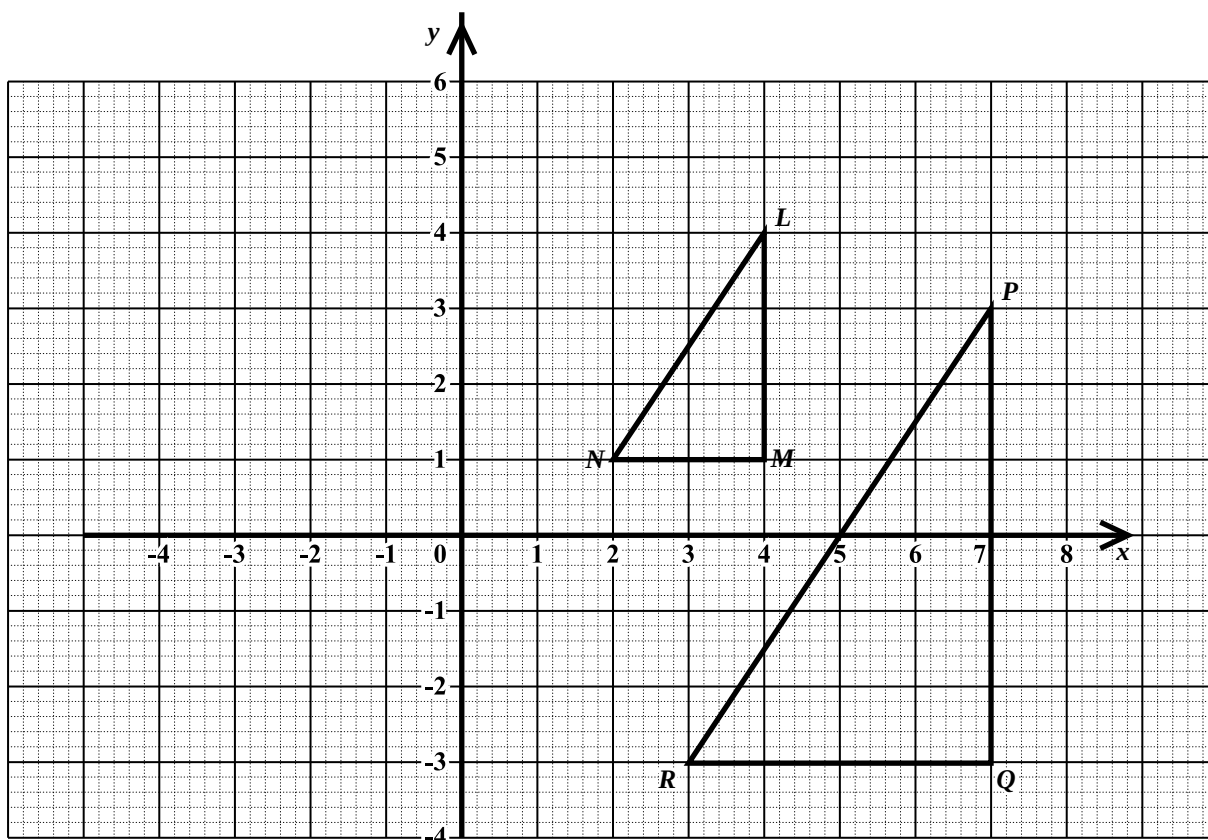
**SECONDARY EDUCATION CERTIFICATE
EXAMINATION**

MATHEMATICS

Paper 02 – General Proficiency

Answer Sheet for Question 6

Candidate Number



(b) Scale factor: _____ Centre: _____

(c) $\frac{\text{Area of } PQR}{\text{Area of } LMN} =$

(e) The single transformation which maps triangle LMN onto triangle ABC:

ATTACH THIS ANSWER SHEET TO YOUR ANSWER BOOKLET

CARIBBEAN EXAMINATIONS COUNCIL**SECONDARY EDUCATION CERTIFICATE
EXAMINATION****MATHEMATICS****Paper 02 – General Proficiency****Answer Sheet for Question 8****Candidate Number**

.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

(2 marks)

	Figure	Area of Triangle	No. of Pins on Base	
	1	1	$2 \times 1 + 1 = 3$	
	2	4	$2 \times 2 + 1 = 5$	
	3	9	$2 \times 3 + 1 = 7$	
(i)	4	_____	_____	(2 marks)
(ii)	_____	100	_____	(2 marks)
(iii)	20	_____	_____	(2 marks)
(iv)	n	_____	_____	(2 marks)

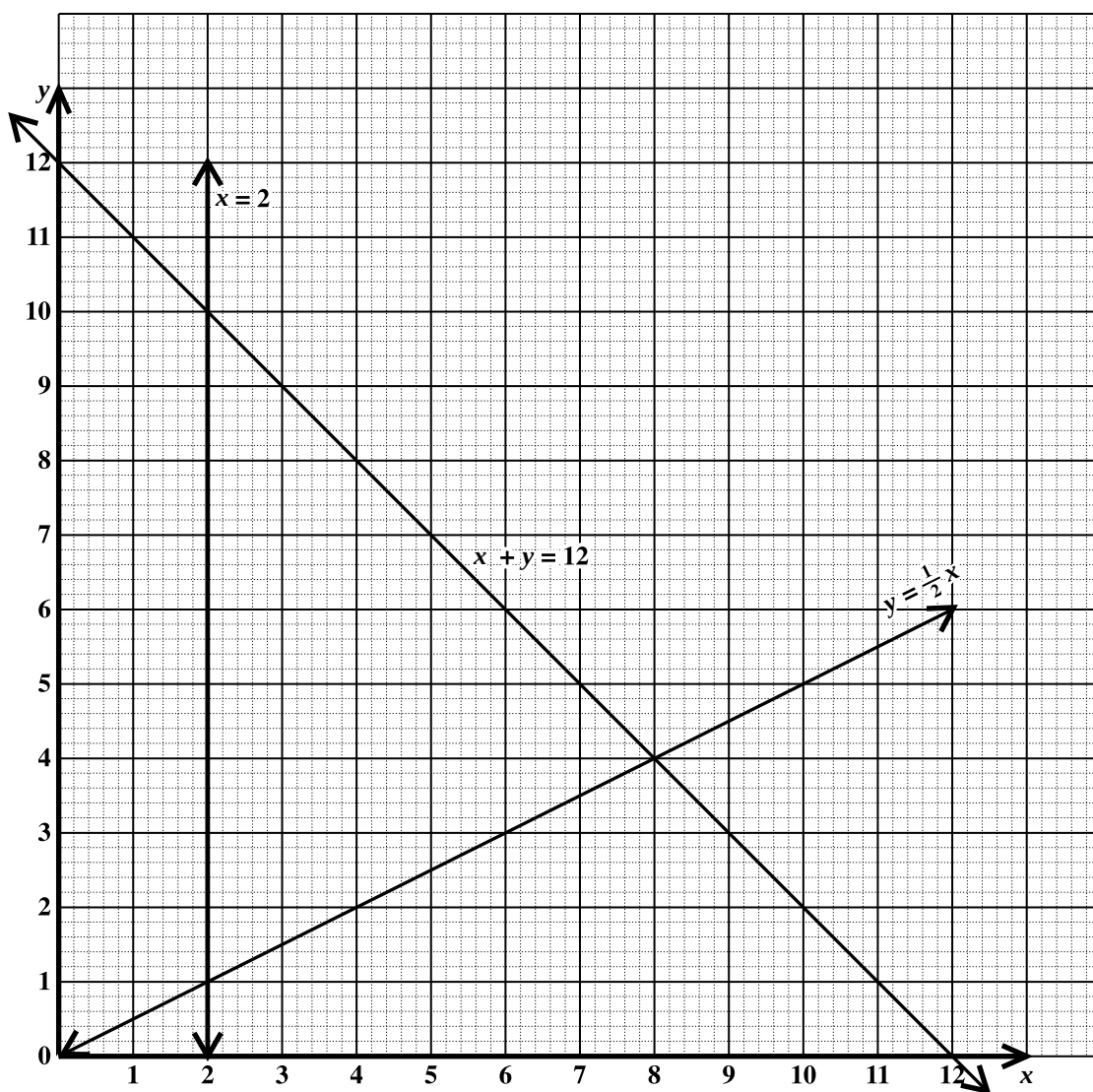
ATTACH THIS ANSWER SHEET TO YOUR ANSWER BOOKLET

C A R I B B E A N E X A M I N A T I O N S C O U N C I L
S E C O N D A R Y E D U C A T I O N C E R T I F I C A T E
E X A M I N A T I O N
M A T H E M A T I C S

Paper 02 – General Proficiency

Answer Sheet for Question 9 (b)

Candidate Number



ATTACH THIS ANSWER SHEET TO YOUR ANSWER BOOKLET

FORM TP 2013017



TEST CODE **01234020**

JANUARY 2013

C A R I B B E A N E X A M I N A T I O N S C O U N C I L

**C A R I B B E A N S E C O N D A R Y E D U C A T I O N C E R T I F I C A T E[®]
E X A M I N A T I O N**

M A T H E M A T I C S

Paper 02 – General Proficiency

2 hours 40 minutes

04 JANUARY 2013 (a.m.)

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of TWO sections.
2. There are EIGHT questions in Section I and THREE questions in Section II.
3. Answer ALL questions in Section I, and any TWO questions from Section II.
4. Write your answers in the booklet provided.
5. All working must be clearly shown.
6. A list of formulae is provided on page 2 of this booklet.

Required Examination Materials

Electronic calculator
Geometry set
Graph paper (provided)

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

Copyright © 2010 Caribbean Examinations Council
All rights reserved.

01234020/JANUARY/F 2013

LIST OF FORMULAE

Volume of a prism $V = Ah$ where A is the area of a cross-section and h is the perpendicular length.

Volume of cylinder $V = \pi r^2 h$ where r is the radius of the base and h is the perpendicular height.

Volume of a right pyramid $V = \frac{1}{3} Ah$ where A is the area of the base and h is the perpendicular height.

Circumference $C = 2\pi r$ where r is the radius of the circle.

Arc length $S = \frac{\theta}{360} \times 2\pi r$ where θ is the angle subtended by the arc, measured in degrees.

Area of a circle $A = \pi r^2$ where r is the radius of the circle.

Area of a sector $A = \frac{\theta}{360} \times \pi r^2$ where θ is the angle of the sector, measured in degrees.

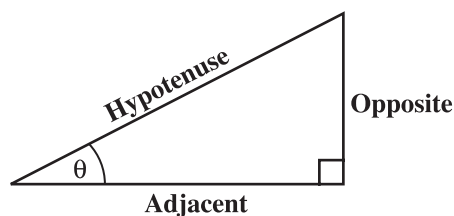
Area of trapezium $A = \frac{1}{2} (a + b) h$ where a and b are the lengths of the parallel sides and h is the perpendicular distance between the parallel sides.

Roots of quadratic equations If $ax^2 + bx + c = 0$,
then $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$.

Trigonometric ratios $\sin \theta = \frac{\text{opposite side}}{\text{hypotenuse}}$

$$\cos \theta = \frac{\text{adjacent side}}{\text{hypotenuse}}$$

$$\tan \theta = \frac{\text{opposite side}}{\text{adjacent side}}$$



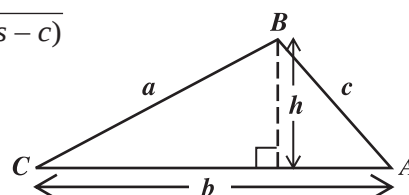
Area of triangle Area of $\Delta = \frac{1}{2} bh$ where b is the length of the base and h is the perpendicular height.

$$\text{Area of } \Delta ABC = \frac{1}{2} ab \sin C$$

$$\text{Area of } \Delta ABC = \sqrt{s(s-a)(s-b)(s-c)}$$

$$\text{where } s = \frac{a+b+c}{2}$$

Sine rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$



Cosine rule $a^2 = b^2 + c^2 - 2bc \cos A$

GO ON TO THE NEXT PAGE

SECTION I

Answer ALL questions.

All working must be clearly shown.

1. (a) Using a calculator or otherwise, calculate the exact value of

$$(2.67 \times 4.1) - 1.3^2.$$

(3 marks)

- (b) Mr Harry who lives in St Kitts is planning to travel to Barbados. A travel club offers the rates shown below.

Petty's Travel Club	
Holiday in Barbados	
Return Air Fare	US \$356.00
Hotel Accommodation	US \$97.00 per night

- (i) Calculate the TOTAL cost of airfare and hotel accommodation for 3 nights using the rates offered by Petty's Travel Club. (3 marks)
- (ii) Another travel club advertises the following package deal.

Angie's Travel Club	
Holiday in Barbados	
3 Nights Hotel Accommodation plus Return Air Fare	
EC \$1610.00	

Calculate, in US dollars, the cost of the trip for 3 nights as advertised by Angie's travel club.

$$\text{US \$1.00} = \text{EC \$2.70}$$

(2 marks)

- (iii) State, giving a reason for your answer, which travel club (Petty's or Angie's) has the better offer. (1 mark)
- (iv) The EC \$1610.00 charged by Angie's Travel Club includes a sales tax of 15%. Calculate the cost of the trip for three nights BEFORE the sales tax was added. (2 marks)

Total 11 marks

GO ON TO THE NEXT PAGE

2. (a) Solve for p

$$2(p + 5) - 7 = 4p. \quad (2 \text{ marks})$$

- (b) Factorize completely

(i) $25m^2 - 1$ (2 marks)

(ii) $2n^2 - 3n - 20$ (2 marks)

- (c) A candy store packages lollipops and toffees in bags for sale.



5 lollipops and 12 toffees have a mass of 61 grams.
10 lollipops and 13 toffees have a mass of 89 grams.

- (i) If the mass of one lollipop is x grams and the mass of one toffee is y grams, write two equations in x and y to represent the above information. (2 marks)
- (ii) Calculate the mass of
- a) ONE lollipop
- b) ONE toffee (4 marks)

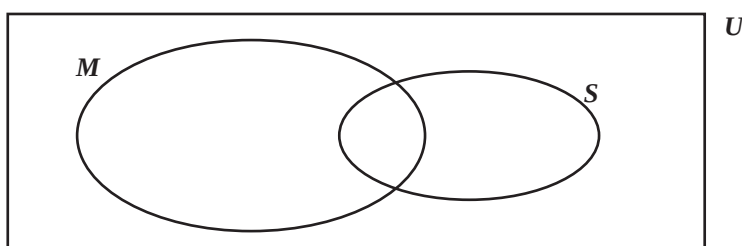
Total 12 marks

3. (a) There are 50 students in a class. Students in the class were given awards for Mathematics or Science.

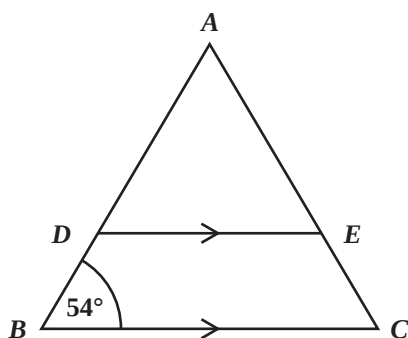
36 students received awards in either Mathematics or Science.
 6 students received awards in BOTH Mathematics and Science.
 $2x$ students received awards for Mathematics only.
 x students received awards for Science only.

In the Venn Diagram below:

U = {all the students in the class}
 M = {students who received awards for Mathematics}
 S = {students who received awards for Science}



- (i) Copy and complete the Venn Diagram to represent the information about the awards given, showing the number of students in EACH subset. **(4 marks)**
- (ii) Calculate the value of x . **(2 marks)**
- (b) In the diagram below, **not drawn to scale**, ABC is an isosceles triangle with $AB = AC$ and angle $ABC = 54^\circ$. DE is parallel to BC .



- (i) Calculate, **giving a reason for your answer**, the measure of:
- a) $\angle BAC$
- b) $\angle AED$ **(4 marks)**
- (ii) Explain why triangles ABC and ADE are similar but not congruent. **(2 marks)**

Total 12 marks

GO ON TO THE NEXT PAGE

4. (a) Make r the subject of EACH of the following formulae:

(i) $r - h = rh$ (2 marks)

(ii) $V = \pi r^2 h$ (2 marks)

- (b) The functions f and g are defined as follows:

$$f(x) = 2x + 5$$

$$g(x) = \frac{x-3}{2}$$

Evaluate:

(i) $f^{-1}(19)$ (2 marks)

(ii) $gf(3)$ (2 marks)

- (c) A line segment GH has equation $3x + 2y = 15$.

(i) Determine the gradient of GH . (1 mark)

(ii) Another line segment, JK , is perpendicular to GH and passes through the point $(4, 1)$. Determine the equation of the line JK . (3 marks)

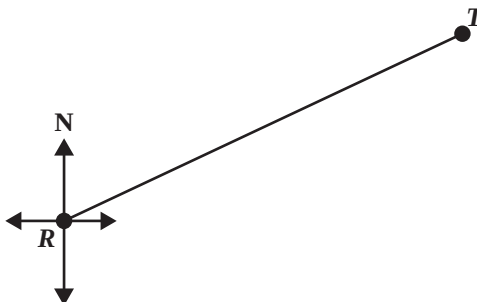
Total 12 marks

GO ON TO THE NEXT PAGE

5. An answer sheet is provided for this question.

- (a) The diagram below is a scale drawing showing the line RT and the north direction on a playground.

It is drawn to a scale of **1 centimetre : 30 metres**.



Using the answer sheet provided,

- (i) measure and state, in centimetres, the length of RT as drawn on the diagram. **(1 mark)**
 - (ii) measure and state, in degrees, the size of the angle that shows the bearing of T from R . **(2 marks)**
 - (iii) calculate the actual distance, in metres, on the playground that RT represents. **(2 marks)**
- (b) A point M on the playground is located 300 metres from R on a bearing of 120° .

On the same answer sheet,

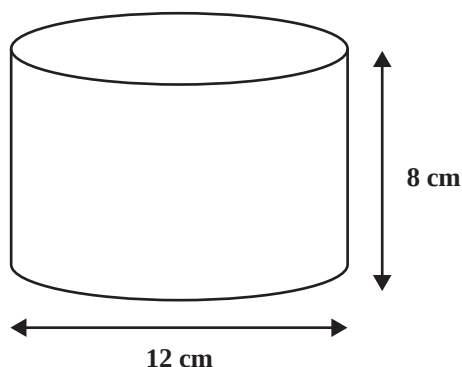
- (i) calculate, in centimetres, the length of RM that should be used on the scale drawing. **(2 marks)**
- (ii) using a ruler and a pair of compasses, draw the line RM on the scale drawing. **(4 marks)**
- (iii) mark and name the angle in the scale drawing that measures 120° . **(1 mark)**

Total 12 marks

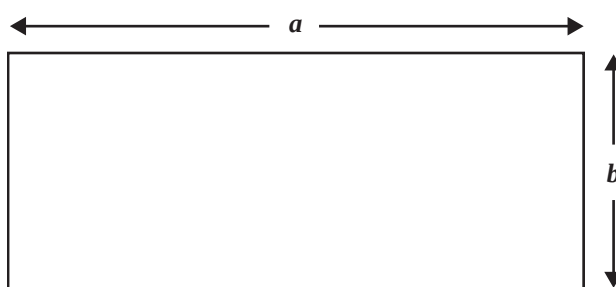
GO ON TO THE NEXT PAGE

6. The diagram below, **not drawn to scale**, shows a hollow cylinder with height 8 cm and diameter 12 cm.

Use $\pi = 3.14$



- (a) Calculate for the cylinder:
- (i) The radius (1 mark)
 - (ii) The circumference of the cross section (2 marks)
- (b) The rectangle shown below, **not drawn to scale**, represents the net of the curved surface of the cylinder shown above.



- (i) State the values of a and b . (2 marks)
 - (ii) Hence, calculate the area of the curved surface of the cylinder. (2 marks)
- (c) If 0.5 litres of water is poured into the cylinder, calculate, correct to one decimal place, the height of water in the cylinder. (4 marks)

Total 11 marks

GO ON TO THE NEXT PAGE

7. The scores obtained by 100 children in a competition are summarized in the table below.

Score	Class mid-point (x)	Frequency (f)	$f \times x$
0–9	4.5	8	36
10–19	14.5	13	188.5
20–29		25	
30–39		22	
40–49		20	
50–59		12	
Total		100	

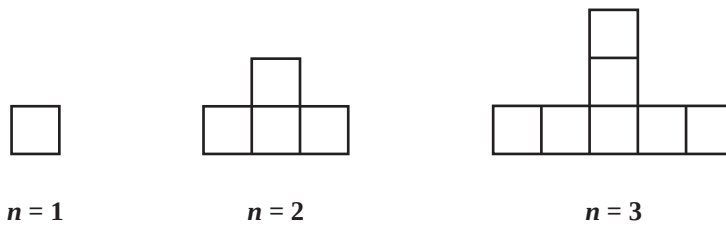
- (a) (i) State the modal class interval. **(1 mark)**
- (ii) State the class interval in which a score of 19.4 would lie. **(1 mark)**
- (b) (i) Copy and complete the table to show
- a) the class mid-points
- b) the values of “ $f \times x$ ” **(2 marks)**
- (ii) Calculate the mean score for the sample. **(3 marks)**
- (c) Explain why the value of the mean obtained in (b) (ii) is only an estimate of the true value. **(1 mark)**
- (d) In order to qualify for the next round of the competition a student must score AT LEAST 40 points.

What is the probability that a student selected at random qualifies for the next round? **(2 marks)**

Total 10 marks

GO ON TO THE NEXT PAGE

8. The first three diagrams in a sequence are shown below.



- (a) In your answer booklet, draw the FOURTH diagram in the sequence. **(2 marks)**
- (b) The table below shows the number of squares in EACH diagram.

	Diagram (n)	Number of Squares
	1	1
	2	4
	3	7
(i)	4	a
(ii)	10	b
(iii)	c	40

Determine the values of

- (i) a
- (ii) b
- (iii) c **(5 marks)**
- (c) Write down, in terms of n , the number of squares in the n^{th} diagram of the sequence. **(3 marks)**

Total 10 marks

GO ON TO THE NEXT PAGE

SECTION II

Answer TWO questions.

ALGEBRA AND RELATIONS, FUNCTIONS AND GRAPHS

9. (a) The table below shows corresponding values of x and y for the function

$$y = \frac{3}{x}, \quad x \neq 0$$

where y represents the velocity of a particle after x seconds.

x (sec)	0.25	0.5	1	2	3	4	5	6
y (m/s)	12		3	1.5		0.75		0.5

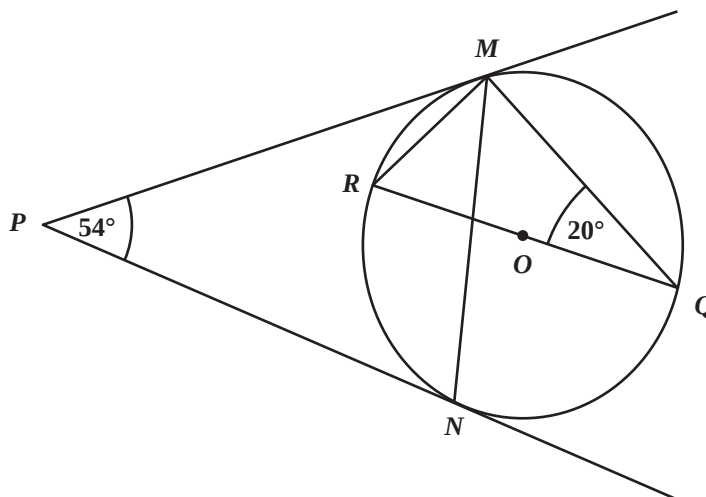
- (i) Copy and complete the table for the function. (2 marks)
- (ii) Using a scale of **2 cm to represent 1 unit on the x axis and 1 cm to represent 1 unit on the y axis**, plot the points from your table, drawing a smooth curve through all points. (5 marks)
- (b) (i) Write $f(x) = 3x^2 - 5x + 1$ in the form $a(x - h)^2 + k$ where a , h and k are constants to be determined. (2 marks)
- (ii) Hence, or otherwise, determine the minimum value of $f(x)$ and the value of x for which $f(x)$ is a minimum. (2 marks)
- (iii) Solve the equation
- $$3x^2 - 5x + 1 = 0$$
- expressing your answer correct to two decimal places. (4 marks)

Total 15 marks

GO ON TO THE NEXT PAGE

GEOMETRY AND TRIGONOMETRY

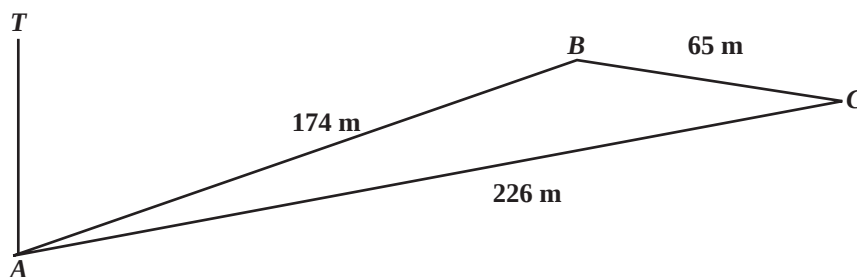
10. (a) The diagram below, **not drawn to scale**, shows a circle, centre O . RQ is a diameter and PM and PN are tangents to the circle. Angle $MPN = 54^\circ$ and angle $RQM = 20^\circ$.



Calculate, giving reasons for your answer, the measure of:

- (i) $\angle MRQ$ (2 marks)
 - (ii) $\angle PMR$ (2 marks)
 - (iii) $\angle PMN$ (3 marks)
- (b) (i) The diagram below, **not drawn to scale**, shows the position of three points A , B and C on a horizontal plane.

$AB = 174$ metres, $BC = 65$ metres and $AC = 226$ metres



Calculate

- a) the measure of angle ABC (2 marks)
- b) the area of triangle ABC . (2 marks)

GO ON TO THE NEXT PAGE

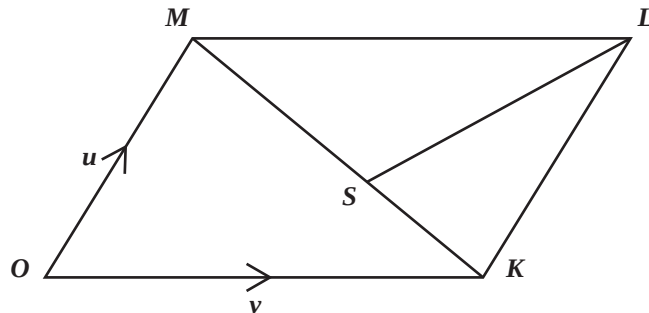
- (ii) The line TA represents a vertical lighthouse. The angle of elevation of T from B is 23° .
- a) In your answer booklet, draw the triangle TAB showing the angle of elevation. **(2 marks)**
- b) Calculate the height, TA , of the lighthouse. **(2 marks)**

Total 15 marks

GO ON TO THE NEXT PAGE

VECTORS AND MATRICES

11. (a) The diagram below, **not drawn to scale**, shows a parallelogram $OKLM$ where O is the origin. The point S is on KM such that $MS = 2 SK$. $\vec{OK} = v$ and $\vec{OM} = u$.



Express EACH of the following in terms of u and v :

- (i) $\vec{MK}$ (1 mark)
- (ii) $\vec{SL}$ (2 marks)
- (iii) $\vec{OS}$ (2 marks)

- (b) The matrix $J = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$ represents a single transformation.

The image of the point P under transformation J is $(5, 4)$.

Determine the coordinates of P . (3 marks)

- (c) (i) Write down a matrix, H , of size 2×2 which represents an enlargement of scale factor 3 about the origin. (1 mark)
- (ii) Determine the coordinates of the point $(5, -7)$ under the combined transformation, H followed by J . (2 marks)

GO ON TO THE NEXT PAGE

- (d) A superstore sells 3 models of cell phones. Model A costs \$40 each, model B costs \$55 each and model C costs \$120 each.

The weekly sales for 2 weeks in June were:

Week 1	Week 2
2 model A	no model A
5 model B	6 model B
3 model C	10 model C

- (i) Write down a matrix of size 3×2 which represents the sales for the two weeks. **(1 mark)**
- (ii) Write down a matrix of size 1×3 which represents the cost of the different models of cell phones. **(1 mark)**
- (iii) Write down the multiplication of the two matrices which represents the superstore's takings from the sale of cell phones for each of the two weeks. **(2 marks)**

Total 15 marks

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.

C A R I B B E A N E X A M I N A T I O N S C O U N C I L

**C A R I B B E A N S E C O N D A R Y E D U C A T I O N C E R T I F I C A T E[®]
E X A M I N A T I O N**

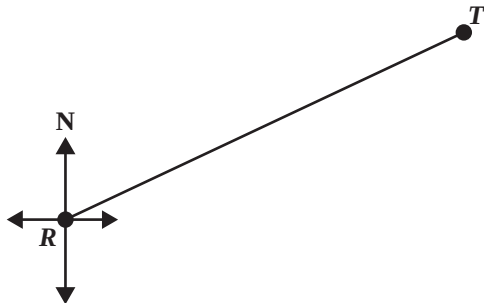
M A T H E M A T I C S

Paper 02 – General Proficiency

Answer Sheet for Question 5.

Candidate Number

(a)



Scale: 1 cm represents 30 m

(i) $RT =$ _____ centimetres

(ii) Angle = _____ degrees

(iii) Actual distance of $RT =$ _____ metres

(b) (i) $RM =$ _____ centimetres

ATTACH THIS ANSWER SHEET TO YOUR ANSWER BOOKLET

FORM TP 2013092



TEST CODE **01234020**

MAY/JUNE 2013

CARIBBEAN EXAMINATIONS COUNCIL
CARIBBEAN SECONDARY EDUCATION CERTIFICATE®
EXAMINATION

MATHEMATICS

Paper 02 – General Proficiency

2 hours 40 minutes

22 MAY 2013 (a.m.)

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of **TWO** sections.
2. There are **EIGHT** questions in Section I and **THREE** questions in Section II.
3. Answer **ALL** questions in Section I, and any **TWO** questions from Section II.
4. Write your answers in the booklet provided.
5. All working must be clearly shown.
6. A list of formulae is provided on page 2 of this booklet.

Required Examination Materials

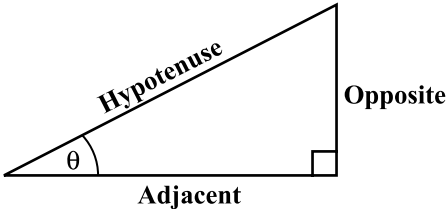
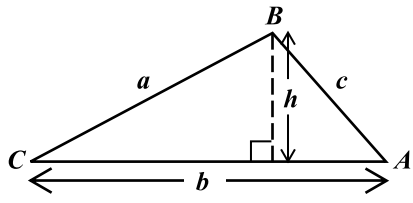
Electronic calculator
Geometry set
Graph paper (provided)

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

Copyright © 2011 Caribbean Examinations Council
All rights reserved.

01234020/F 2013

LIST OF FORMULAE

Volume of a prism	$V = Ah$ where A is the area of a cross-section and h is the perpendicular length.
Volume of cylinder	$V = \pi r^2 h$ where r is the radius of the base and h is the perpendicular height.
Volume of a right pyramid	$V = \frac{1}{3} Ah$ where A is the area of the base and h is the perpendicular height.
Circumference	$C = 2\pi r$ where r is the radius of the circle.
Arc length	$S = \frac{\theta}{360} \times 2\pi r$ where θ is the angle subtended by the arc, measured in degrees.
Area of a circle	$A = \pi r^2$ where r is the radius of the circle.
Area of a sector	$A = \frac{\theta}{360} \times \pi r^2$ where θ is the angle of the sector, measured in degrees.
Area of trapezium	$A = \frac{1}{2} (a + b) h$ where a and b are the lengths of the parallel sides and h is the perpendicular distance between the parallel sides.
Roots of quadratic equations	If $ax^2 + bx + c = 0$, then $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
Trigonometric ratios	$\sin \theta = \frac{\text{opposite side}}{\text{hypotenuse}}$ $\cos \theta = \frac{\text{adjacent side}}{\text{hypotenuse}}$ $\tan \theta = \frac{\text{opposite side}}{\text{adjacent side}}$ 
Area of triangle	Area of $\Delta = \frac{1}{2} bh$ where b is the length of the base and h is the perpendicular height. Area of $\Delta ABC = \frac{1}{2} ab \sin C$ Area of $\Delta ABC = \sqrt{s(s-a)(s-b)(s-c)}$ where $s = \frac{a + b + c}{2}$ $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$ $a^2 = b^2 + c^2 - 2bc \cos A$ 

GO ON TO THE NEXT PAGE

SECTION I

Answer ALL the questions in this section.

All working must be clearly shown.

1. (a) Using a calculator, or otherwise, calculate the EXACT value of

(i)
$$\frac{1\frac{4}{5} - \frac{1}{3}}{2\frac{2}{5}}$$
 (2 marks)

(ii) $\sqrt{1.5625} + (0.32)^2$. (2 marks)

- (b) Smiley Orange Juice is sold in cartons of two different sizes at the prices shown in the table below.

Carton Size	Cost
350 ml	\$4.20
450 ml	\$5.13

Which size carton of orange juice is the BETTER buy? **Justify your answer.** (3 marks)

- (c) Faye borrowed \$9 600 at 8% per annum compound interest.

- (i) Calculate the interest on the loan for the first year. (1 mark)

At the end of the first year, she repaid \$4 368.

- (ii) How much did she still owe at the beginning of the second year? (2 marks)

- (iii) Calculate the interest on the remaining balance for the second year. (1 mark)

Total 11 marks

GO ON TO THE NEXT PAGE

2. (a) Factorize completely:
- (i) $2x^3 - 8x$ (2 marks)
 - (ii) $3x^2 - 5x - 2$ (2 marks)
- (b) (i) Make C the subject of the formula $F = \frac{9}{5}C + 32$. (2 marks)
- (ii) Given that $F = 113$, calculate the value of C . (1 mark)
- (c) 500 tickets were sold for a concert. Of these x tickets were sold at \$6 each, and the remainder at \$10 each.
- (i) Write an expression, in terms of x , for
 - a) the number of tickets sold at \$10 each (1 mark)
 - b) the TOTAL amount of money collected for the sale of the 500 tickets. (1 mark)
 - (ii) The sum of \$4108 was collected for the sale of the 500 tickets.
Calculate the number of tickets sold at \$6 each. (3 marks)

Total 12 marks

GO ON TO THE NEXT PAGE

3. (a) A survey of the 30 students in Form 5 showed that some students used cameras (C) or mobile phones (M) to take photographs.

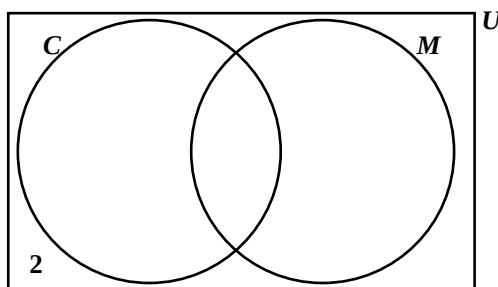
20 students used mobile phones

$4x$ students used ONLY cameras

x students used BOTH mobile phones and cameras

2 students did not use either cameras or phones.

- (i) Copy the Venn diagram below and complete it to show, in terms of x , the number of students in each region. **(3 marks)**



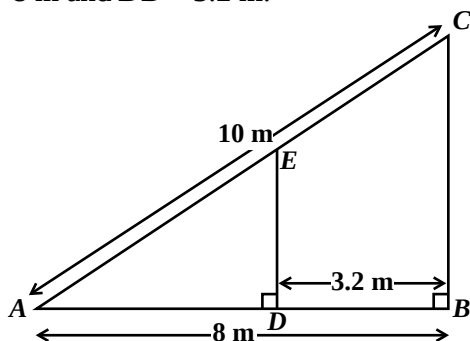
- (ii) Write an expression, in terms of x , which represents the TOTAL number of students in the survey. **(1 mark)**

- (iii) Determine the number of students in Form 5 who used ONLY cameras. **(2 marks)**

- (b) In the diagram below, **not drawn to scale**, AEC and ADB are straight lines.

$$\angle ABC = \angle ADE = 90^\circ.$$

$AC = 10$ m, $AB = 8$ m and $DB = 3.2$ m.

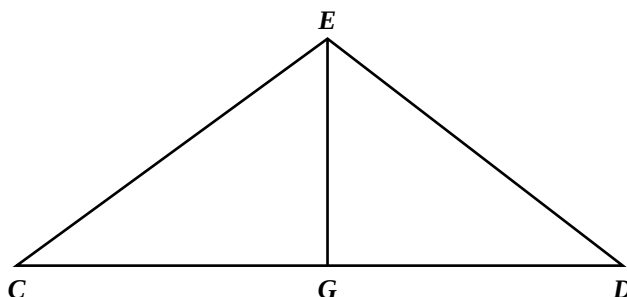


- (i) Calculate the length of BC . **(2 marks)**
- (ii) Explain why triangles ABC and ADE are similar. **(1 mark)**
- (iii) Determine the length of DE . **(3 marks)**

Total 12 marks

GO ON TO THE NEXT PAGE

4. (a) The diagram below shows an isosceles triangle CDE . G is the midpoint of CD .



- (i) Measure and state, in centimetres, the length of DE . **(1 mark)**
 - (ii) Measure and state, in degrees, the size of $\angle ECD$. **(1 mark)**
 - (iii) Determine the perimeter of the triangle CDE . **(2 marks)**
 - (iv) Calculate the area of the triangle CDE . **(1 mark)**
- (b) $A(-1, 4)$ and $B(3, 2)$ are the end points of a line segment AB . Determine
- (i) the gradient of AB **(2 marks)**
 - (ii) the coordinates of the midpoint of AB **(2 marks)**
 - (iii) the equation of the perpendicular bisector of AB . **(3 marks)**

Total 12 marks

GO ON TO THE NEXT PAGE

5. (a) The incomplete table below shows one pair of values for A and R where A is directly proportional to the square of R .

A	36		196
R	3	5	

- (i) Express A in terms of R and a constant k . **(1 mark)**
- (ii) Calculate the value of the constant k . **(2 marks)**
- (iii) Copy and complete the table. **(2 marks)**
- (b) Given that $f(x) = \frac{2x+1}{3}$ and $g(x) = 4x + 5$, determine the values of:
- (i) $fg(2)$ **(3 marks)**
- (ii) $f^{-1}(3)$ **(3 marks)**

Total 11 marks

GO ON TO THE NEXT PAGE

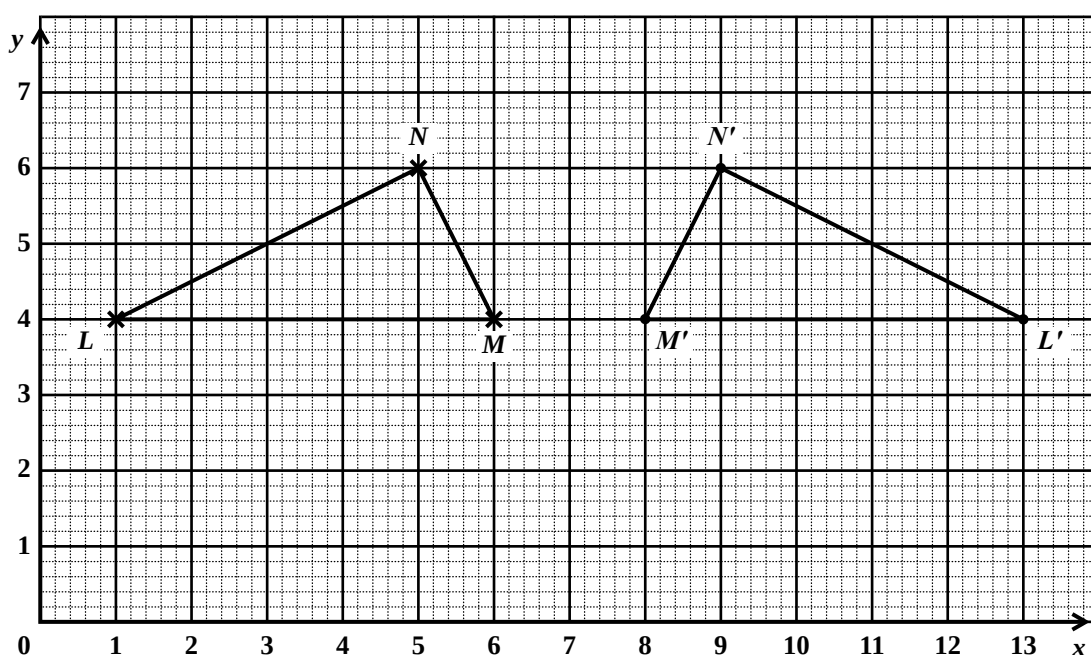
6. (a) A car, travelling along a straight road at a constant speed of 54 km/h, takes 20 seconds to travel the distance between two sign posts.

Calculate

- (i) the speed of the car in m/s (2 marks)
- (ii) the distance, in metres, between the two sign posts. (2 marks)

- (b) **An answer sheet is provided for this question.**

The graph below shows triangle LMN and its image $L' M' N'$ after undergoing a single transformation.



- (i) Describe **fully** the transformation that maps $\triangle LMN$ onto $\triangle L' M' N'$. (2 marks)
- (ii) **On the answer sheet provided**, draw triangle $L'' M'' N''$ the image of triangle LMN , after a translation by the vector $\begin{pmatrix} 0 \\ -3 \end{pmatrix}$. (2 marks)
- (iii) Name and describe a combination of TWO transformations which may be used to map $\triangle L'' M'' N''$ onto $\triangle L' M' N'$. (3 marks)

Total 11 marks

GO ON TO THE NEXT PAGE

7. The table below shows the amount, to the nearest dollar, spent by a group of 40 students at the school canteen during a period of one week.

Amount Spent (\$)	Number of Students	Cumulative Frequency
1 – 10	3	3
11 – 20	7	10
21 – 30	9	19
31 – 40	11	
41 – 50	8	
51 – 60	2	

- (a) Copy and complete the table to show the cumulative frequency. **(2 marks)**
- (b) Using a scale of **1 cm to represent \$5 on the horizontal axis** and **1 cm to represent 5 students on the vertical axis**, draw the cumulative frequency graph for the data. **(5 marks)**

(Marks will be awarded for axes appropriately labelled, points correctly plotted, and a smooth curve carefully drawn.)

- (c) Use your graph to estimate
- (i) the median amount of money spent **(2 marks)**
- (ii) the probability that a student chosen at random spent less than \$23 during the week. **(2 marks)**

Show on your graph, using broken lines, how these estimates were determined.

Total 11 marks

GO ON TO THE NEXT PAGE

8. An answer sheet is provided for this question.

The drawings below show the first three diagrams in a sequence.

Diagram 1

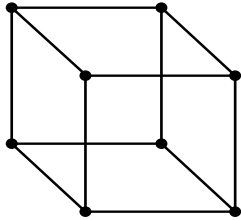


Diagram 2

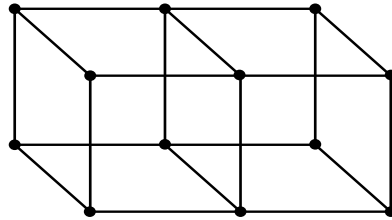
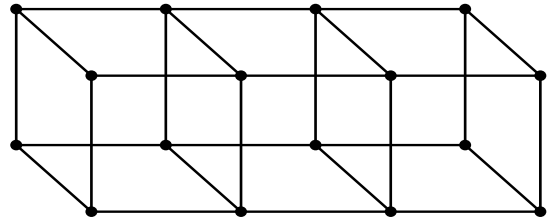
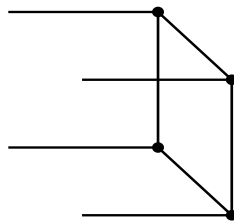


Diagram 3



Each diagram is made up of wires of equal length which are joined at the ends by balls of plasticine. Diagram 1 is made of 12 wires and 8 balls. Each new diagram in the sequence is formed by fitting the frame shown below to the right of the previous diagram.



Thus, Diagram 2 has 8 more wires and 4 more balls than Diagram 1.

On the answer sheet provided:

- (a) Draw a sketch of Diagram 4, the fourth diagram in the sequence. **(2 marks)**
- (b) Complete the table by inserting the missing values at the rows marked (i) and (ii).

	Name of Diagram (N)	No. of Wires (W)	No. of Balls (B)	
	1	12	8	
	2	20	12	
	3	28	16	
(i)	4	_____	_____	(2 marks)
(ii)	20	_____	_____	(4 marks)

- (c) Write the rules which may be used to find the values of W and of B where N is known.

(i) $W =$ _____ **(1 mark)**

(ii) $B =$ _____ **(1 mark)**

Total 10 marks

GO ON TO THE NEXT PAGE

SECTION II

Answer TWO questions in this section.

ALGEBRA AND RELATIONS, FUNCTIONS AND GRAPHS

9. (a) An answer sheet is provided for this question.

Trish wishes to buy x oranges and y mangoes which she intends to carry in her bag. Her bag has space for only 6 fruits.

- (i) Write an inequality to represent this information. (1 mark)

To get a good bargain, she must buy AT LEAST 2 mangoes.

- (ii) Write an inequality to represent this information. (1 mark)

More information about the number of oranges and mangoes associated with the good bargain is represented by

$$y \leq 2x.$$

- (iii) Write the information represented by this inequality as a sentence in your own words. (2 marks)

- (iv) On the answer sheet provided, draw the lines associated with the two inequalities obtained in (i) and (ii) above. (3 marks)

- (v) Shade on your graph the region which represents the solution set for the three inequalities. (1 mark)

- (b) (i) Write $3x^2 - 12x + 8$ in the form $a(x + h)^2 + k$ where a , h and k are constants. (3 marks)

- (ii) Sketch the graph of $y = 3x^2 - 12x + 8$, showing on your sketch

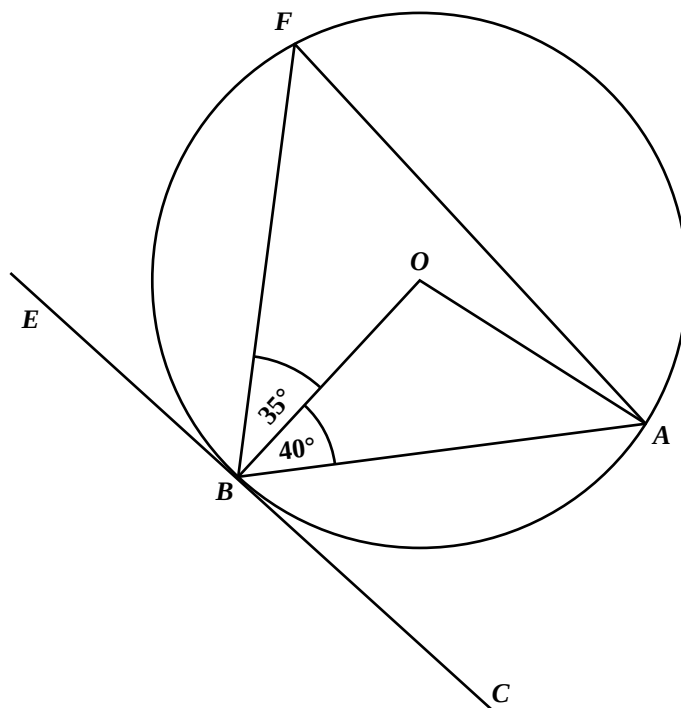
- a) the intercept on the y -axis
b) the coordinates of the minimum point. (4 marks)

Total 15 marks

GO ON TO THE NEXT PAGE

MEASUREMENT, GEOMETRY AND TRIGONOMETRY

10. (a) The diagram below, **not drawn to scale**, shows a circle with centre O . EBC is a tangent to the circle. $\angle OBA = 40^\circ$ and $\angle OBF = 35^\circ$.

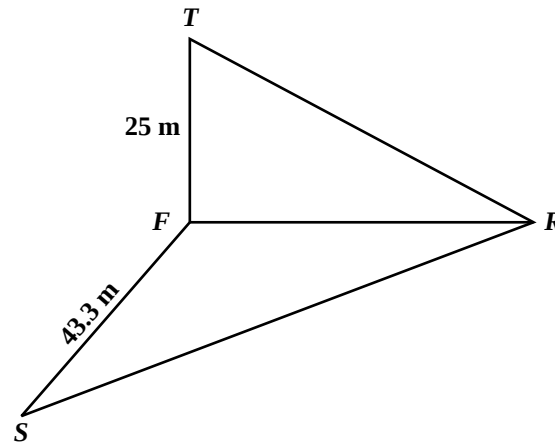


Calculate, **giving reasons for your answer**, the measure of

- | | | |
|-------|--------------|------------------|
| (i) | $\angle EBF$ | (1 mark) |
| (ii) | $\angle BOA$ | (2 marks) |
| (iii) | $\angle AFB$ | (2 marks) |
| (iv) | $\angle OAF$ | (2 marks) |

GO ON TO THE NEXT PAGE

- (b) The diagram below, **not drawn to scale**, shows three points R , S and F on the horizontal ground. FT is a vertical tower of height 25 m. The angle of elevation of the top of the tower, T , from R is 27° . R is due east of F and S is due south of F . $SF = 43.3$ m.



- (i) Sketch **separate** diagrams of the triangles RFT , TFS and SFR . Mark on EACH diagram the given measures of sides and angles. **(3 marks)**
- (ii) Show, by calculation, that $RF = 49.1$ m. **(2 marks)**
- (iii) Calculate the length of SR correct to 1 decimal place. **(1 mark)**
- (iv) Calculate the angle of elevation of the top of the tower, T , from S . **(2 marks)**

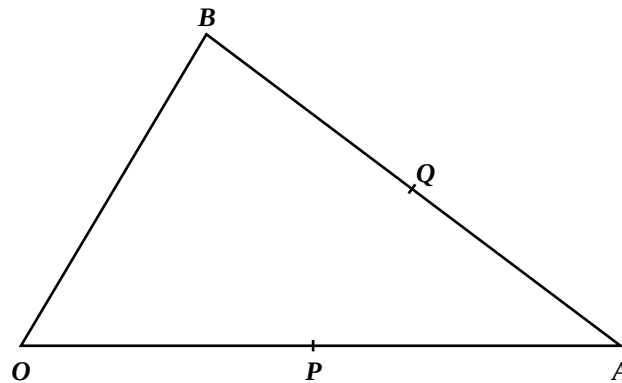
Total 15 marks

GO ON TO THE NEXT PAGE

VECTORS AND MATRICES

11. (a) In the diagram below, **not drawn to scale**, P and Q are the midpoints of OA and AB respectively.

$$\vec{OA} = 2\mathbf{a} \text{ and } \vec{OB} = 2\mathbf{b}.$$



- (i) Express in terms of $\mathbf{a}$ and $\mathbf{b}$ the vectors
- a) $\vec{AB}$ (2 marks)
- b) $\vec{PQ}$. (2 marks)
- (ii) State TWO geometrical relationships that exist between OB and PQ .
Give reasons for your answers. (2 marks)
- (b) Given that $M = \begin{pmatrix} 2 & 1 \\ 4 & 3 \end{pmatrix}$
- (i) Evaluate M^{-1} , the inverse of M . (2 marks)
- (ii) Show that $M^{-1}M = I$. (2 marks)
- (iii) Use a matrix method to solve for r , s , t and u in the equation
- $$\begin{pmatrix} 2 & 1 \\ 4 & 3 \end{pmatrix} \begin{pmatrix} r & s \\ t & u \end{pmatrix} = \begin{pmatrix} 2 & 1 \\ 4 & -1 \end{pmatrix}. \quad (5 \text{ marks})$$

Total 15 marks

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.

CARIBBEAN EXAMINATIONS COUNCIL
CARIBBEAN SECONDARY EDUCATION CERTIFICATE®
EXAMINATION
MATHEMATICS

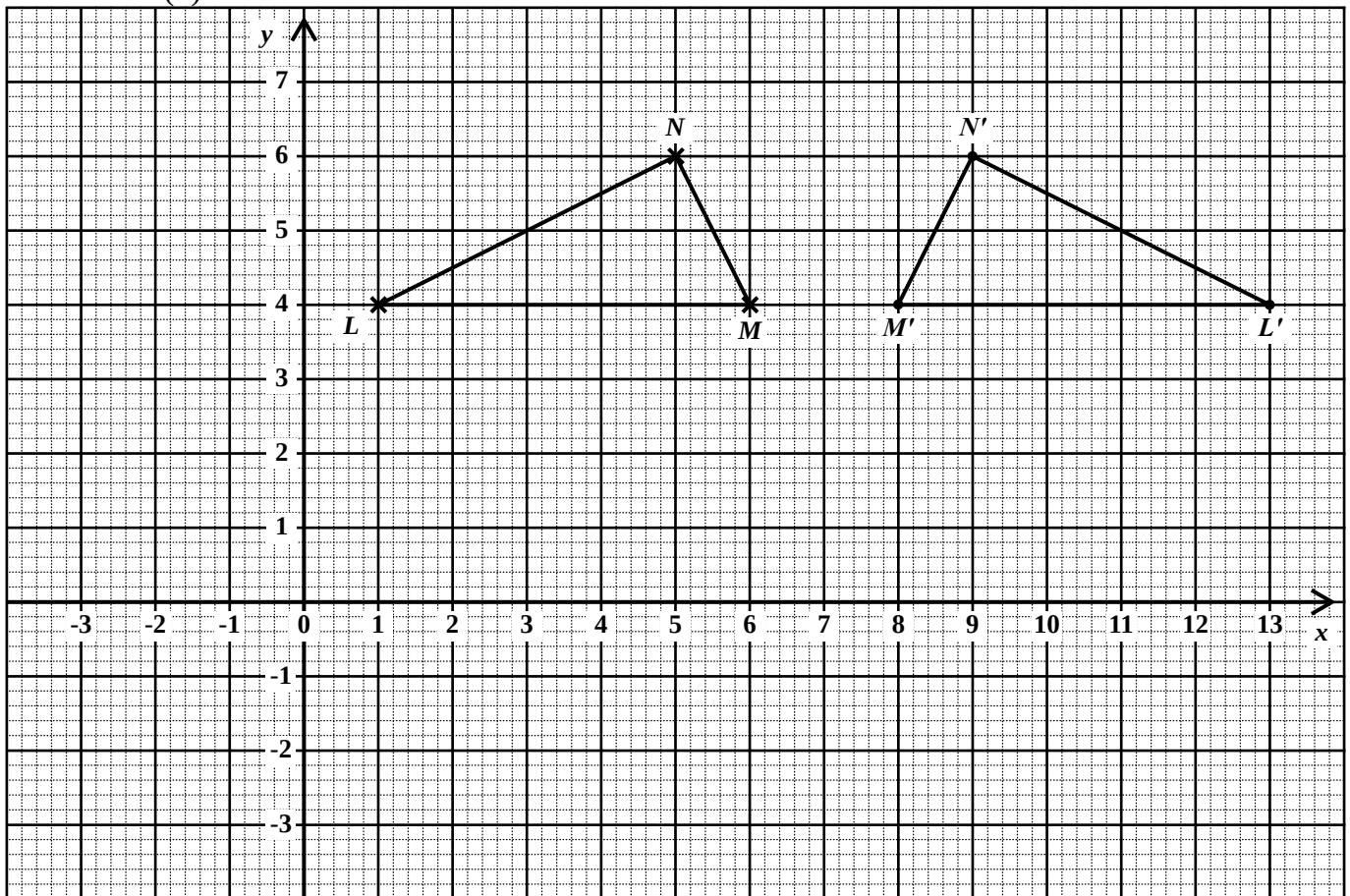
Paper 02 – General Proficiency

Answer Sheet for Question 6 (b)

Candidate Number

(i) _____

(ii)



(iii) _____

GO ON TO THE NEXT PAGE

CARIBBEAN EXAMINATIONS COUNCIL**CARIBBEAN SECONDARY EDUCATION CERTIFICATE®
EXAMINATION****MATHEMATICS****Paper 02 – General Proficiency****Answer Sheet for Question 8****Candidate Number**

(a)

(b)

	Name of Diagram (N)	No. of Wires (W)	No. of Balls (B)
	1	12	8
	2	20	12
	3	28	16
(i)	4	_____	_____
(ii)	20	_____	_____

(c) (i) $W =$ _____(ii) $B =$ _____**ATTACH THIS ANSWER SHEET TO YOUR ANSWER BOOKLET**

CARIBBEAN EXAMINATIONS COUNCIL

**CARIBBEAN SECONDARY EDUCATION CERTIFICATE®
EXAMINATION**

MATHEMATICS

Paper 02 – General Proficiency

Answer Sheet for Question 9 (a)

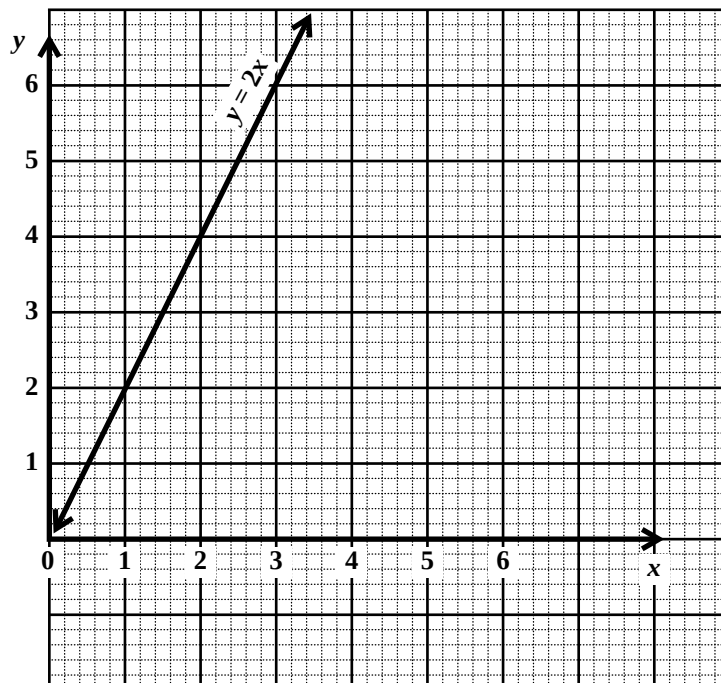
Candidate Number

(i) _____

(ii) _____

(iii) _____

(iv)



ATTACH THIS ANSWER SHEET TO YOUR ANSWER BOOKLET

FORM TP 2014017



TEST CODE **01234020**

JANUARY 2014

C A R I B B E A N E X A M I N A T I O N S C O U N C I L

**C A R I B B E A N S E C O N D A R Y E D U C A T I O N C E R T I F I C A T E[®]
E X A M I N A T I O N**

M A T H E M A T I C S

Paper 02 – General Proficiency

2 hours 40 minutes

03 JANUARY 2014 (a.m.)

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of TWO sections.
2. There are EIGHT questions in Section I and THREE questions in Section II.
3. Answer ALL questions in Section I, and any TWO questions from Section II.
4. Write your answers in the booklet provided.
5. Begin EACH question on a separate page.
6. All working must be clearly shown.
7. A list of formulae is provided on page 3 of this booklet.

Required Examination Materials

Electronic calculator
Geometry set
Graph paper (provided)

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

Copyright © 2011 Caribbean Examinations Council
All rights reserved.

01234020/JANUARY/F 2014

NOTHING HAS BEEN OMITTED.

LIST OF FORMULAE

Volume of a prism	$V = Ah$ where A is the area of a cross section and h is the perpendicular length.
Volume of cylinder	$V = \pi r^2 h$ where r is the radius of the base and h is the perpendicular height.
Volume of a right pyramid	$V = \frac{1}{3} Ah$ where A is the area of the base and h is the perpendicular height.
Circumference	$C = 2\pi r$ where r is the radius of the circle.
Arc length	$S = \frac{\theta}{360} \times 2\pi r$ where θ is the angle subtended by the arc, measured in degrees.
Area of a circle	$A = \pi r^2$ where r is the radius of the circle.
Area of a sector	$A = \frac{\theta}{360} \times \pi r^2$ where θ is the angle of the sector, measured in degrees.
Area of trapezium	$A = \frac{1}{2} (a + b) h$ where a and b are the lengths of the parallel sides and h is the perpendicular distance between the parallel sides.
Roots of quadratic equations	If $ax^2 + bx + c = 0$,

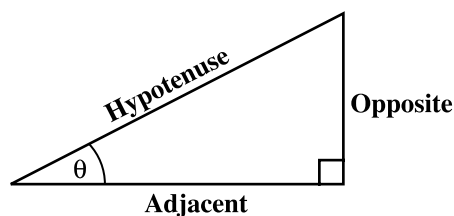
$$\text{then } x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Trigonometric ratios

$$\sin \theta = \frac{\text{opposite side}}{\text{hypotenuse}}$$

$$\cos \theta = \frac{\text{adjacent side}}{\text{hypotenuse}}$$

$$\tan \theta = \frac{\text{opposite side}}{\text{adjacent side}}$$



Area of triangle

Area of $\Delta = \frac{1}{2} bh$ where b is the length of the base and h is the perpendicular height.

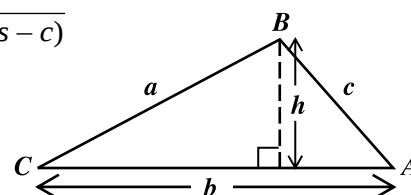
$$\text{Area of } \Delta ABC = \frac{1}{2} ab \sin C$$

$$\text{Area of } \Delta ABC = \sqrt{s(s-a)(s-b)(s-c)}$$

$$\text{where } s = \frac{a+b+c}{2}$$

Sine rule

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$



Cosine rule

$$a^2 = b^2 + c^2 - 2bc \cos A$$

GO ON TO THE NEXT PAGE

SECTION I

Answer ALL questions.

All working must be clearly shown.

1. (a) Calculate the EXACT value of

$$\left(1\frac{3}{4} - \frac{1}{8}\right) + \left(\frac{5}{6} \div \frac{2}{3}\right). \quad (3 \text{ marks})$$

- (b) Using a calculator or otherwise, calculate

$$\sqrt{2.891} + \frac{1.2}{(1.31)^2}$$

giving your answer correct to 2 decimal places. (3 marks)

- (c) A jeweller paid \$6 800 for 165 bracelets bought in China. The Customs Department in his country charged him \$1 360 in duty.

- (i) Calculate the TOTAL cost of the 165 bracelets inclusive of duty. (1 mark)

- (ii) The jeweller sold the 165 bracelets at a selling price of \$68.85 EACH.

- a) Calculate the TOTAL profit he made on the sale of the 165 bracelets.

(2 marks)

- b) Calculate the profit as a percentage of the cost price, giving your answer to the nearest whole number. (2 marks)

Total 11 marks

2. (a) (i) Solve for x , where x is a real number

$$2(x - 6) + 3x \leq 8. \quad (3 \text{ marks})$$

- (ii) Using a number line, show your solution to Part (a) (i). (1 mark)

- (b) Factorize completely:

- (i) $3x - 6y + ax - 2ay$ (2 marks)

- (ii) $p^2 - 1$ (1 mark)

GO ON TO THE NEXT PAGE

- (c) Expand and simplify

$$(2k - 3)(k - 2).$$

(2 marks)

- (d) The lines whose equations are

$$3x + y = 2 \text{ and } 4x - 2y = 6 \text{ intersect at } (x, y).$$

Show that the point of intersection is $(1, -1)$.

(3 marks)

Total 12 marks

3. (a) In a class of 32 students, ALL the students study Spanish (S) and 20 of the students study French (F).

- (i) Represent this information on a Venn diagram.

(2 marks)

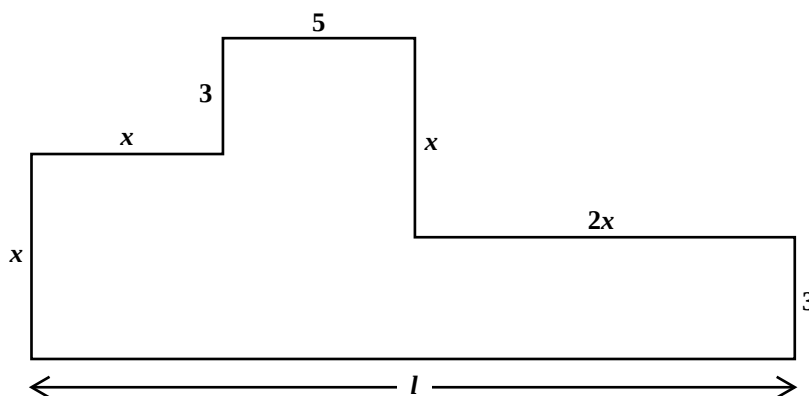
- (ii) Calculate the number of students who study Spanish (S) but NOT French (F).

(1 mark)

- (iii) Write, using set notation, the relationship between F and S .

(1 mark)

- (b) The diagram below is an accurate plan of the floor of a room. All the corners are right angles. All measures shown on the diagram are recorded to the nearest metre.



- (i) State, in terms of x , the length l of the floor.

(1 mark)

- (ii) The perimeter of the floor is 56 metres.

- a) Determine the value of x .

(3 marks)

- b) Calculate the area of the floor.

(2 marks)

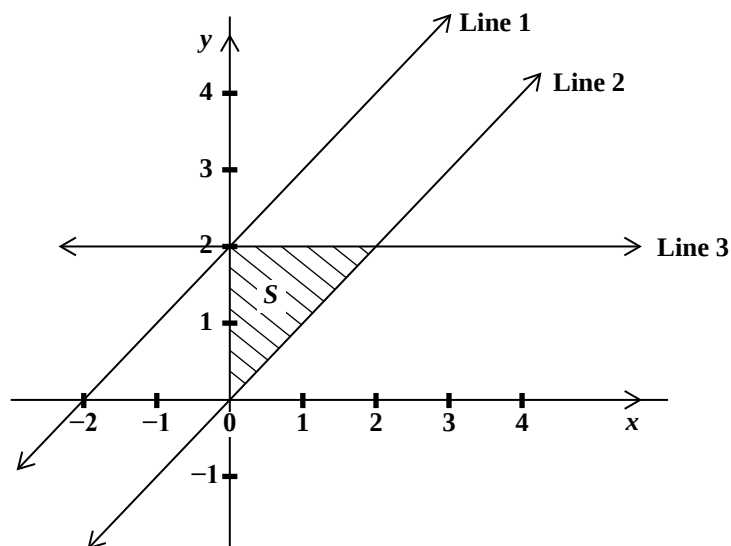
Total 10 marks

GO ON TO THE NEXT PAGE

4. An answer sheet is provided for this question.

The diagram below shows the graphs of three straight lines:

$$y = 2, \quad y = x \quad \text{and} \quad y = x + 2.$$



On the answer sheet

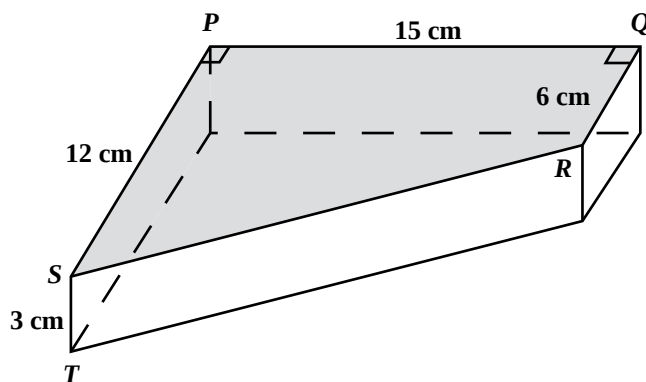
- (a) State the correct equation for EACH of the following:
- (i) Line 1 (1 mark)
 - (ii) Line 2 (1 mark)
 - (iii) Line 3 (1 mark)
- (b) Show that the gradient of Line 2 is 1. (1 mark)
- (c) Shade the region which is described as $y \geq x + 2$. (2 marks)
- (d) Write THREE inequalities that define the shaded region, S, shown in the diagram. (3 marks)
- (e) Write the equation of the straight line which is perpendicular to Line 1 and passes through the origin. (2 marks)

Total 11 marks

GO ON TO THE NEXT PAGE

5. (a) (i) **Using a ruler, a pencil and a pair of compasses**, construct triangle ABC with
 $BC = 10\text{ cm}$ $AB = 6\text{ cm}$ and $AC = 8\text{ cm}$. **(3 marks)**
- (ii) Measure and state the size of angle ABC . **(1 mark)**
- (iii) Complete the diagram to show a quadrilateral, $CABD$, such that $CD = CA$ and $BD = BA$. **(2 marks)**
- (b) The diagram below, **not drawn to scale**, shows a block of metal in the shape of a prism. The cross section of the block is a trapezium, $PQRS$, with parallel sides QR and PS , and PQ , the perpendicular distance between the sides.

$$PQ = 15\text{ cm} \quad QR = 6\text{ cm} \quad PS = 12\text{ cm} \quad \text{and} \quad ST = 3\text{ cm}$$

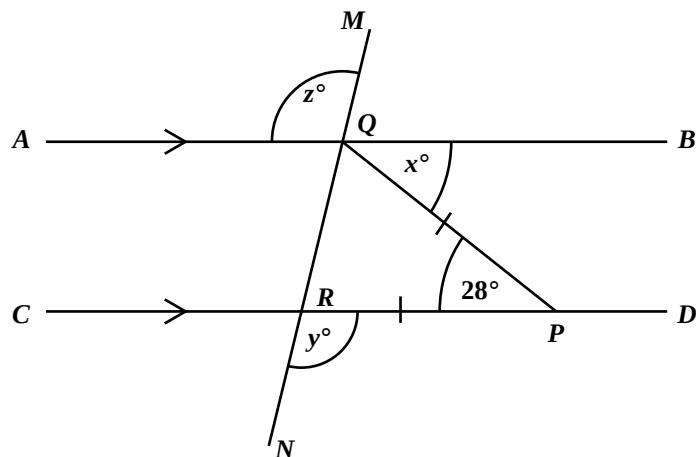


- (i) Calculate the area of the trapezium $PQRS$. **(2 marks)**
- (ii) Given that $ST = 3\text{ cm}$, calculate the volume of the block of metal. **(1 mark)**
- (iii) The block of metal has a mass of 1.5 kg . Calculate, in grams, the mass of ONE cubic centimetre of metal. **(3 marks)**

Total 12 marks

GO ON TO THE NEXT PAGE

6. (a) In the figure below, **not drawn to scale**, the lines AQB and $CRPD$ are parallel and $MQRN$ is a transversal. $PQ = PR$ and angle $QPR = 28^\circ$.

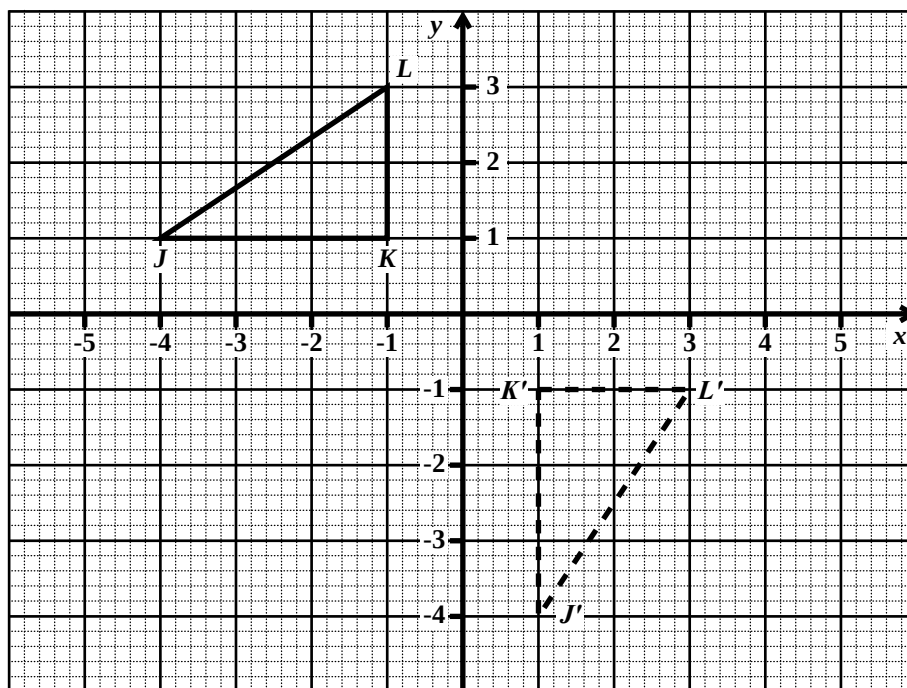


Calculate, giving reasons for your answer, the value of

- | | | |
|-------|-------|-----------|
| (i) | x | (2 marks) |
| (ii) | y | (2 marks) |
| (iii) | z . | (2 marks) |

GO ON TO THE NEXT PAGE

- (b) The diagram below shows triangle JKL and its image $J'K'L'$ after a transformation.



- State the coordinates of the vertex, J , of triangle JKL . (1 mark)
- State the length of the side $K'L'$ of triangle $J'K'L'$. (1 mark)
- Describe FULLY a **single** transformation that maps triangle JKL onto triangle $J'K'L'$. (2 marks)
- State the coordinates of triangle $J''K''L''$, the image of triangle JKL , under the translation by the vector $\begin{pmatrix} 5 \\ -3 \end{pmatrix}$. (2 marks)

Total 12 marks

7. The heights of a sample of seedlings were measured to the nearest centimetre and then arranged in class intervals as shown in the table below.

Height in cm	Midpoint	Frequency
3–7	5	0
8–12	10	3
13–17	15	12
18–22		16
23–27		22
28–32		18
33–37		14

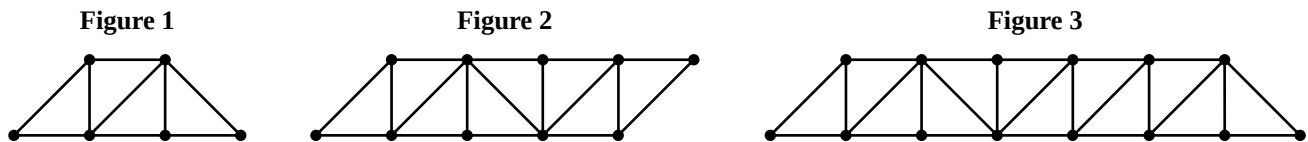
- (a) How many seedlings were in the sample? **(1 mark)**
- (b) For the class interval written as “8–12” in the table above, write down
- (i) the lower class **limit** **(1 mark)**
 - (ii) the upper class **boundary** **(1 mark)**
 - (iii) the class **width**. **(1 mark)**
- (c) Copy and complete the table by inserting
- (i) the midpoints of EACH class interval **(2 marks)**
 - (ii) the missing values for the class interval **after** the interval “33–37”. **(1 mark)**
- (d) Using a scale of **2 cm to represent 5 cm on the horizontal axis** and **2 cm to represent 5 seedlings on the vertical axis**, draw a frequency polygon to represent the data as shown in your table at (c). **(5 marks)**

Total 12 marks

GO ON TO THE NEXT PAGE

8. An answer sheet is provided for this question.

The diagram below shows the first three figures in a sequence of figures. Each figure is made up of one or more trapezia with dots one unit apart on their parallel sides. Each trapezium can be partitioned into four congruent triangles as follows:



- (a) **On the answer sheet provided, draw Figure 4, the FOURTH figure in the sequence.**
(2 marks)
- (b) Study the patterns in the table shown below. Complete the table by inserting the missing values in the rows numbered (i), (ii), (iii) and (iv).

	No. of Trapezia (n)	No. of Triangles	No. of Dots	
	1	4	6	
	2	8	10	
	3	12	14	
(i)	4	_____	_____	(2 marks)
(ii)	10	_____	_____	(2 marks)
(iii)	_____	64	_____	(2 marks)
(iv)	n	_____	_____	(2 marks)

Total 10 marks

GO ON TO THE NEXT PAGE

SECTION II**Answer TWO questions.****ALGEBRA AND RELATIONS, FUNCTIONS AND GRAPHS**

- 9.** (a) The functions $h(x)$ and $g(x)$ are defined as

$$h(x) = \frac{10}{x} - 3 \qquad g(x) = 3x - 2.$$

- (i) Evaluate:

a) $g(4)$

(1 mark)

b) $hg(4)$

(2 marks)

- (ii) Write expressions in x for:

a) $h^{-1}(x)$

b) $g \circ g(x)$

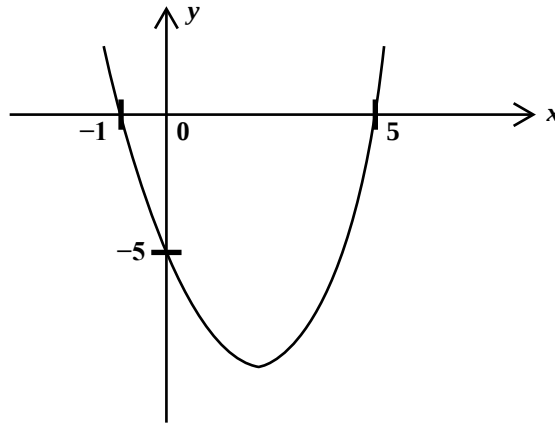
(4 marks)

GO ON TO THE NEXT PAGE

- (b) The diagram below shows a sketch of the quadratic function

$$y = x^2 + bx + c, \quad -2 \leq x \leq 6$$

where b and c are constants.



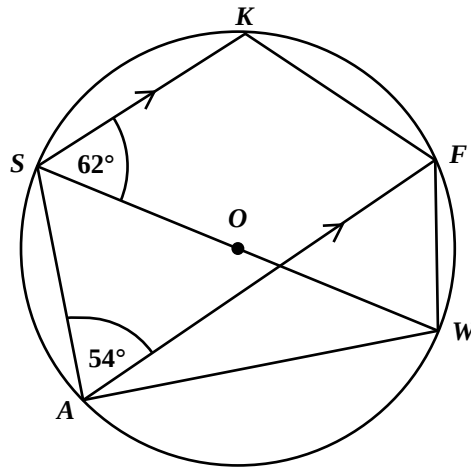
- (i) State the roots of the equation $x^2 + bx + c = 0$. **(2 marks)**
- (ii) For the function $y = x^2 + bx + c$
- a) determine the value of c **(2 marks)**
- b) show that $b = -4$. **(2 marks)**
- (iii) State the coordinates of the MINIMUM point on the graph of the function $y = x^2 + bx + c$. **(2 marks)**

Total 15 marks

GEOMETRY AND TRIGONOMETRY

10. (a) In the diagram below, **not drawn to scale**, O is the centre of the circle. The lines SK and AF are parallel.

$$\angle KSW = 62^\circ \quad \angle SAF = 54^\circ$$



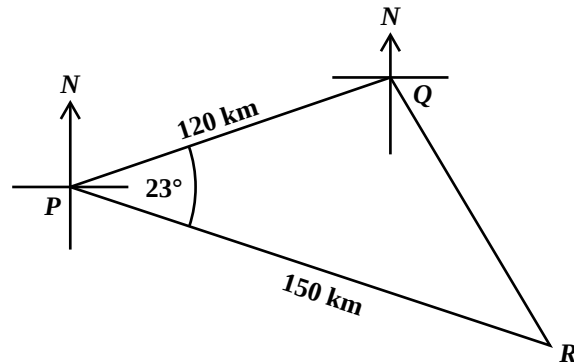
Calculate, **giving reasons for your answer**, the measure of:

- | | | |
|-------|--------------|-----------|
| (i) | $\angle FAW$ | (2 marks) |
| (ii) | $\angle SKF$ | (2 marks) |
| (iii) | $\angle ASW$ | (2 marks) |

GO ON TO THE NEXT PAGE

- (b) The diagram below, **not drawn to scale**, shows the positions of three points, P , Q and R on a horizontal plane.

$$PQ = 120 \text{ km} \quad PR = 150 \text{ km} \quad \angle QPR = 23^\circ$$



- (i) Calculate, correct to one decimal place
- the distance QR **(3 marks)**
 - the area of triangle PQR . **(2 marks)**
- (ii) The bearing of P from Q is 252° . Calculate the bearing of R from P . **(4 marks)**

Total 15 marks

GO ON TO THE NEXT PAGE

VECTORS AND MATRICES

11. (a) The matrix, T , is such that

$$T = \begin{pmatrix} 2 & -1 \\ 1 & 3 \end{pmatrix}.$$

- (i) Determine, T^{-1} , the inverse of T . **(3 marks)**
- (ii) The matrix T maps the point (a, b) onto the point $(4, 9)$. Determine the values of a and b . **(4 marks)**

- (b) $\vec{OM}$ and $\vec{ON}$ are position vectors with respect to the origin, O , such that

$$\vec{OM} = \mathbf{m} \quad \text{and} \quad \vec{ON} = \mathbf{n}$$

L is a point on MN such that $ML : LN = 2 : 1$.

- (i) Draw a sketch of the triangle OMN and label the points O, M, N and L . **(2 marks)**
- (ii) Write in terms of $\mathbf{m}$ and $\mathbf{n}$ an expression for:
- a) $\vec{MN}$
- b) $\vec{ML}$ **(3 marks)**
- (iii) If $\mathbf{m} = \begin{pmatrix} 3 \\ 6 \end{pmatrix}$ and $\mathbf{n} = \begin{pmatrix} 9 \\ 0 \end{pmatrix}$,
determine the position vector of L . **(3 marks)**

Total 15 marks

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.

CARIBBEAN EXAMINATIONS COUNCIL

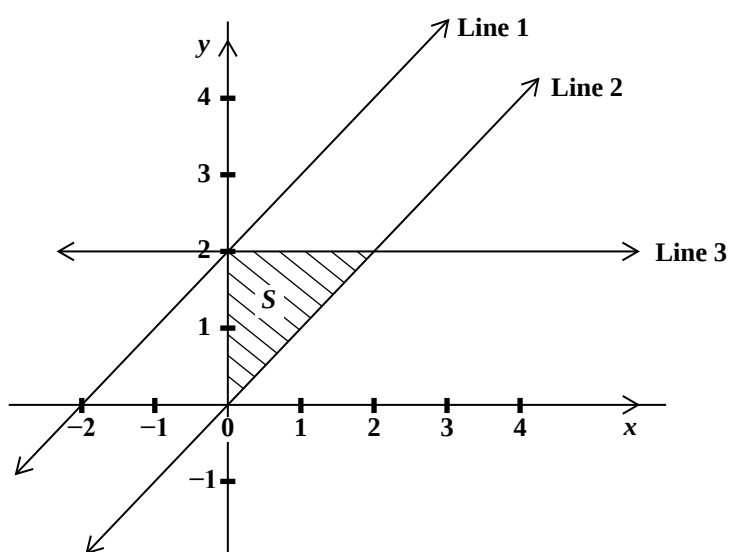
**CARIBBEAN SECONDARY EDUCATION CERTIFICATE®
EXAMINATION**

MATHEMATICS

Paper 02 – General Proficiency

Answer Sheet for Question 4.

Candidate Number



- (a) (i) Line 1: _____
- (ii) Line 2: _____
- (iii) Line 3: _____
- (b) _____
- (d) Inequalities that define S: _____
- _____
- (e) Equation of the straight line: _____

ATTACH THIS ANSWER SHEET TO YOUR ANSWER BOOKLET

FORM TP 2014017



TEST CODE **01234020**

JANUARY 2014

CARIBBEAN EXAMINATIONS COUNCIL

**CARIBBEAN SECONDARY EDUCATION CERTIFICATE®
EXAMINATION**

MATHEMATICS

Paper 02 – General Proficiency

Answer Sheet for Question 8.

Candidate Number

(a)

--

(b)

	No. of Trapezia (<i>n</i>)	No. of Triangles	No. of Dots
	1	4	6
	2	8	10
	3	12	14
(i)	4	_____	_____
(ii)	10	_____	_____
(iii)	_____	64	_____
(iv)	<i>n</i>	_____	_____

ATTACH THIS ANSWER SHEET TO YOUR ANSWER BOOKLET



TEST CODE **01234020**

FORM TP 2014089

MAY/JUNE 2014

C A R I B B E A N E X A M I N A T I O N S C O U N C I L
C A R I B B E A N S E C O N D A R Y E D U C A T I O N C E R T I F I C A T E[®]
E X A M I N A T I O N
M A T H E M A T I C S

Paper 02 – General Proficiency

2 hours 40 minutes

21 MAY 2014 (a.m.)

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of TWO sections: I and II.
2. Section I has EIGHT questions and Section II has THREE questions.
3. Answer ALL questions in Section I, and any TWO questions from Section II.
4. Write your answers in the booklet provided.
5. Begin EACH question on a separate page.
6. All working must be shown clearly.
7. A list of formulae is provided on page 2 of this booklet.

Required Examination Materials

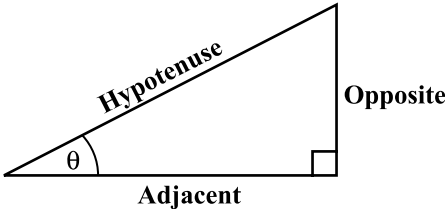
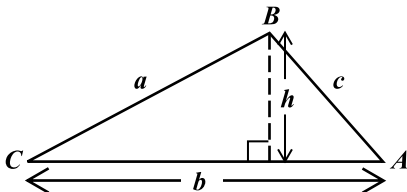
Electronic calculator
Geometry set
Graph paper (provided)

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

Copyright © 2013 Caribbean Examinations Council
All rights reserved.

01234020/F 2014

LIST OF FORMULAE

Volume of a prism	$V = Ah$ where A is the area of a cross-section and h is the perpendicular length.
Volume of cylinder	$V = \pi r^2 h$ where r is the radius of the base and h is the perpendicular height.
Volume of a right pyramid	$V = \frac{1}{3} Ah$ where A is the area of the base and h is the perpendicular height.
Circumference	$C = 2\pi r$ where r is the radius of the circle.
Arc length	$S = \frac{\theta}{360} \times 2\pi r$ where θ is the angle subtended by the arc, measured in degrees.
Area of a circle	$A = \pi r^2$ where r is the radius of the circle.
Area of a sector	$A = \frac{\theta}{360} \times \pi r^2$ where θ is the angle of the sector, measured in degrees.
Area of trapezium	$A = \frac{1}{2} (a + b) h$ where a and b are the lengths of the parallel sides and h is the perpendicular distance between the parallel sides.
Roots of quadratic equations	If $ax^2 + bx + c = 0$, then $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
Trigonometric ratios	$\sin \theta = \frac{\text{opposite side}}{\text{hypotenuse}}$ $\cos \theta = \frac{\text{adjacent side}}{\text{hypotenuse}}$ $\tan \theta = \frac{\text{opposite side}}{\text{adjacent side}}$ 
Area of triangle	Area of $\Delta = \frac{1}{2} bh$ where b is the length of the base and h is the perpendicular height. Area of $\Delta ABC = \frac{1}{2} ab \sin C$ Area of $\Delta ABC = \sqrt{s(s-a)(s-b)(s-c)}$ where $s = \frac{a+b+c}{2}$ $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$ Cosine rule $a^2 = b^2 + c^2 - 2bc \cos A$ 

GO ON TO THE NEXT PAGE

SECTION I**Answer ALL the questions in this section.****All working must be clearly shown.**

- 1.** (a) Using a calculator, or otherwise, determine the value of:
- (i) $5.25 \div 0.015$ **(1 mark)**
 - (ii) $\sqrt{6.5025}$ **(1 mark)**
 - (iii) 3.142×2.236^2 (correct to 3 significant figures) **(2 marks)**
- (b) Concrete tiles are made using buckets of cement, sand and gravel mixed in the ratio 1:4:6.
- (i) How many buckets of gravel are needed for 4 buckets of cement? **(2 marks)**
 - (ii) If 20 buckets of sand are used, how many buckets of EACH of the following will be needed?
 - a) Cement
 - b) Gravel **(3 marks)**
- (c) The cash price of a laptop is \$1 299. It can be bought on hire purchase by making a deposit of \$350 and 10 monthly payments of \$120 each.
- (i) What is the TOTAL hire purchase price of the laptop? **(2 marks)**
 - (ii) How much is saved by buying the laptop for cash? **(1 mark)**

Total 12 marks

GO ON TO THE NEXT PAGE

2. (a) Write as a single fraction in its LOWEST terms

$$\frac{x-2}{3} + \frac{x+1}{4}.$$

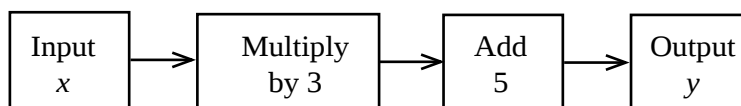
(3 marks)

- (b) Write an equation in x to represent EACH statement below. Do NOT solve the equation.

(i) When 4 is added to a certain number the result is the same as halving the number and adding 10. **(1 mark)**

(ii) Squaring a number and subtracting 6 gives the same result as doubling the number and adding 9. **(1 mark)**

- (c) John drew the diagram below to show what he was thinking.



(i) Use information from the diagram to write a formula for y in terms of x .

(1 mark)

(ii) If the number 4 is the input, what number would be the output?

(1 mark)

(iii) If the number 8 was the output, what number was the input?

(1 mark)

(iv) Reverse the formula written at (c) (i) above to write x in terms of y .

(1 mark)

- (d) Solve the following simultaneous equations:

$$2x + 3y = 9$$

$$3x - y = 8$$

(3 marks)

Total 12 marks

GO ON TO THE NEXT PAGE

3. (a) The universal set, U , is defined as the set of integers between 11 and 26.

A and B are subsets of U such that:

$A = \{\text{even numbers}\}$

$B = \{\text{multiples of 3}\}$

- (i) How many members are in the universal set, U ? **(1 mark)**
- (ii) List the members of the subset A . **(1 mark)**
- (iii) List the members of the subset B . **(1 mark)**
- (iv) Draw a Venn diagram to represent the relationships among A , B and U . **(3 marks)**

- (b) (i) Using **a ruler, a pencil and a pair of compasses**, construct

a) a triangle PQR in which $PQ = 8$ cm, $PR = 6$ cm and angle $P = 60^\circ$ **(3 marks)**

b) the line segment RX which is perpendicular to PQ and meets PQ at X . **(2 marks)**

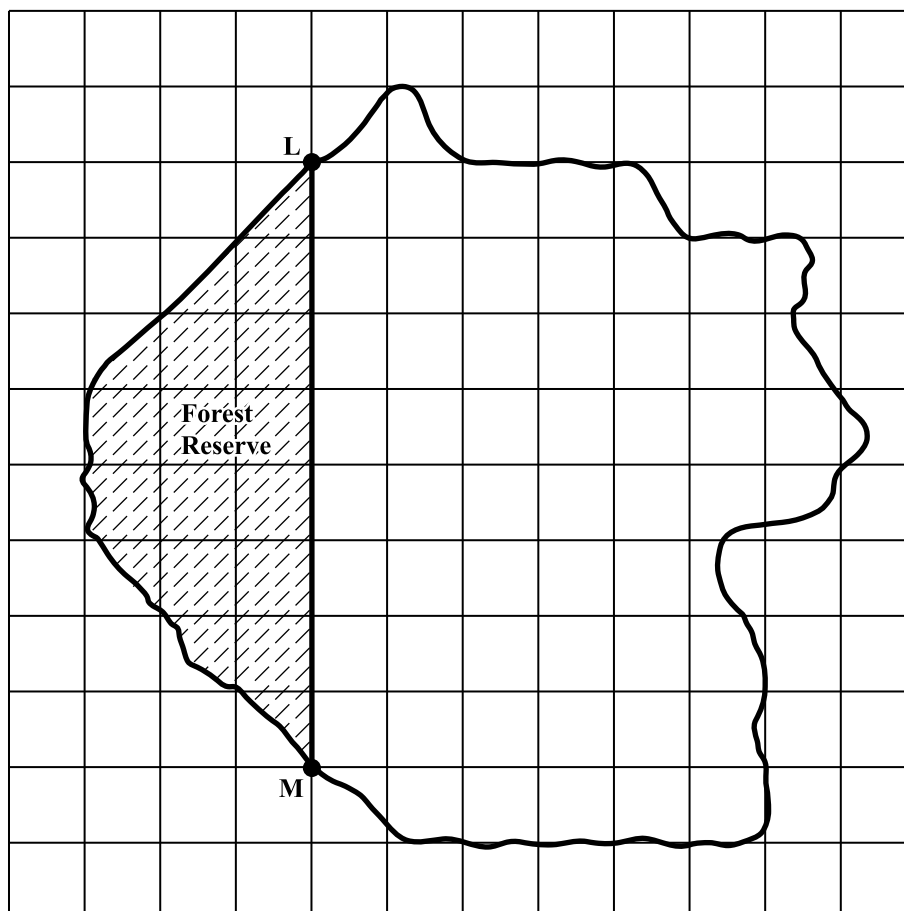
[Note: Credit will be given for clearly drawn construction lines.]

- (ii) Measure and state the size of angle QRX . **(1 mark)**

Total 12 marks

GO ON TO THE NEXT PAGE

4. The diagram below shows a map of an island drawn on a grid of 1-cm squares. The map is drawn to a scale of 1:50 000.



(a) Copy and complete EACH of the following sentences:

- (i) 1 cm on the map represents _____ cm on the island. **(1 mark)**
- (ii) An area of 1 cm² on the map represents an area of _____ cm² on the island. **(1 mark)**
- (iii) Given that 1 km = 100 000 cm, a distance of 1 cm on the map represents a distance of _____ km on the island. **(1 mark)**

GO ON TO THE NEXT PAGE

- (b) (i) L and M are two tracking stations. State, in centimetres, the distance LM on the map. **(1 mark)**
- (ii) Calculate the ACTUAL distance, in kilometres, from L to M on the island. **(2 marks)**
- (c) (i) The area shaded on the map is a forest reserve. By counting squares estimate, in cm^2 , the area of the forest reserve as shown on the map. **(2 marks)**
- (ii) Calculate, in km^2 , the ACTUAL area of the forest reserve. **(2 marks)**

Total 10 marks

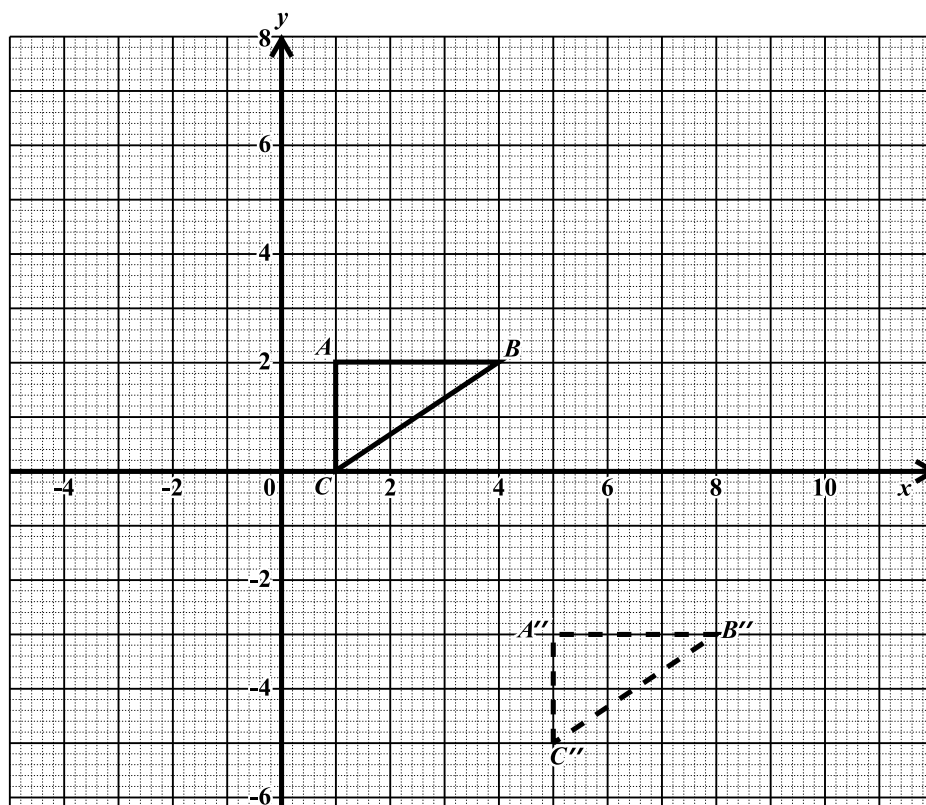
GO ON TO THE NEXT PAGE

5. An answer sheet is provided for this question.

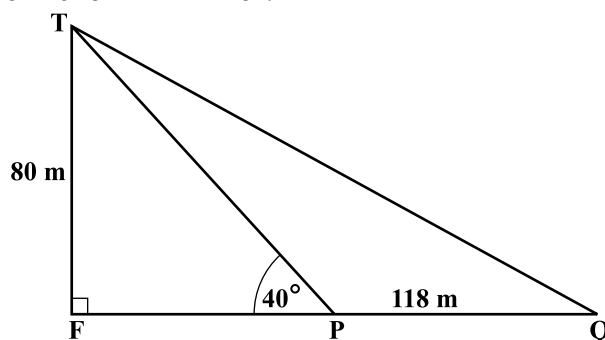
(a) Triangle ABC has coordinates $A(1,2)$, $B(4,2)$ and $C(1,0)$.

(i) **On the answer sheet provided**, draw triangle $A'B'C'$, the image of triangle ABC , under an enlargement, centre O and scale factor 2. **(3 marks)**

(ii) Triangle $A''B''C''$ is the image of triangle ABC , under a transformation, M . Describe **completely** the transformation, M . **(3 marks)**



(b) The diagram below, **not drawn to scale**, shows the positions of two ships, P and Q , at anchor. FT is the vertical face of a cliff jutting out of the water. P and Q are 118 m apart. $FT = 80$ m and $\angle FPT = 40^\circ$.



Determine

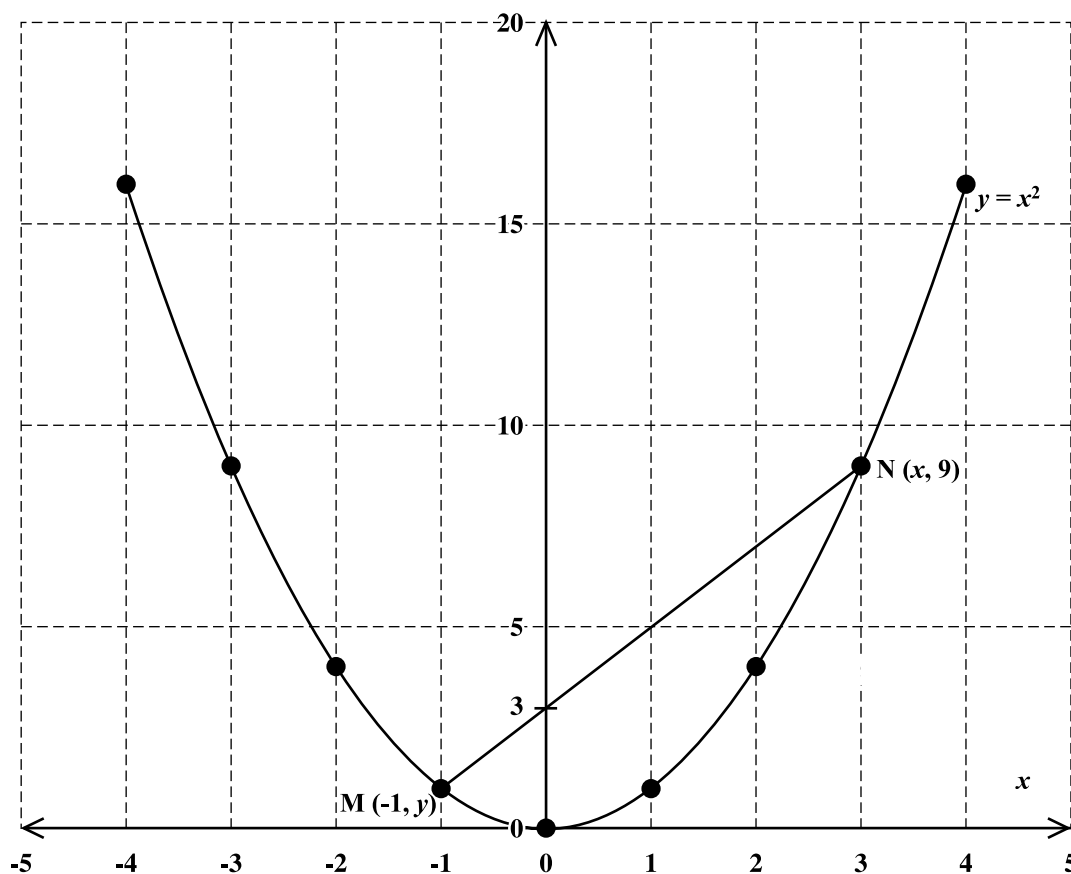
- (i) the angle of elevation of T from P **(1 mark)**
- (ii) the length of FP **(2 marks)**
- (iii) the angle of elevation of T from Q . **(3 marks)**

Total 12 marks

GO ON TO THE NEXT PAGE

6. An answer sheet is provided for this question.

The graph of the quadratic function $y = x^2$ for $-4 \leq x \leq 4$ is shown below.



- (a) The coordinates of the points M and N are $(-1, y)$ and $(x, 9)$ respectively.
Determine the value of
- (i) x (1 mark)
 - (ii) y . (1 mark)
- (b) Determine
- (i) the gradient of the line MN (1 mark)
 - (ii) the equation of the line MN (2 marks)
 - (iii) the equation of the line parallel to MN, and passing through the origin. (2 marks)
- (c) **On the answer sheet provided**, carefully draw the tangent line to the graph $y = x^2$ at the point $(2, 4)$. (2 marks)
- (d) Estimate the gradient of the tangent to the curve at $(2, 4)$. (2 marks)

Total 11 marks

GO ON TO THE NEXT PAGE

7. A class of 30 students counted the number of books in their bags on a certain day. The number of books in EACH bag is shown below.

5	4	6	3	2	1	7	4	5	3
6	5	4	3	7	6	2	5	4	5
5	7	5	4	3	2	1	6	3	4

- (a) Copy and complete the frequency table for the data shown above.

Number of Books (x)	Tally	Frequency (f)	$f \times x$
1	||	2	2
2	|||	3	6
3			
4			
5			
6			
7			

(4 marks)

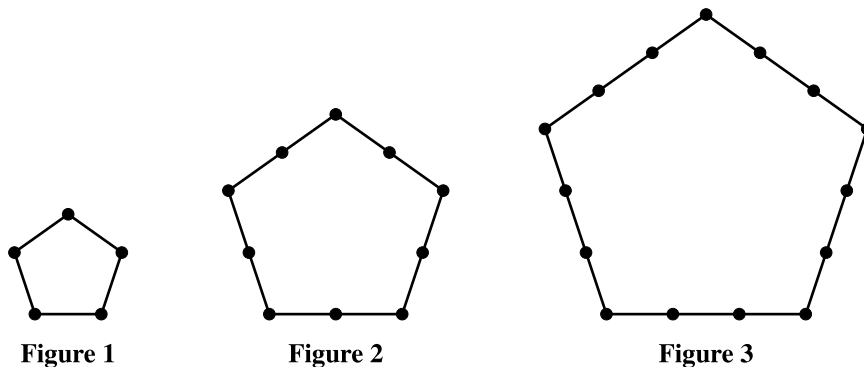
- (b) State the modal number of books in the bags of the sample of students. **(1 mark)**
- (c) Using the table in (a) above, or otherwise, calculate
- (i) the TOTAL number of books **(2 marks)**
- (ii) the mean number of books per bag. **(2 marks)**
- (d) Determine the probability that a student chosen at random has LESS THAN 4 books in his/her bag. **(2 marks)**

Total 11 marks

GO ON TO THE NEXT PAGE

8. An answer sheet is provided for this question.

A number sequence may be formed by counting the number of dots used to draw each of a set of geometric figures. The first three figures are shown below.



On the answer sheet provided,

- (a) Draw Figure 4, the next figure in the sequence above. **(2 marks)**
- (b) Complete the table below by inserting the missing information at the rows numbered (i) and (ii).

Figure (<i>f</i>)	Total Number of Dots	
	Formula	Number (<i>n</i>)
1	$5 \times 2 - 5$	5
2	$5 \times 3 - 5$	10
3	$5 \times 4 - 5$	15
4	Not Required	Not Required
(i) 5		
(ii) 6		

(4 marks)

- (c) Write an expression in *f* for the number (*n*) of dots used in drawing the *f*th figure. **(2 marks)**
- (d) Which figure in the sequence contains 145 dots? **(2 marks)**

Total 10 marks

GO ON TO THE NEXT PAGE

SECTION II

Answer TWO questions in this section.

ALGEBRA AND RELATIONS, FUNCTIONS AND GRAPHS

9. (a) Two functions are defined as follows:

$$g(x) = 4x + 3$$

$$f(x) = \frac{2x + 7}{x + 1}$$

- (i) State the value of x for which $f(x)$ is undefined. (1 mark)
- (ii) Calculate the value of $gf(5)$. (3 marks)
- (iii) Find $f^{-1}(x)$. (3 marks)
- (b) A ball is thrown vertically upwards. Its height, h metres, above the ground after t seconds is shown in the table below.

t (s)	0	1	2	3	4	5	6
h (m)	0	50	80	90	80	50	0

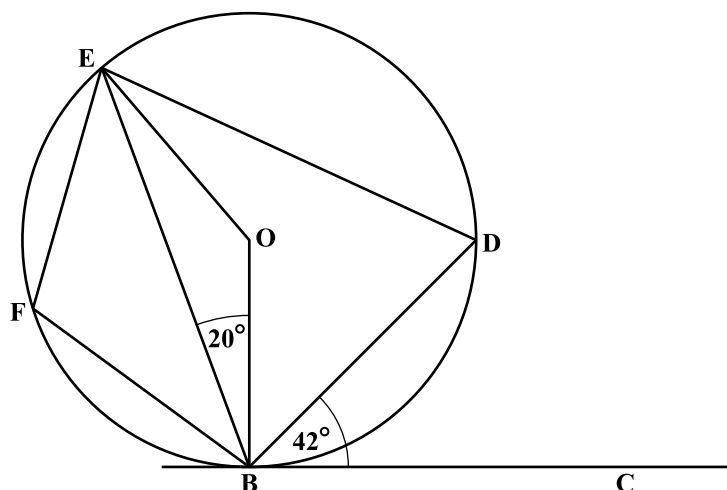
- (i) Using **2 cm to represent 1 second** on the x -axis and **1 cm to represent 10 metres** on the y -axis, plot a graph to show the height of the ball during the first 6 seconds. (4 marks)
- (ii) **Using your graph**, determine
- a) the average speed of the ball during the first 2 seconds (2 marks)
- b) the speed of the ball when $t = 3$ seconds. (2 marks)

Total 15 marks

GO ON TO THE NEXT PAGE

MEASUREMENT, GEOMETRY AND TRIGONOMETRY

10. (a) The diagram below, **not drawn to scale**, shows a circle, centre O . The line BC is a tangent to the circle at B . Angle $CBD = 42^\circ$ and angle $OBE = 20^\circ$.

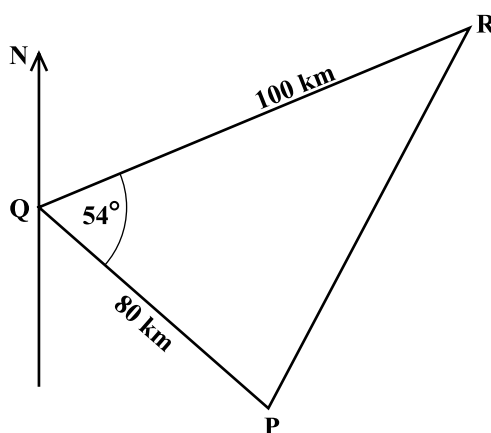


Calculate, giving a reason for EACH step of your answer, the measure of:

- | | | |
|-------|--------------|-----------|
| (i) | $\angle BOE$ | (2 marks) |
| (ii) | $\angle OED$ | (2 marks) |
| (iii) | $\angle BFE$ | (3 marks) |

GO ON TO THE NEXT PAGE

- (b) The diagram below, **not drawn to scale**, shows the positions of three ports, P , Q and R .



Q is 80 km from P .

R is 100 km from Q on a bearing of 066° .

$\angle PQR = 54^\circ$.

Calculate

- | | | |
|-------|---|------------------|
| (i) | the bearing of P from Q | (2 marks) |
| (ii) | the distance PR correct to 2 decimal places | (3 marks) |
| (iii) | the measure of $\angle QPR$ to the nearest degree. | (3 marks) |

Total 15 marks

GO ON TO THE NEXT PAGE

VECTORS AND MATRICES

11. (a) The matrix M is defined as

$$M = \begin{pmatrix} 7 & 2 \\ p & -1 \end{pmatrix}$$

Determine the value of p for which the matrix M does NOT have an inverse.

(2 marks)

- (b) Express the equations

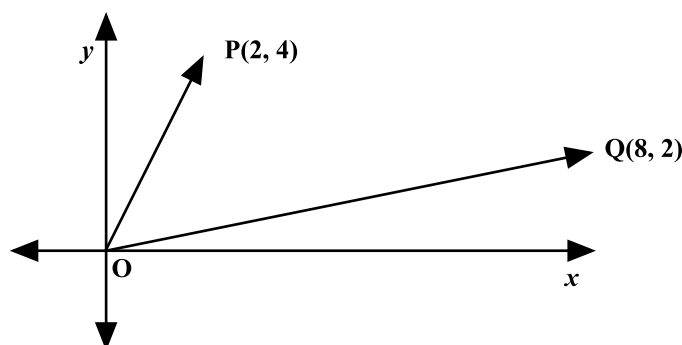
$$4x - 2y = 0$$

$$2x + 3y = 4$$

in the form $AX = B$, where A , X and B are matrices.

(2 marks)

- (c) In the diagram below, the coordinates of P and Q are $(2, 4)$ and $(8, 2)$ respectively. The line segment joining the origin $(0, 0)$ to the point P may be written as $\overrightarrow{OP}$.



- (i) What term is used to describe $\overrightarrow{OP}$? (2 marks)
- (ii) Write EACH of the following in the form : $\begin{pmatrix} a \\ b \end{pmatrix}$
- a) $\overrightarrow{OP}$ (1 mark)
- b) $\overrightarrow{OQ}$ (1 mark)
- c) $\overrightarrow{PQ}$ (2 marks)
- (iii) Given that $\overrightarrow{OP} = \overrightarrow{RQ}$, determine the coordinates of the point, R . (3 marks)
- (iv) State the type of quadrilateral formed by $PQRO$. Justify your answer. (2 marks)

Total 15 marks

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.

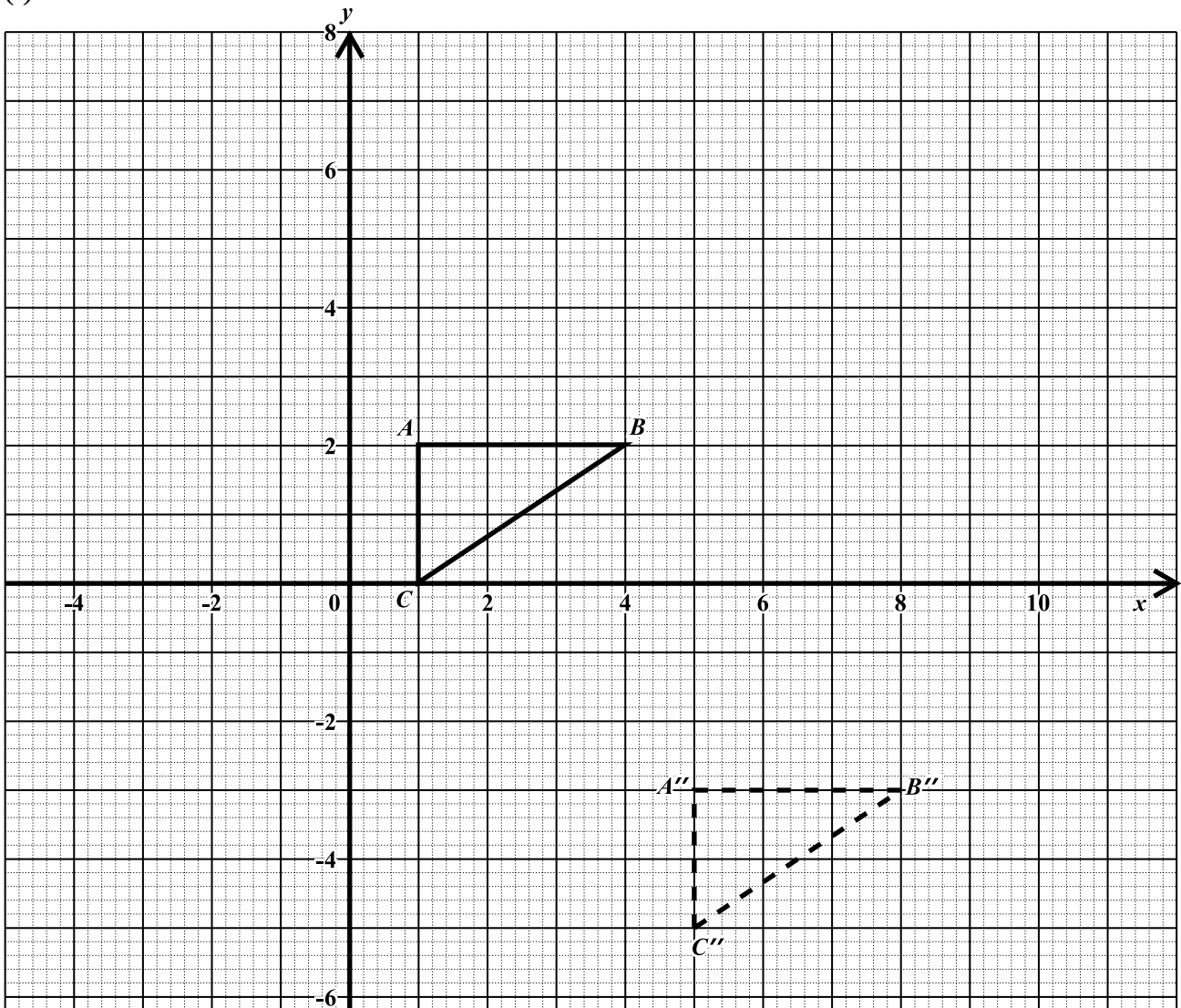
C A R I B B E A N E X A M I N A T I O N S C O U N C I L
C A R I B B E A N S E C O N D A R Y E D U C A T I O N C E R T I F I C A T E[®]
E X A M I N A T I O N
M A T H E M A T I C S

Paper 02 – General Proficiency

Answer Sheet for Question 5 (a)

Candidate Number

(i)



(ii) The transformation, M , that maps triangle ABC onto triangle $A''B''C''$ is

ATTACH THIS ANSWER SHEET TO YOUR ANSWER BOOKLET

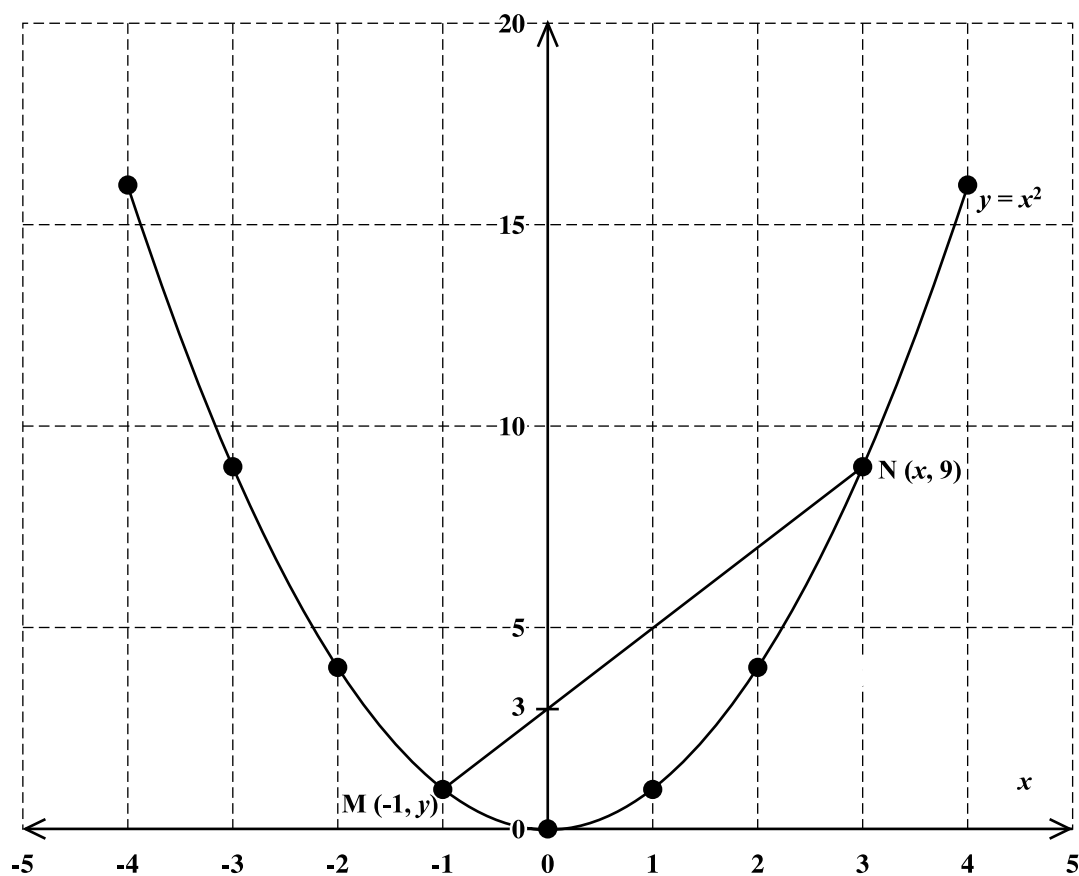
CARIBBEAN EXAMINATIONS COUNCIL
CARIBBEAN SECONDARY EDUCATION CERTIFICATE®
EXAMINATION
MATHEMATICS

Paper 02 – General Proficiency

Answer Sheet for Question 6 (c) and (d)

Candidate Number

(c)



(d) The gradient of the tangent to the graph at (2, 4) is _____

ATTACH THIS ANSWER SHEET TO YOUR ANSWER BOOKLET

TEST CODE **01234020****FORM TP 2014089**

MAY/JUNE 2014

C A R I B B E A N E X A M I N A T I O N S C O U N C I L
C A R I B B E A N S E C O N D A R Y E D U C A T I O N C E R T I F I C A T E[®]
E X A M I N A T I O N
M A T H E M A T I C S

Paper 02 – General Proficiency

Answer Sheet for Question 8**Candidate Number**

(a)

Figure 4

(b)

Figure (<i>f</i>)	Total Number of Dots	
	Formula	Number (<i>n</i>)
1	$5 \times 2 - 5$	5
2	$5 \times 3 - 5$	10
3	$5 \times 4 - 5$	15
4	Not Required	Not Required
(i) 5		
(ii) 6		

(c) Expression in *n*: _____

(d) Which figure in the sequence contains 145 dots? _____

ATTACH THIS ANSWER SHEET TO YOUR ANSWER BOOKLET

FORM TP 2015017



TEST CODE **01234020**

JANUARY 2015

CARIBBEAN EXAMINATIONS COUNCIL
CARIBBEAN SECONDARY EDUCATION CERTIFICATE®
EXAMINATION

MATHEMATICS

Paper 02 – General Proficiency

2 hours 40 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of TWO sections: I and II.
2. Section I has EIGHT questions and Section II has THREE questions.
3. Answer ALL questions in Section I, and any TWO questions from Section II.
4. Write your answers in the booklet provided.
5. Do NOT write in the margins.
6. All working MUST be shown clearly.
7. **A list of formulae is provided on page 2 of this booklet.**
8. If you need to rewrite any answer and there is not enough space to do so on the original page, you must use the extra page(s) provided at the back of this booklet. **Remember to draw a line through your original answer.**
9. **If you use the extra page(s) you MUST write the question number clearly in the box provided at the top of the extra page(s) and, where relevant, include the question part beside the answer.**

Required Examination Materials

Electronic calculator
Geometry set

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

Copyright © 2013 Caribbean Examinations Council
All rights reserved.

01234020/JANUARY/F 2015



0123402003

LIST OF FORMULAE

Volume of a prism	$V = Ah$ where A is the area of a cross section and h is the perpendicular length.
Volume of cylinder	$V = \pi r^2 h$ where r is the radius of the base and h is the perpendicular height.
Volume of a right pyramid	$V = \frac{1}{3} Ah$ where A is the area of the base and h is the perpendicular height.
Circumference	$C = 2\pi r$ where r is the radius of the circle.
Arc length	$S = \frac{\theta}{360} \times 2\pi r$ where θ is the angle subtended by the arc, measured in degrees.
Area of a circle	$A = \pi r^2$ where r is the radius of the circle.
Area of a sector	$A = \frac{\theta}{360} \times \pi r^2$ where θ is the angle of the sector, measured in degrees.
Area of trapezium	$A = \frac{1}{2} (a + b) h$ where a and b are the lengths of the parallel sides and h is the perpendicular distance between the parallel sides.

Roots of quadratic equations If $ax^2 + bx + c = 0$,

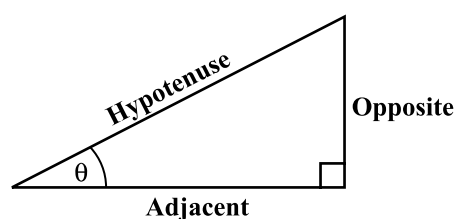
$$\text{then } x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Trigonometric ratios

$$\sin \theta = \frac{\text{opposite side}}{\text{hypotenuse}}$$

$$\cos \theta = \frac{\text{adjacent side}}{\text{hypotenuse}}$$

$$\tan \theta = \frac{\text{opposite side}}{\text{adjacent side}}$$



Area of triangle

Area of $\Delta = \frac{1}{2} bh$ where b is the length of the base and h is the perpendicular height.

$$\text{Area of } \Delta ABC = \frac{1}{2} ab \sin C$$

$$\text{Area of } \Delta ABC = \sqrt{s(s-a)(s-b)(s-c)}$$

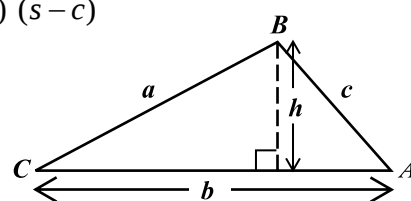
$$\text{where } s = \frac{a+b+c}{2}$$

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

Sine rule

Cosine rule

$$a^2 = b^2 + c^2 - 2bc \cos A$$



GO ON TO THE NEXT PAGE



SECTION I**Answer ALL the questions in this section.****All working must be clearly shown.**

1. (a) Using a calculator, or otherwise, calculate the EXACT value of

$$(12.8)^2 - (30 \div 0.375).$$

(3 marks)

- (b) Mark spends $\frac{3}{8}$ of his monthly income on housing. Of the REMAINDER, he spends $\frac{1}{3}$ on food and saves what is left.

(i) Calculate the fraction of his monthly income spent on food.

(2 marks)

(ii) Calculate the fraction of his monthly income that he saved.

(2 marks)

GO ON TO THE NEXT PAGE



- (c) (i) At Bank A, US \$1.00 = BD \$1.96. Calculate the value of US \$700 in BD\$.
US\$ means United States dollars and BD\$ means Barbados dollars.

(2 marks)

- (ii) At Bank B, the value of US \$700 is BD \$1 386. Calculate the value of US \$1.00 in BD\$ at this bank.

(2 marks)

Total 11 marks

GO ON TO THE NEXT PAGE



DO NOT WRITE IN THIS AREA

2. (a) Simplify

$$p^3 q^2 \times pq^5.$$

(2 marks)

- (b) Express as a single fraction in its simplest form

$$\frac{a}{5} + \frac{3a}{2}.$$

(2 marks)

GO ON TO THE NEXT PAGE



(c) Factorize completely:

(i) $x^2 - 5x + 4$

(2 marks)

(ii) $m^2 - 4n^2$

(2 marks)

GO ON TO THE NEXT PAGE



- (d) (i) Solve for x

$$2x - 7 \leq 3.$$

(1 mark)

- (ii) If x is a positive integer, list the possible values of x .

(1 mark)



- (e) Find the value of $2\pi\sqrt{\frac{l}{g}}$

where $\pi = 3.14$, $l = 0.625$ and $g = 10$.

(2 marks)

Total 12 marks

GO ON TO THE NEXT PAGE



3. (a) In a survey of 30 families, the findings were that:

15 families owned dogs

12 families owned cats

x families owned BOTH dogs and cats

8 families owned NEITHER dogs NOR cats

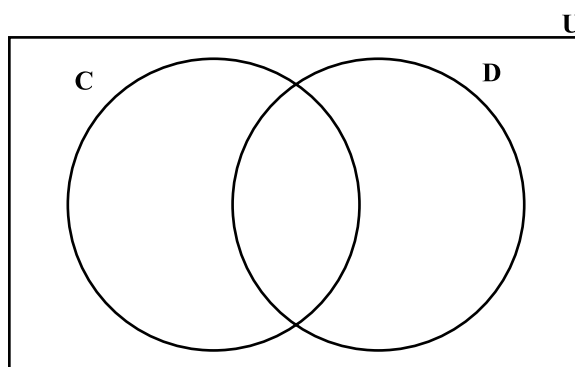
- (i) Given that:

$U = \{\text{families in the survey}\}$

$C = \{\text{families who owned cats}\}$

$D = \{\text{families who owned dogs}\}$

Use the given information to complete the Venn diagram below.



(4 marks)

- (ii) Write an expression, in x , which represents the TOTAL number of families in the survey.

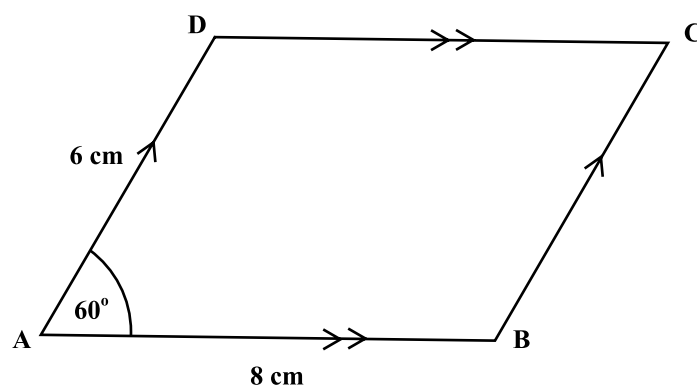
(1 mark)

- (iii) Write an equation which may be used to solve for x .

(1 mark)



- (b) The diagram below, **not drawn to scale**, shows parallelogram $ABCD$.



Using **a ruler, a pencil and a pair of compasses only**, construct parallelogram $ABCD$ with $AB = 8\text{ cm}$, $AD = 6\text{ cm}$ and $\angle DAB = 60^\circ$.

Marks will be awarded for construction lines clearly shown.

(6 marks)

Total 12 marks

GO ON TO THE NEXT PAGE



4. An electrician charges a fixed fee for a house visit plus an additional charge based on the length of time spent on the job.

The total charges, y , are calculated using the equation $y = 40x + 75$, where x represents the time in hours spent on the job.

- (a) Complete the table of values for the equation $y = 40x + 75$.

x (time in hours)	0	1	2	3	4	5	6
y (total charges in \$)	75	115		195		275	315

(2 marks)

- (b) On the grid on page 13, using a scale of **2 cm to represent one hour on the x-axis** and **2 cm to represent 50 dollars on the y-axis**, plot the 7 pairs of values shown in your completed table. Draw a straight line through all plotted points. (5 marks)

- (c) Using your graph, determine

- (i) the total charges when the job took 4.5 hours

(2 marks)

- (ii) the time, in hours, spent on a job if the total charges were \$300

(2 marks)

- (iii) the fixed charge for a visit.

(1 mark)

Draw lines on your graph to show how the values for (c) (i) and (c) (ii) were obtained.

Total 12 marks

GO ON TO THE NEXT PAGE



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

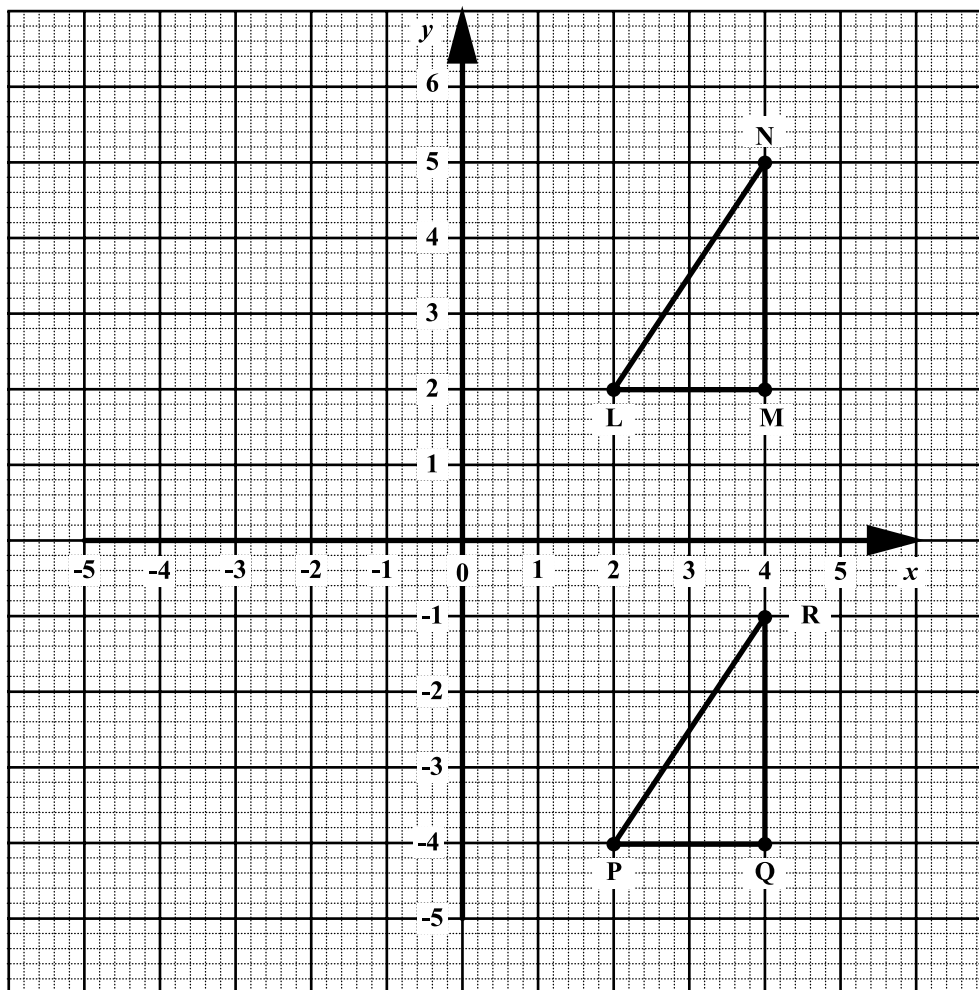
A full-page sheet of white graph paper featuring a uniform grid of small squares. The grid consists of thin black lines forming a continuous pattern across the entire surface. There are no margins, text, or other markings present.

01234020/JANUARY/F 2015



0123402015

5. The diagram below shows $\triangle LMN$ and its image $\triangle PQR$ after a transformation.



- (i) Write down the coordinates of N (1 mark)
- (ii) On the grid above, draw $\triangle FGH$, the reflection of $\triangle LMN$ in the y -axis. (4 marks)
- (iii) Using vector notation, describe the transformation which maps $\triangle LMN$ onto $\triangle PQR$.

.....

 (2 marks)

GO ON TO THE NEXT PAGE



- (iv) Complete the following statement:

$\triangle PQR$ is mapped onto $\triangle FGH$ by a combination of two transformations. First, $\triangle PQR$ is mapped onto $\triangle LMN$ by a , parallel to the ; then $\triangle LMN$ is mapped onto $\triangle FGH$ by a in the

(3 marks)

- (v) $\triangle PQR$ and $\triangle FGH$ are congruent.
State TWO reasons why they are congruent.

.....

.....

.....

.....

.....

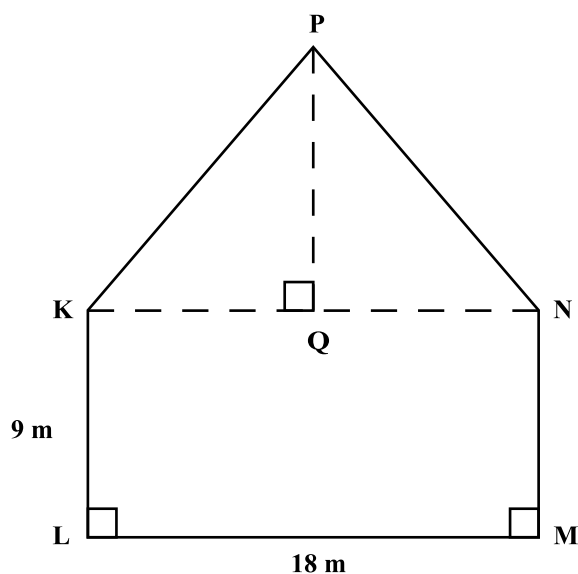
(2 marks)

Total 12 marks

GO ON TO THE NEXT PAGE



6. (a) The diagram below is a scale drawing of the side view of a building. Q is the midpoint of KN , and $\angle KLM = \angle LMN = 90^\circ$.



- (i) Measure and state the length of PQ on the drawing.

$PQ =$ (1 mark)

- (ii) Determine the scale of the drawing.

The scale is 1: (2 marks)

- (iii) Calculate the actual area of the face $LMNPK$ on the building.

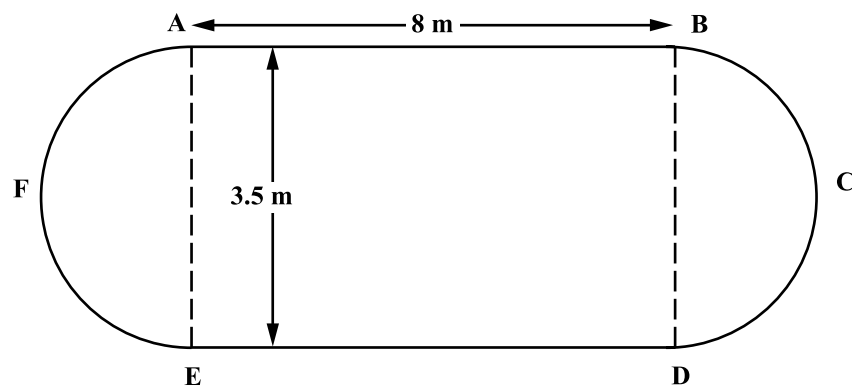
(4 marks)

GO ON TO THE NEXT PAGE



- (b) The diagram below, **not drawn to scale**, shows the plan of a swimming pool in the shape of a rectangle and two semicircles. The rectangle has dimensions 8 metres by 3.5 metres.

[Use $\pi = \frac{22}{7}$]



- (i) State the length of the diameter of the semicircle, AFE .

(1 mark)

- (ii) Calculate the perimeter of the swimming pool.

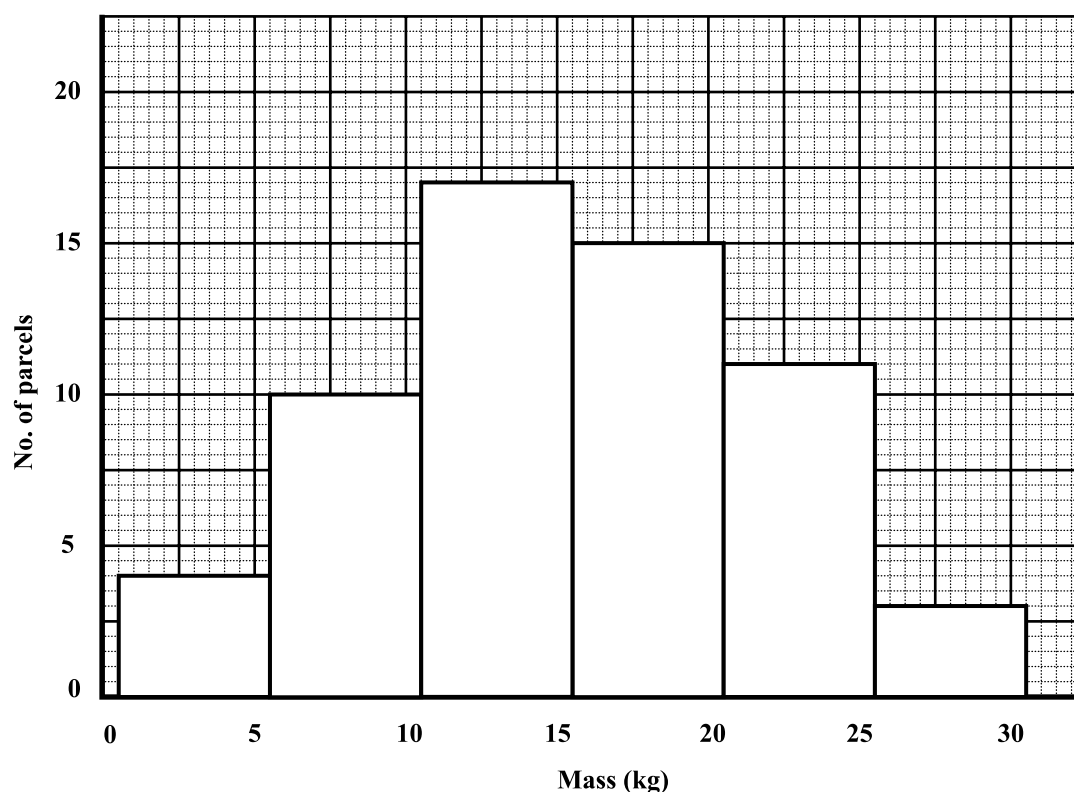
(3 marks)

Total 11 marks

GO ON TO THE NEXT PAGE



7. The masses of 60 parcels collected at a post office were grouped and recorded as shown in the histogram below.



- (a) (i) Complete the table below to show the information given in the histogram. **(2 marks)**
- (ii) Complete the column headed “Cumulative Frequency”. **(1 mark)**

Mass (kg)	No. of Parcels	Cumulative Frequency
1–5	4	4
6–10	10	14
11–15	17	31
16–20		46
21–25	11	
26–30		60

- (b) On the grid provided on page 19, using a scale of **2 cm to represent 5 kg on the x-axis** and **2 cm to represent 10 parcels on the y-axis**, draw the cumulative frequency curve for the data. **(5 marks)**

GO ON TO THE NEXT PAGE



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

A full-page sheet of white graph paper featuring a uniform grid of thin black lines. The grid consists of small squares covering the entire area, typical of standard graph paper used for mathematics or engineering.

01234020/JANUARY/F 2015



0123402021

- (c) Use the graph drawn at (b) to estimate the median mass of the parcels.

Draw lines on your graph to show how this estimate was obtained. (2 marks)

Total 10 marks



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

NOTHING HAS BEEN OMITTED.

GO ON TO THE NEXT PAGE

01234020/JANUARY/F 2015



0123402023

8. The diagram below shows the first three figures in a sequence of figures.

Figure 1

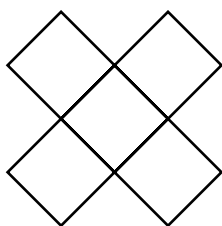


Figure 2

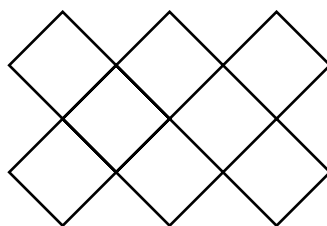
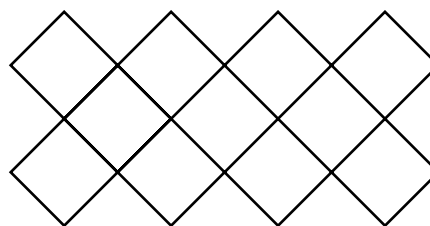


Figure 3



- (a) Draw the fourth figure in the sequence.

(2 marks)

GO ON TO THE NEXT PAGE



- (b) The table below shows the number of squares in each figure. Study the pattern in the table and complete the table by inserting the missing values in the rows numbered (i), (ii), (iii) and (iv).

	Figure (n)	No. of Squares	
	1	5	
	2	8	
	3	11	
(i)	4	.....	(1 mark)
(ii)	10	.....	(2 marks)
(iii)	.....	50	(2 marks)
(iv)	n	.....	(3 marks)

Total 10 marks

GO ON TO THE NEXT PAGE



SECTION II

Answer TWO questions in this section.

ALGEBRA AND RELATIONS, FUNCTIONS AND GRAPHS

9. (a) The functions $f(x)$ and $g(x)$ are defined as:

$$f(x) = \frac{5x-4}{3} \qquad g(x) = x^2 - 1$$

- (i) Evaluate $f(7)$.

(1 mark)

- (ii) Write an expression, in terms of x , for $f^{-1}(x)$.

(2 marks)

GO ON TO THE NEXT PAGE



- (iii) Write an expression, in terms of x , for $fg(x)$.

(2 marks)

GO ON TO THE NEXT PAGE



- (b) (i) Express the quadratic function $f(x) = 3x^2 + 6x - 2$, in the form $a(x + h)^2 + k$, where a , h and k are constants.

(3 marks)

- (ii) Hence, or otherwise, state the **minimum** value of $f(x) = 3x^2 + 6x - 2$.

(1 mark)



- (iii) State the equation of the axis of symmetry of the function

$$f(x) = 3x^2 + 6x - 2.$$

(2 marks)

- (iv) Sketch the graph of $y = 3x^2 + 6x - 2$, showing on your sketch

- a) the intercept on the y-axis
- b) the coordinates of the minimum point.

(4 marks)

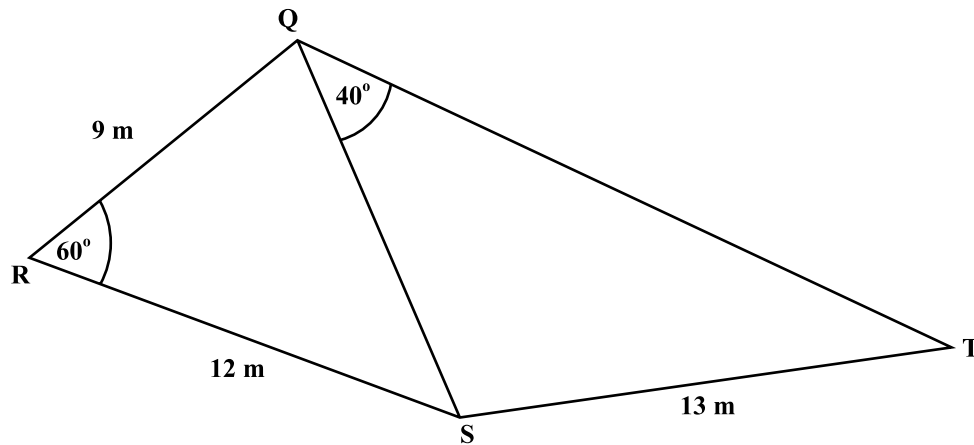
Total 15 marks

GO ON TO THE NEXT PAGE



MEASUREMENT, GEOMETRY AND TRIGONOMETRY

10. (a) On the diagram below, **not drawn to scale**, $RQ = 9$ m, $RS = 12$ m, $ST = 13$ m, $\angle QRS = 60^\circ$ and $\angle SQT = 40^\circ$.



Calculate, correct to 1 decimal place,

- (i) the length QS

(2 marks)

- (ii) the measure of $\angle QTS$

(2 marks)

GO ON TO THE NEXT PAGE



- (iii) the area of triangle QRS

(2 marks)

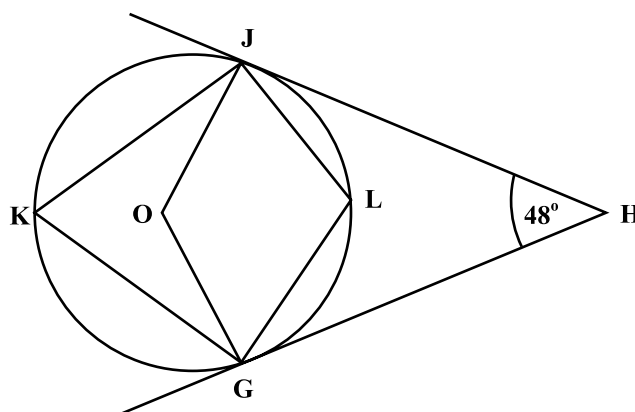
- (iv) the perpendicular distance from Q to RS .

(1 mark)

GO ON TO THE NEXT PAGE



- (b) The diagram below, **not drawn to scale**, shows a circle with centre O . HJ and HG are tangents to the circle and $\angle JHG = 48^\circ$.



Calculate, **giving the reason for each step of your answer**, the measure of:

- (i) $\angle OJH$

(2 marks)

- (ii) $\angle JOG$

(2 marks)

GO ON TO THE NEXT PAGE



(iii) $\angle JKG$

(2 marks)

(iv) $\angle JLG$

(2 marks)

Total 15 marks



DO NOT WRITE IN THIS AREA

VECTORS AND MATRICES

11. (a) (i) Write the following simultaneous equations

$$3x + 2y = -1$$

$$5x + 4y = 6$$

in the form $AX = B$, where A , X and B are matrices.

(2 marks)

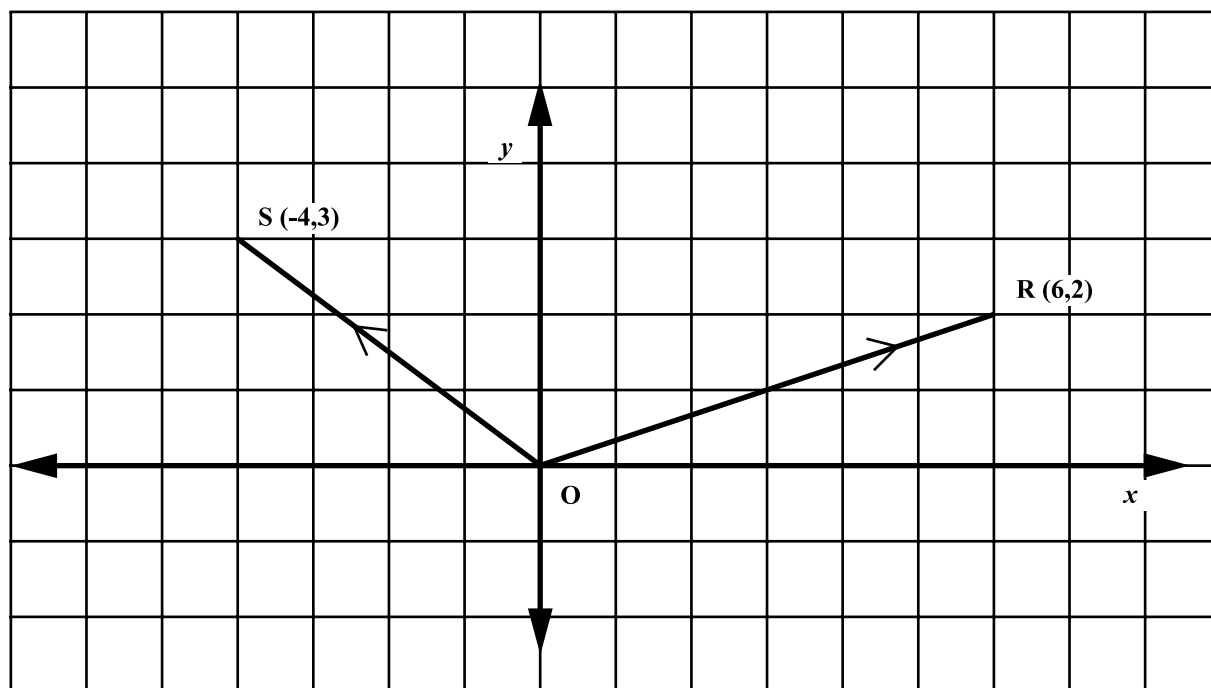
- (ii) Use a matrix method to solve for x and y .

(4 marks)

GO ON TO THE NEXT PAGE



- (b) The diagram below shows two position vectors $\vec{OR}$ and $\vec{OS}$ such that $R(6, 2)$ and $S(-4, 3)$.



Write as a column vector in the form $\begin{pmatrix} x \\ y \end{pmatrix}$:

(i) $\vec{OR}$

(1 mark)

(ii) $\vec{OS}$

(1 mark)

(iii) $\vec{SR}$

(2 marks)

GO ON TO THE NEXT PAGE



(iv) Find $|\vec{OS}|$.

(1 mark)

(v) Given that $OT = \begin{pmatrix} 2 \\ 5 \end{pmatrix}$, prove that $OSTR$ is a parallelogram.

(4 marks)

Total 15 marks

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.



0123402036

01234020/JANUARY/F 2015

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



TEST CODE **01234020**

FORM TP 2015089

MAY/JUNE 2015

CARIBBEAN EXAMINATIONS COUNCIL

**CARIBBEAN SECONDARY EDUCATION CERTIFICATE®
EXAMINATION**

MATHEMATICS

Paper 02 – General Proficiency

2 hours 40 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of TWO sections: I and II.
2. Section I has EIGHT questions and Section II has THREE questions.
3. Answer ALL questions in Section I, and any TWO questions from Section II.
4. Write your answers in the booklet provided.
5. Do NOT write in the margins.
6. All working MUST be shown clearly.
7. **A list of formulae is provided on page 2 of this booklet.**
8. If you need to rewrite any answer and there is not enough space to do so on the original page, you must use the extra page(s) provided at the back of this booklet. **Remember to draw a line through your original answer.**
9. **If you use the extra page(s) you MUST write the question number clearly in the box provided at the top of the extra page(s) and, where relevant, include the question part beside the answer.**

Required Examination Materials

Electronic calculator
Geometry set

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

Copyright © 2014 Caribbean Examinations Council
All rights reserved.

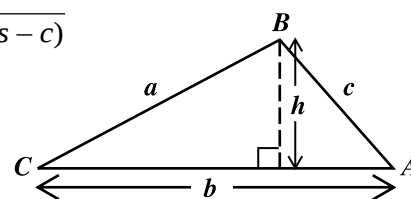
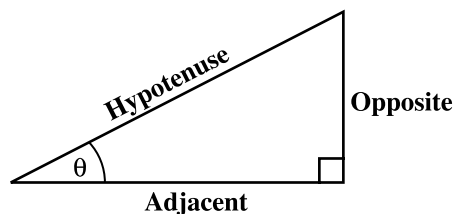
01234020/F 2015



0123402003

LIST OF FORMULAE

Volume of a prism	$V = Ah$ where A is the area of a cross-section and h is the perpendicular length.
Volume of cylinder	$V = \pi r^2 h$ where r is the radius of the base and h is the perpendicular height.
Volume of a right pyramid	$V = \frac{1}{3} Ah$ where A is the area of the base and h is the perpendicular height.
Circumference	$C = 2\pi r$ where r is the radius of the circle.
Arc length	$S = \frac{\theta}{360} \times 2\pi r$ where θ is the angle subtended by the arc, measured in degrees.
Area of a circle	$A = \pi r^2$ where r is the radius of the circle.
Area of a sector	$A = \frac{\theta}{360} \times \pi r^2$ where θ is the angle of the sector, measured in degrees.
Area of trapezium	$A = \frac{1}{2} (a + b) h$ where a and b are the lengths of the parallel sides and h is the perpendicular distance between the parallel sides.
Roots of quadratic equations	If $ax^2 + bx + c = 0$, then $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
Trigonometric ratios	$\sin \theta = \frac{\text{opposite side}}{\text{hypotenuse}}$ $\cos \theta = \frac{\text{adjacent side}}{\text{hypotenuse}}$ $\tan \theta = \frac{\text{opposite side}}{\text{adjacent side}}$
Area of triangle	Area of $\Delta = \frac{1}{2} bh$ where b is the length of the base and h is the perpendicular height. Area of $\Delta ABC = \frac{1}{2} ab \sin C$ Area of $\Delta ABC = \sqrt{s(s-a)(s-b)(s-c)}$ where $s = \frac{a+b+c}{2}$ Sine rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$ Cosine rule $a^2 = b^2 + c^2 - 2bc \cos A$



GO ON TO THE NEXT PAGE



SECTION I

Answer ALL questions in this section.

All working must be clearly shown.

1. (a) Using a calculator, or otherwise, determine the EXACT value of:

(i) $2\frac{2}{5} - 1\frac{1}{3} + 3\frac{1}{2}$

(1 mark)

(ii) $(4.14 \div 5.75) + (1.62)^2$

(2 marks)



(iii) $2 \times 3.142 \times 1.25$

(iv) $\sqrt{2.89} \times \tan 45^\circ$

(1 mark)

(2 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



- (b) The table below shows a shopping bill prepared for Mrs Rowe. The prices of some items are missing.

Shopping Bill		
Item	Unit Cost Price	Total Cost Price
3 kg sugar	X	\$10.80
4 kg rice	Y	Z
2 kg flour	\$1.60	\$3.20

- (i) Calculate the value of X, the cost of 1 kg of sugar.

(1 mark)

- (ii) If the cost price of 1 kg of rice is 80 cents MORE than for 1 kg of flour, calculate the values of Y and Z.

(2 marks)

- (iii) A tax of 10% of the total cost price of the three items is added to Mrs Rowe's bill. What is Mrs Rowe's TOTAL bill including the tax?

(3 marks)

Total 12 marks

GO ON TO THE NEXT PAGE



2. (a) Given that $a = 4$, $b = 2$ and $c = -1$, find the value of:

(i) $a - b + c$

(1 mark)

(ii) $2a^b$

(1 mark)

- (b) A bottle contains **500 ml** of orange juice. Write an expression for EACH of the following.

The amount of juice left in the bottle after pouring out

(i) p ml

(1 mark)

(ii) q glasses each containing r ml.

(1 mark)



- (c) Write as a single fraction, as simply as possible

$$\frac{2k}{3} + \frac{2-k}{5}.$$

(2 marks)

- (d) Four mangoes and two pears cost \$24.00, while two mangoes and three pears cost \$16.00.

- (i) Write a pair of simultaneous equations in x and y to represent the information given above.

(2 marks)

- (ii) State clearly what x and y represent.

x represents

.....

y represents

.....

(1 mark)

GO ON TO THE NEXT PAGE



(e) Factorize completely:

(i) $a^3 - 12a$

(1 mark)

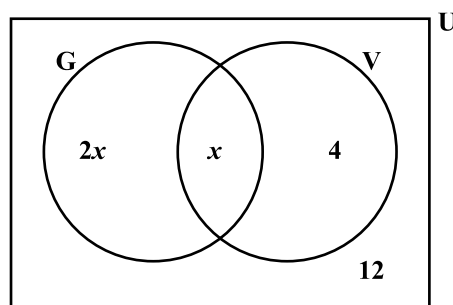
(ii) $2x^2 - 5x + 3$

(2 marks)

Total 12 marks



3. (a) The Venn diagram below shows the number of students who play the guitar (G) or the violin (V) in a class of 40 students.



- (i) How many students play neither the guitar nor the violin?

(1 mark)

- (ii) Write an expression, in terms of x , which represents the TOTAL number of students in the class.

(1 mark)

- (iii) Write an equation which may be used to determine the total number of students in the class.

(1 mark)

- (iv) How many students play the guitar?

(2 marks)

GO ON TO THE NEXT PAGE



- (b) (i) Using **a ruler, a pencil and a pair of compasses**, construct triangle ABC with $AB = 9$ cm, $\angle ABC = 90^\circ$ and $BC = 6$ cm.

(4 marks)

- (ii) Measure and state the size of $\angle BAC$.

(1 mark)

- (iii) On the diagram, show the point D such that ABCD is a parallelogram.

(2 marks)

Total 12 marks



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

NOTHING HAS BEEN OMITTED.



4. A graph sheet is provided for this question.

The table below is designed to show values of x and y for the function $y = x^2 - 2x - 3$ for integer values of x from -2 to 4 .

x	-2	-1	0	1	2	3	4
y	5		-3	-4	-3		5

- (a) Complete the table for the function $y = x^2 - 2x - 3$. (2 marks)
- (b) **On the graph on page 13**, plot the graph of $y = x^2 - 2x - 3$ using a scale of 2 cm to represent 1 unit on the x -axis and 1 cm to represent 1 unit on the y -axis. (4 marks)
- (c) **On the graph on page 13**, draw a smooth curve passing through the points on your graph. (1 mark)
- (d) Complete the following sentences using information from your graph.
- (i) The values of x for which $x^2 - 2x - 3 = 0$ are and (1 mark)
- (ii) The **minimum** value of $x^2 - 2x - 3$ is (1 mark)
- (iii) The equation of the line of symmetry of the graph of $y = x^2 - 2x - 3$ is (1 mark)

Total 10 marks



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

A full page of blank graph paper. The grid consists of small squares formed by thin black lines. There are no margins or additional markings on the page.

01234020/F 2015



0123402015

5. (a) A car is travelling at a constant speed of 54 km/h.
- (i) Calculate the distance it travels in $2\frac{1}{4}$ hours.

(1 mark)

- (ii) Calculate the time, in seconds, it takes to travel 315 metres, given that

$$1 \text{ km/h} = \frac{5}{18} \text{ m/s}.$$

(2 marks)

- (b) Write the following scales in the form 1 : x .

- (i) 1 millimetre = 1 metre

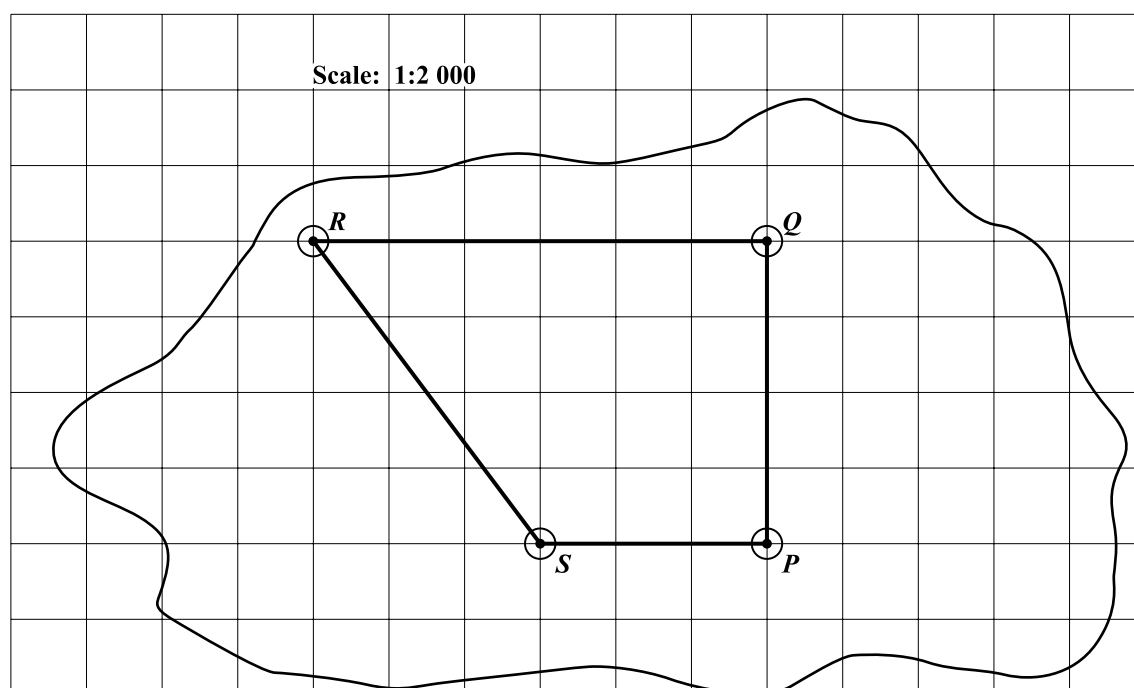
(1 mark)

- (ii) 2 cm = 6 m

(1 mark)



- (c) The map shown below is drawn on a grid of 1 cm squares. P , Q , R and S are four tracking stations. **The scale of the map is 1:2 000.**



- (i) Determine, in centimetres, the distance from Q to R on the map.

$QR = \dots\dots\dots$ cm

(1 mark)

- (ii) Determine, by counting, the area in square centimetres of the plane $PQRS$ on the map.

(2 marks)

- (iii) Calculate the ACTUAL distance, in kilometres, between Q and R .

(2 marks)

GO ON TO THE NEXT PAGE



- (iv) Calculate the ACTUAL area, in square metres, of the plane PQRS.

(2 marks)

Total 12 marks

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



DO NOT WRITE IN THIS AREA

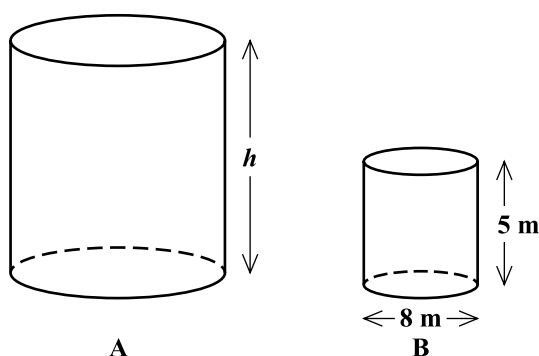
DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

NOTHING HAS BEEN OMITTED.



6. (a) The diagram below, **not drawn to scale**, shows two cylindrical water tanks, A and B. Tank B has base diameter 8 m and height 5 m. Both tanks are filled with water.



Take $\pi = 3.14$.

- (i) Calculate the volume of water in Tank B.

(2 marks)

- (ii) If the area of the base of A is 314 m^2 , calculate the length of the radius of Tank A.

(1 mark)

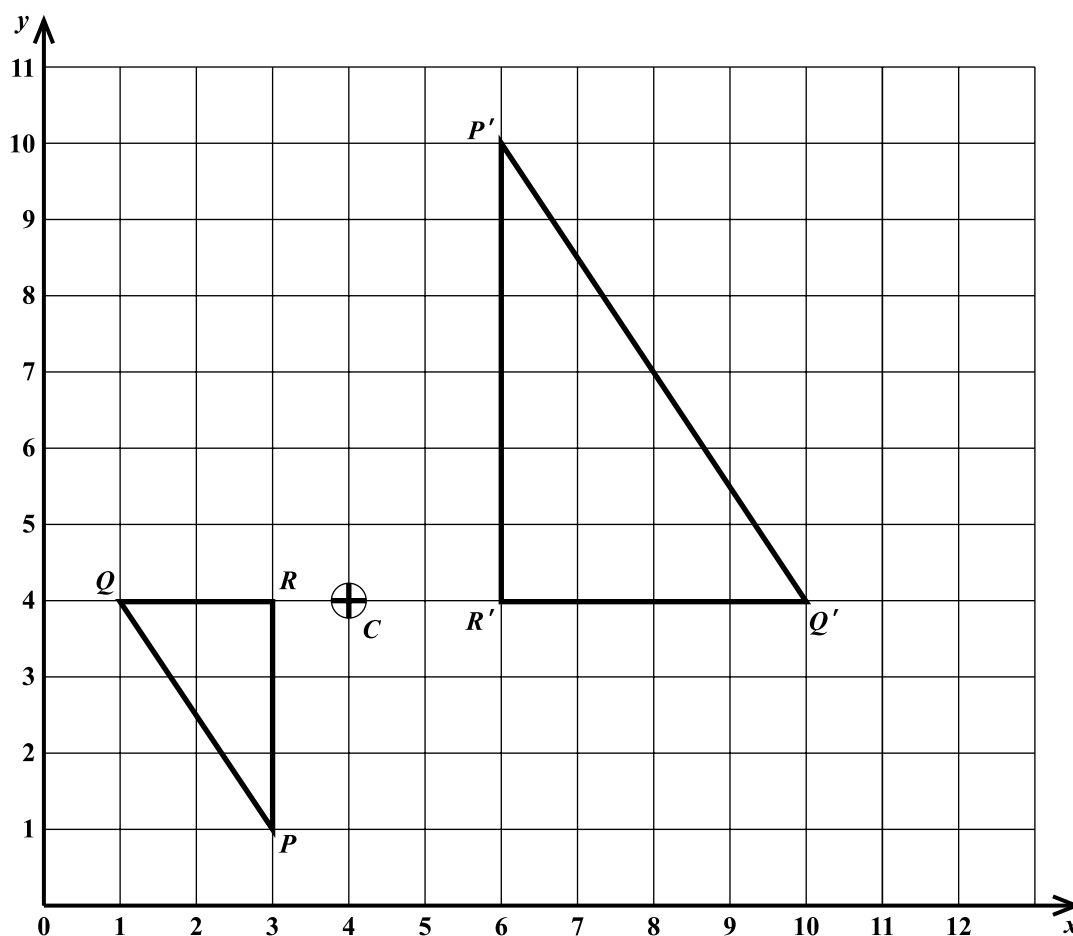


- (iii) Tank A holds 8 times as much water as Tank B. Calculate the height, h , of Tank A.

(2 marks)



- (b) The diagram below shows triangle PQR and its image, triangle $P'Q'R'$, after an enlargement centred at the point C on the diagram.



Use the information from the diagram to complete the statements below.

- (i) The size of the scale factor is (1 mark)
- (ii) The scale factor is negative because

.....

.....

(1 mark)



- (iii) The length of PQ is $\sqrt{13}$ units, therefore,
the length of $P'Q'$ is units.

(1 mark)

- (iv) The area of triangle PQR is square units.

(1 mark)

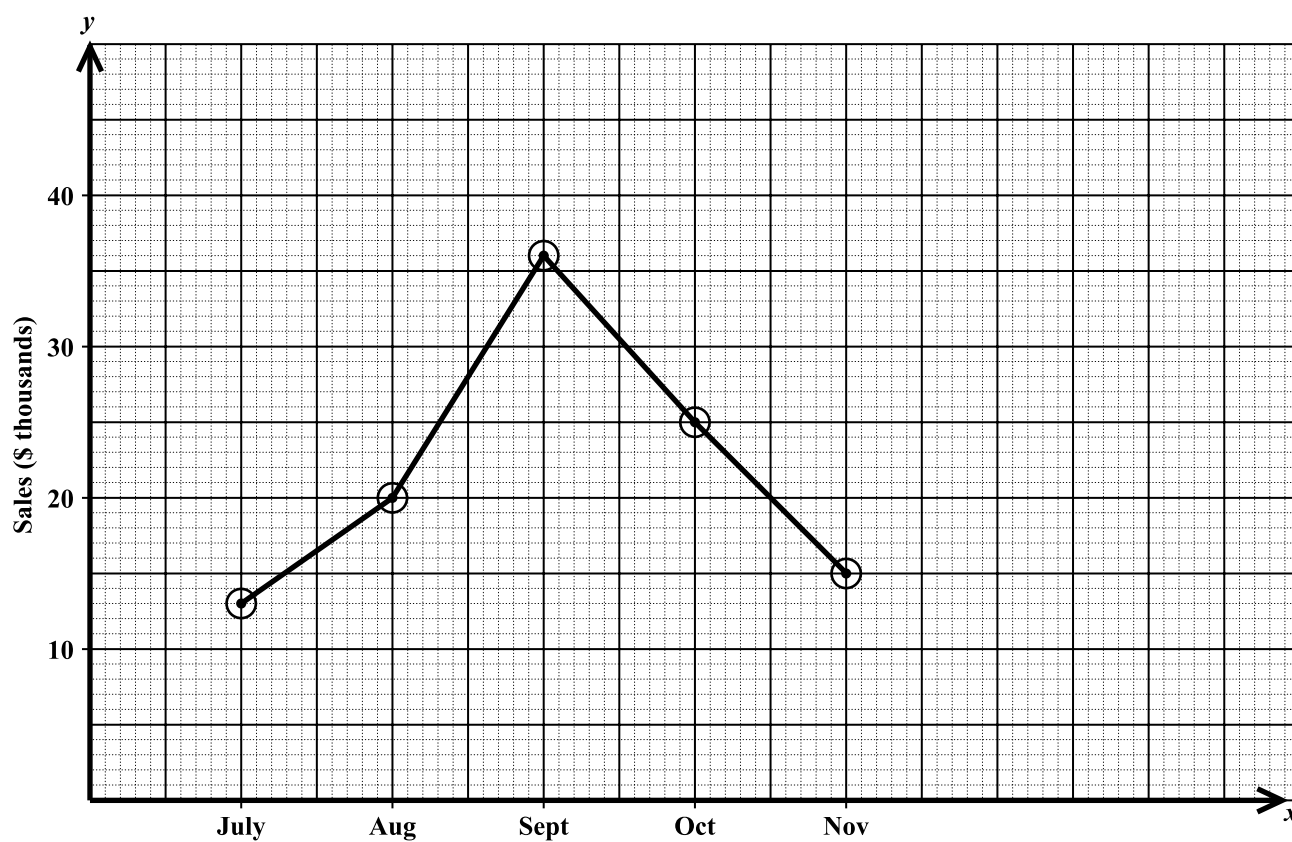
- (v) The area of $P'Q'R'$ is times the area of triangle PQR which is
..... square units.

(2 marks)

Total 11 marks



7. The line graph below shows the monthly sales, in thousands of dollars, at a car dealership for the period July to November 2014.



- (a) Complete the table below to show the sales for EACH month.

Month	July	August	September	October	November
Sales in \$ Thousands	13		36		

(2 marks)



- (b) (i) Between which TWO consecutive months was there the GREATEST increase in sales?

..... and
(1 mark)

- (ii) Between which TWO consecutive months was there the SMALLEST increase in sales?

..... and
(1 mark)

- (iii) What feature of the line graph enables you to infer that the increase in sales between two consecutive months was the greatest or the smallest?

.....
.....
.....
.....
(2 marks)

- (c) Calculate the mean monthly sales for the period July to November 2014.

(2 marks)

- (d) The TOTAL sales for the period July to December was \$130 000.

- (i) Calculate the sales, in dollars, for the month of December.

(1 mark)

- (ii) Complete the line graph to show the sales for December. (2 marks)

Total 11 marks

GO ON TO THE NEXT PAGE



DO NOT WRITE IN THIS AREA

8. A sequence of figures is made up of equilateral triangles, called unit triangles with unit sides. The first three figures in the sequence are shown below.



Figure 1

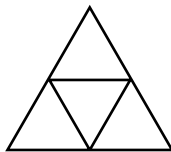


Figure 2

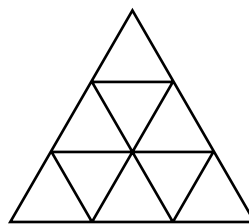


Figure 3

- (a) Draw Figure 4 of the sequence.

(2 marks)



- (b) Study the patterns of numbers in each row of the table below. Each row relates to one of the figures in the sequence of figures. Some rows have not been included in the table.

Complete the rows numbered (i), (ii), (iii) and (iv).

	Figure	Number of Unit Triangles	Number of Unit Sides	
	1	1	$\frac{(3 \times 1)(1 + 1)}{2} = 3$	
	2	4	$\frac{(3 \times 2)(2 + 1)}{2} = 9$	
	3	9	$\frac{(3 \times 3)(3 + 1)}{2} = 18$	
(i)	4			(2 marks)
(ii)		144		(2 marks)
(iii)	25			(2 marks)
(iv)	n			(2 marks)

Total 10 marks

GO ON TO THE NEXT PAGE



Answer TWO questions in this section.

9. (a) A graph sheet is provided for this question.

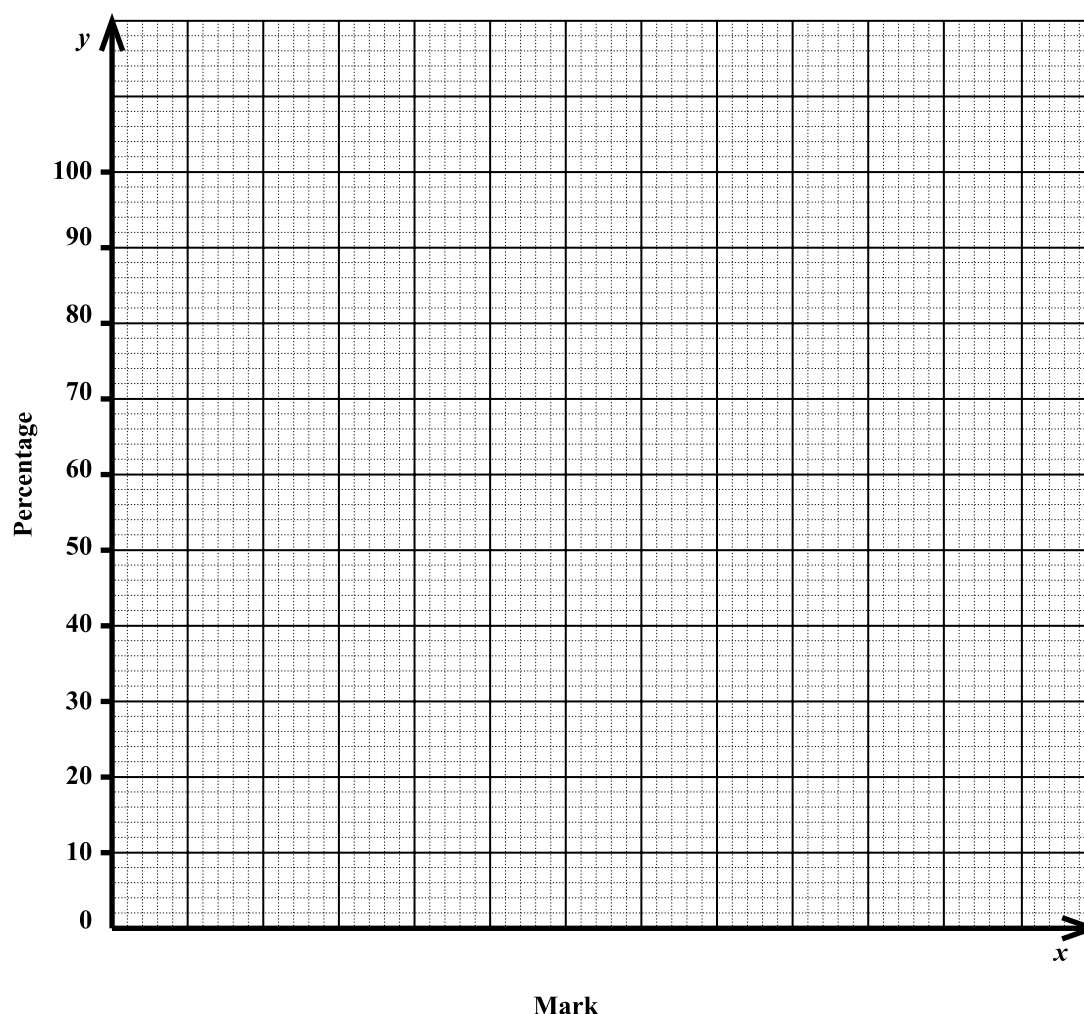
(i) Calculate the percentage for a student who scores

- (2 marks)**

- Draw lines on your graph to show how the percentage was obtained.**

Percentage: (1 mark)

GO ON TO THE NEXT PAGE



- (iv) A candidate is awarded a Grade A if her percentage is 85% or more. Use the graph drawn at (ii) to determine the minimum mark the candidate needs to be awarded a Grade A.

Draw lines on your graph to show how the percentage was obtained.

Minimum mark:
(2 marks)

GO ON TO THE NEXT PAGE



- (b) The functions $f(x)$ and $g(x)$ are defined as

$$f(x) = 3x + 2 \qquad g(x) = \frac{x^2 - 1}{3}.$$

- (i) Evaluate $g(5)$.

(2 marks)

- (ii) Write an expression in terms of x for $f^{-1}(x)$.

(2 marks)

- (iii) Write an expression for $g f(x)$, in the form $(x + a)(x + b)$, where a and $b \in R$.

(4 marks)

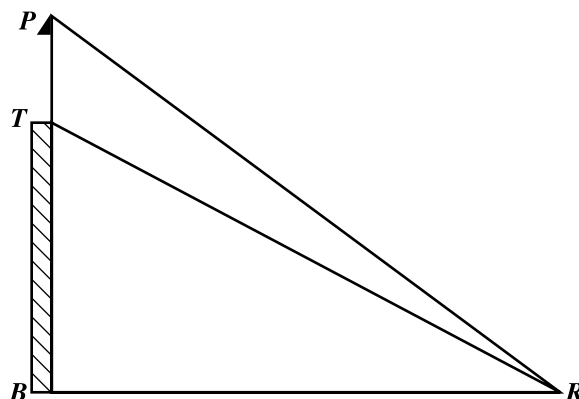
Total 15 marks

GO ON TO THE NEXT PAGE



MEASUREMENT, GEOMETRY AND TRIGONOMETRY

10. (a) The diagram below, **not drawn to scale**, shows a vertical tower, BT , with a flagpole, TP , mounted on it. A point R is on the same horizontal ground as B , such that $RB = 60$ m, and the angles of elevation of T and P from R are 35° and 42° , respectively.



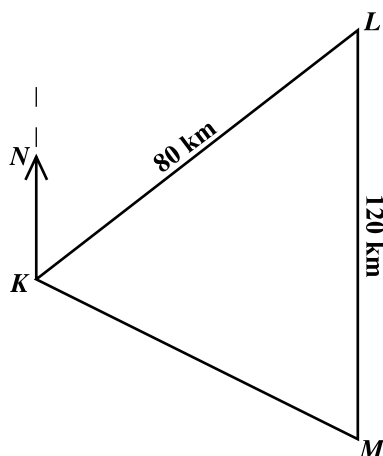
- (i) Label the diagram to show
- the distance 60 m
 - the angles of 35° and 42°
 - any right angle(s).
- (3 marks)
- (ii) Calculate the length of the flagpole, giving your answer to the nearest metre.

(4 marks)

GO ON TO THE NEXT PAGE



- (b) The diagram below, **not drawn to scale**, shows the relative positions of three fishing boats, K , L and M . L is on a bearing of 040° from K and M is due south of L . $LM = 120$ km and $KL = 80$ km.



- (i) On the diagram show the bearing of 040° . (1 mark)
- (ii) Calculate the measure of $\angle KLM$. (1 mark)
- (iii) Calculate the length, to the nearest kilometre, of KM . (3 marks)



- (iv) Calculate the measure of $\angle LKM$ to the nearest degree.

(2 marks)

- (v) Calculate the bearing of M from K .

(1 mark)

Total 15 marks



VECTORS AND MATRICES

11. (a) (i) Calculate the matrix product $\mathbf{AB}$ where $\mathbf{A} = \begin{pmatrix} 1 & 1 \\ 2 & 3 \end{pmatrix}$ and $\mathbf{B} = \begin{pmatrix} 1 & 2 \\ 0 & 1 \end{pmatrix}$.

(2 marks)

- (ii) Show that the matrix product of $\mathbf{A}$ and $\mathbf{B}$ is NOT commutative, that is, $\mathbf{AB} \neq \mathbf{BA}$.

(2 marks)

- (iii) Find $\mathbf{A}^{-1}$, the inverse of $\mathbf{A}$.

(2 marks)



- (iv) Given that $\mathbf{M} = \begin{pmatrix} 2x & 2 \\ 9 & 3 \end{pmatrix}$, calculate the value(s) of x for which $|\mathbf{M}| = 0$.

(2 marks)

- (b) The position vectors of the points R, S and T, relative to an origin, O, are $\begin{pmatrix} -3 \\ 4 \end{pmatrix}$, $\begin{pmatrix} 1 \\ 1 \end{pmatrix}$ and $\begin{pmatrix} 5 \\ -2 \end{pmatrix}$ respectively.

- (i) Calculate the value of $|\overrightarrow{OR}|$.

(2 marks)

- (ii) Express in the form $\begin{pmatrix} x \\ y \end{pmatrix}$, the vectors $\overrightarrow{RS}$ and $\overrightarrow{ST}$.

$$\overrightarrow{RS} =$$

$$\overrightarrow{ST} =$$

(3 marks)

GO ON TO THE NEXT PAGE

- (iii) Using the results of combining the vectors in (b) (ii) **on page 33**, justify that RS is parallel to ST and that RST is a straight line.

(2 marks)

Total 15 marks

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.



0123402036

01234020/F 2015

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

CARIBBEAN EXAMINATIONS COUNCIL

CARIBBEAN SECONDARY EDUCATION CERTIFICATE®
EXAMINATION

05 JANUARY 2016 (a.m.)



J1601234020

FILL IN ALL THE INFORMATION REQUESTED CLEARLY IN CAPITAL LETTERS.

TEST CODE

0	1	2	3	4	0	2	0
---	---	---	---	---	---	---	---

SUBJECT MATHEMATICS – Paper 02

PROFICIENCY GENERAL

REGISTRATION NUMBER

--	--	--	--	--	--	--	--	--	--

SCHOOL/CENTRE NUMBER

--	--	--	--	--	--

NAME OF SCHOOL/CENTRE

CANDIDATE'S FULL NAME (FIRST, MIDDLE, LAST)

DATE OF BIRTH

D	D	M	M	Y	Y	Y	Y
---	---	---	---	---	---	---	---

SIGNATURE



0123402001

**DO NOT
WRITE ON
THIS PAGE**



0123402002



TEST CODE **01234020**

FORM TP 2016017

JANUARY 2016

CARIBBEAN EXAMINATIONS COUNCIL

**CARIBBEAN SECONDARY EDUCATION CERTIFICATE®
EXAMINATION**

MATHEMATICS

Paper 02 – General Proficiency

2 hours 40 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of TWO sections: I and II.
2. Section I has EIGHT questions and Section II has THREE questions.
3. Answer ALL questions in Section I and any TWO questions from Section II.
4. Write your answers in the booklet provided.
5. Do NOT write in the margins.
6. All working MUST be clearly shown.
7. **A list of formulae is provided on page 4 of this booklet.**
8. If you need to rewrite any answer and there is not enough space to do so on the original page, you must use the extra page(s) provided at the back of this booklet. **Remember to draw a line through your original answer.**
9. **If you use the extra page(s) you MUST write the question number clearly in the box provided at the top of the extra page(s) and, where relevant, include the question part beside the answer.**

Required Examination Materials

Electronic calculator
Geometry set

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

Copyright © 2014 Caribbean Examinations Council
All rights reserved.

01234020/JANUARY/F 2016



0123402003

LIST OF FORMULAE

Volume of a prism	$V = Ah$ where A is the area of a cross section and h is the perpendicular length.
Volume of cylinder	$V = \pi r^2 h$ where r is the radius of the base and h is the perpendicular height.
Volume of a right pyramid	$V = \frac{1}{3} Ah$ where A is the area of the base and h is the perpendicular height.
Circumference	$C = 2\pi r$ where r is the radius of the circle.
Arc length	$S = \frac{\theta}{360} \times 2\pi r$ where θ is the angle subtended by the arc, measured in degrees.
Area of a circle	$A = \pi r^2$ where r is the radius of the circle.
Area of a sector	$A = \frac{\theta}{360} \times \pi r^2$ where θ is the angle of the sector, measured in degrees.
Area of trapezium	$A = \frac{1}{2} (a + b) h$ where a and b are the lengths of the parallel sides and h is the perpendicular distance between the parallel sides.
Roots of quadratic equations	If $ax^2 + bx + c = 0$,

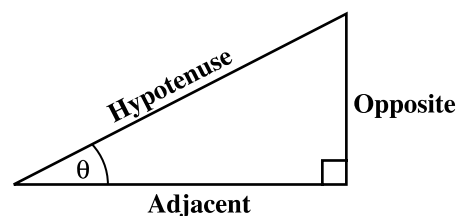
$$\text{then } x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Trigonometric ratios

$$\sin \theta = \frac{\text{opposite side}}{\text{hypotenuse}}$$

$$\cos \theta = \frac{\text{adjacent side}}{\text{hypotenuse}}$$

$$\tan \theta = \frac{\text{opposite side}}{\text{adjacent side}}$$



Area of triangle

Area of $\Delta = \frac{1}{2} bh$ where b is the length of the base and h is the perpendicular height.

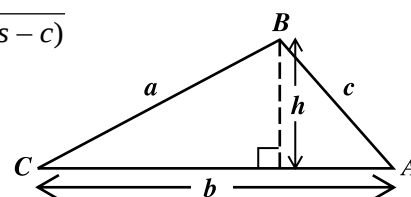
$$\text{Area of } \Delta ABC = \frac{1}{2} ab \sin C$$

$$\text{Area of } \Delta ABC = \sqrt{s(s-a)(s-b)(s-c)}$$

$$\text{where } s = \frac{a+b+c}{2}$$

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

Sine rule



Cosine rule

$$a^2 = b^2 + c^2 - 2bc \cos A$$

GO ON TO THE NEXT PAGE



SECTION I

Answer ALL questions in this section.

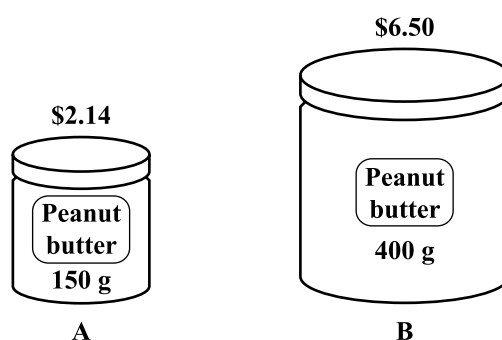
All working must be clearly shown.

1. (a) Using a calculator, or otherwise, calculate the EXACT value of

$$(3.6 + \sqrt{51.84}) \div 3.75$$

(2 marks)

- (b) The diagram below, **not drawn to scale**, shows two jars of peanut butter of the same brand.



Which of the jars shown above is the BETTER buy?
Show ALL working to support your answer.

(3 marks)

GO ON TO THE NEXT PAGE



- (c) Thomas invested \$1498 at 6% simple interest per annum.

Calculate:

- (i) The interest, in dollars, earned after six months

(2 marks)

- (ii) The TOTAL amount of money in his account after 3 years

(2 marks)

- (iii) How long it will be before his investment earns \$449.40

(2 marks)

Total 11 marks

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

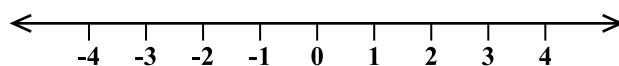


2. (a) (i) Solve for x , where x is a real number.

$$8 - x \leq 5x + 2$$

(3 marks)

- (ii) Show your solution to (a) (i) on the number line below.



(1 mark)

- (b) Expand and simplify

$$2x(x + 5) - 3(x - 4).$$

(2 marks)

GO ON TO THE NEXT PAGE



- (c) Simplify

$$\frac{3x^2 \times 4x^3}{2x}.$$

(2 marks)

- (d) Write as a single fraction, in its lowest terms,

$$\frac{x+1}{2} + \frac{5-x}{5}.$$

(2 marks)

- (e) Factorize completely

$$4x^2 - 4$$

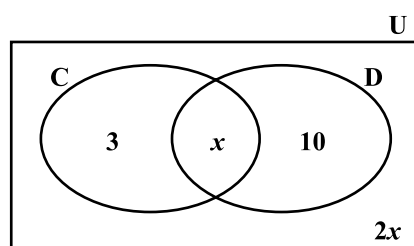
(2 marks)

Total 12 marks

GO ON TO THE NEXT PAGE



3. (a) The Venn diagram below shows the number of students in Form 5A who have visited Canada (C) or Dominica (D).



- (i) How many students have visited Dominica ONLY?

.....
(1 mark)

- (ii) Write an **expression**, in terms of x , to represent the TOTAL number of students who have visited Canada.

.....
(1 mark)

- (iii) Given that there are 25 students in Form 5A, calculate the value of x .

(2 marks)

- (iv) Hence, write down the number of students in each of the following subsets:

- $C \cup D$
- $C \cap D$
- $(C \cup D)'$

(3 marks)

GO ON TO THE NEXT PAGE



- (b) (i) Using **a ruler, a pencil and a pair of compasses**, construct accurately, the **square EFGH** where $EF = 6 \text{ cm}$.

(Show ALL construction lines and curves.)

(4 marks)

- (ii) Measure, and state in centimetres, the length of the diagonal FH.

FH = cm
(1 mark)

Total 12 marks



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

NOTHING HAS BEEN OMITTED.

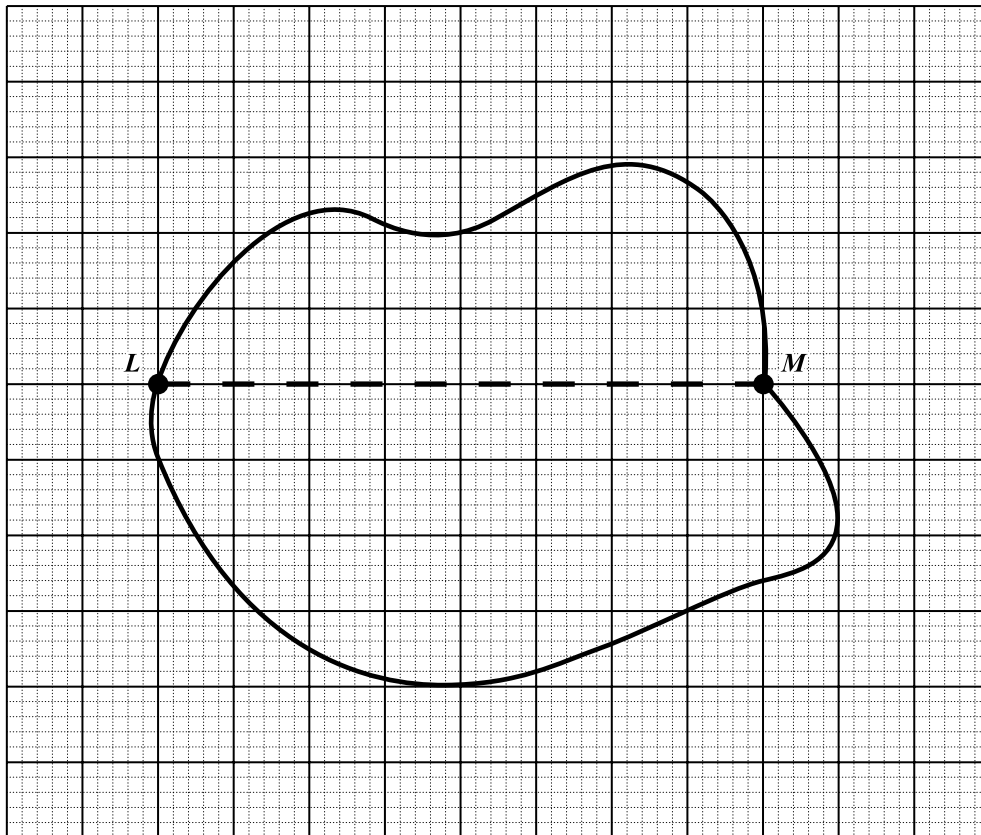
GO ON TO THE NEXT PAGE

01234020/JANUARY/F 2016



0123402011

4. (a) The diagram below shows a map of an island drawn on a grid of 1 cm squares.



- (i) State, in cm, the length of LM as shown in the diagram.

LM = cm
(1 mark)

- (ii) Estimate, by counting squares, the area of the map shown in the diagram.

(1 mark)



- (iii) On the island, the actual distance LM is 20 km. Complete the following statement:

On the map, 1 cm represents km.
(1 mark)

- (iv) Write the scale of the map in the form 1 : x.

(1 mark)

- (v) What distance on the island will be 3 cm on the map?

(1 mark)

- (vi) What area on the island will be represented by 3 cm² on the map?

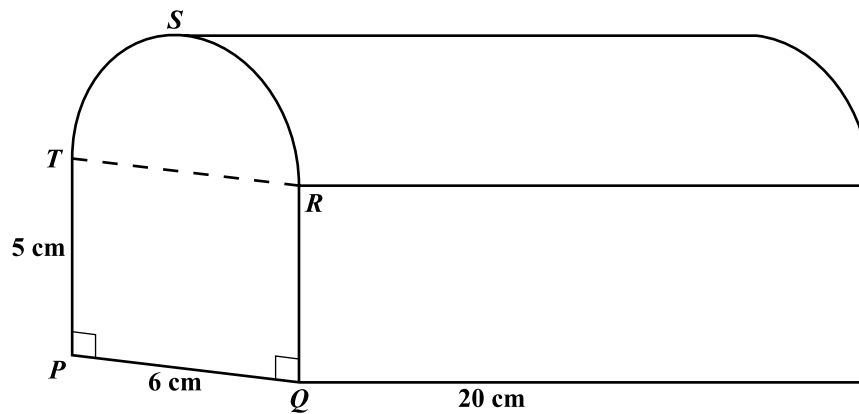
(2 marks)

GO ON TO THE NEXT PAGE



- (b) The diagram below, **not drawn to scale**, shows a prism with cross section PQRTS and length 20 cm. PQRTS is made up of a rectangle PQRT and a semicircle RST such that $PQ = 6$ cm and $QR = 5$ cm.

Use $\pi = 3.14$



- (i) Calculate the area of the cross section PQRTS.

(2 marks)

- (ii) An engineer needs a similar prism whose volume is NOT more than 900 cm^3 . Estimate, in cm, the length of the longest prism he can use.

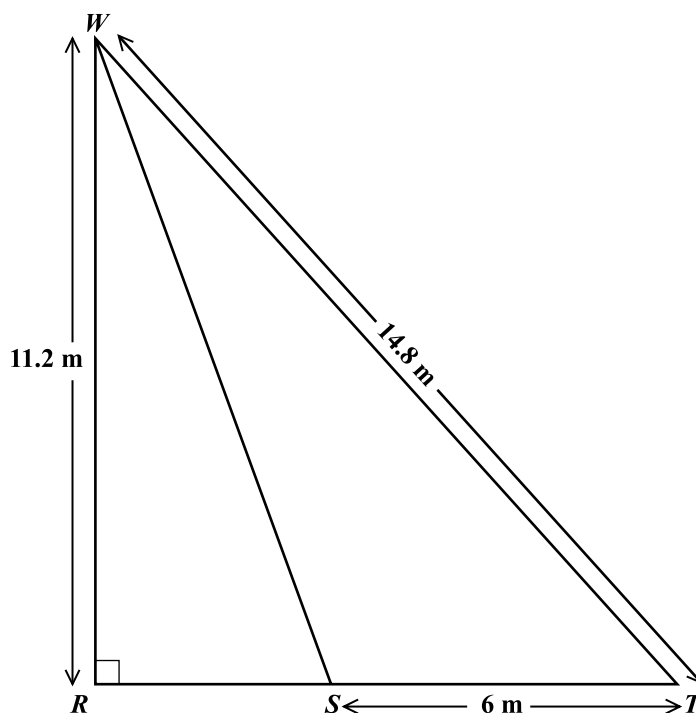
(2 marks)

Total 11 marks

GO ON TO THE NEXT PAGE



5. (a) In the diagram below, **not drawn to scale**, $ST = 6$ m, $WR = 11.2$ m, $WT = 14.8$ m and angle $WRS = 90^\circ$.



Calculate, giving your answer to 1 decimal place

- (i) the length RS

(2 marks)

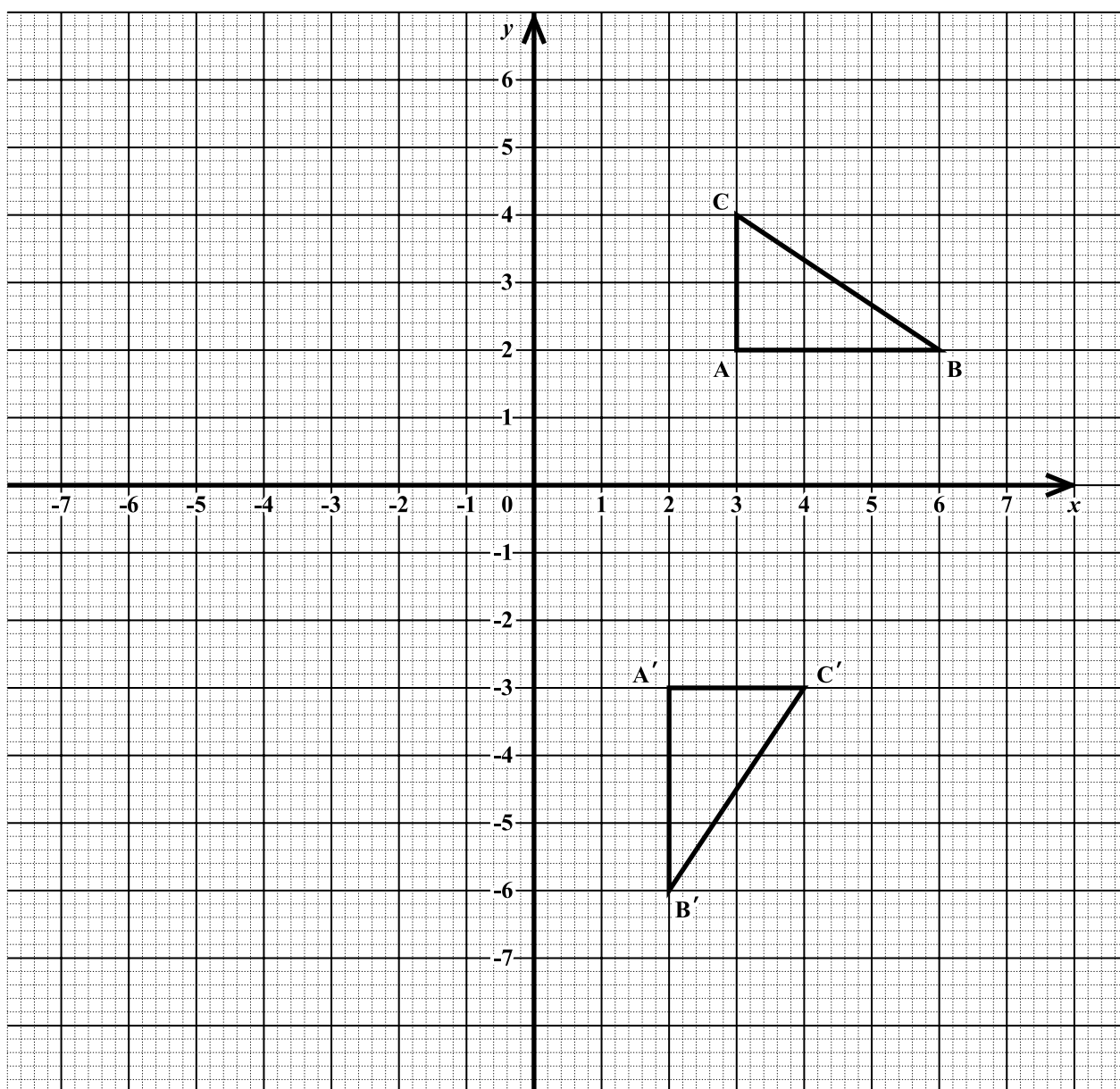
- (ii) the measure of angle RTW .

(2 marks)

GO ON TO THE NEXT PAGE



- (b) The graph below shows a triangle ABC and its image $A'B'C'$ after undergoing a single transformation.



GO ON TO THE NEXT PAGE



- (i) Write down the coordinates of the vertices of $\triangle ABC$.

(1 mark)

- (ii) Write down the coordinates of the vertices of $\triangle A'B'C'$.

(1 mark)

- (iii) Describe FULLY the transformation that maps triangle ABC onto triangle $A'B'C'$.

.....

.....

.....

(2 marks)

- (iv) On the graph on page 16, draw the line $x = 1$ AND the triangle $A''B''C''$, the image of triangle ABC after a reflection in the line $x = 1$. **(3 marks)**

- (v) State ONE geometrical relationship among $\triangle ABC$, $\triangle A'B'C'$ and $\triangle A''B''C''$

.....

.....

.....

(1 mark)

Total 12 marks

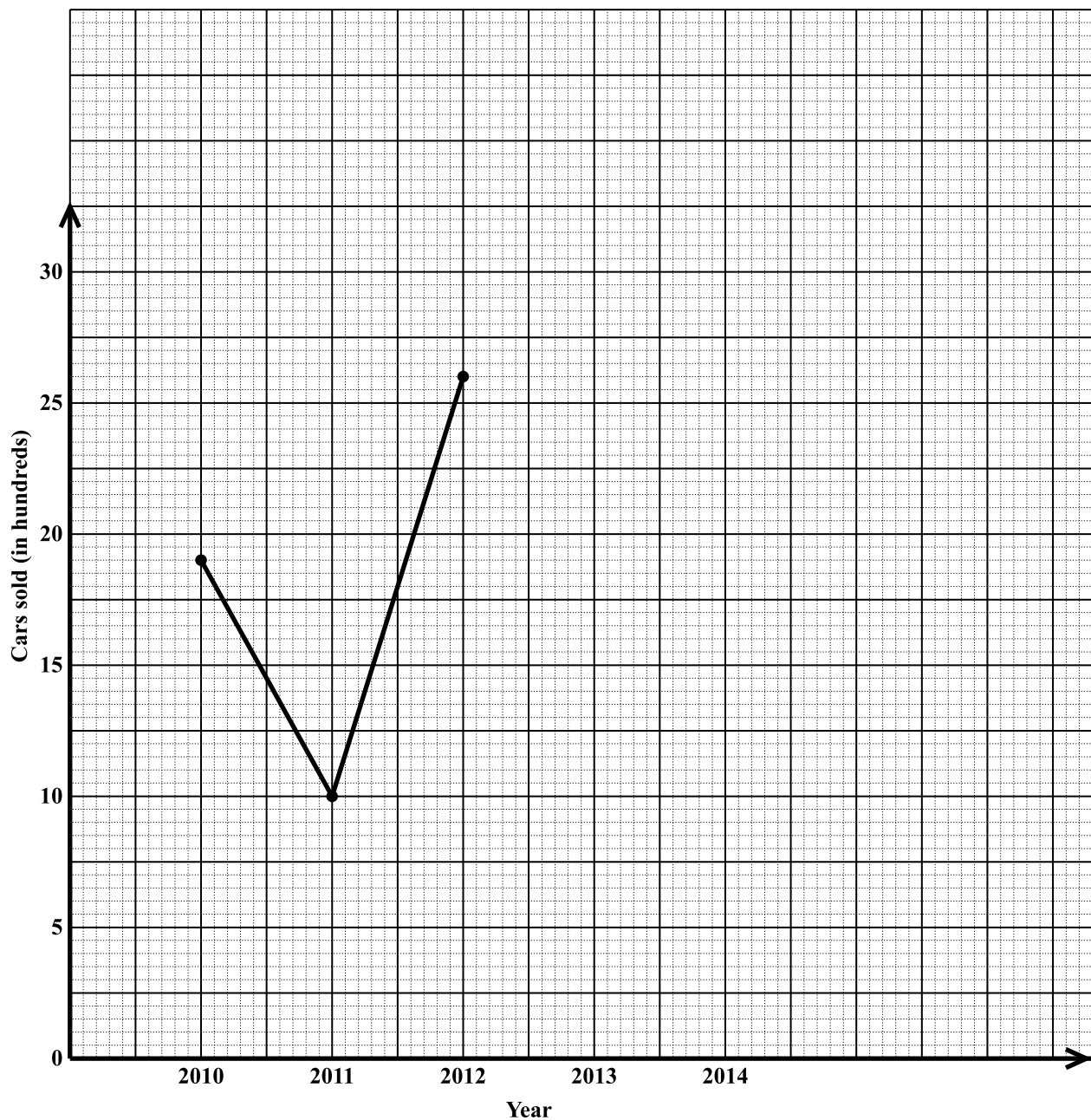
GO ON TO THE NEXT PAGE



DO NOT WRITE IN THIS AREA

6. (a) The table below gives the number of cars sold in a country, in hundreds, from 2010 to 2014.

Year	2010	2011	2012	2013	2014
Cars sold (in hundreds)	19	10	26	16	30



GO ON TO THE NEXT PAGE



- (i) Complete the line graph on page 18 to represent the given information.
(1 mark)

- (ii) Between which two consecutive years was there the GREATEST increase in cars sold?

.....
(1 mark)

- (iii) What was the TOTAL number of cars sold in the five year period 2010 to 2014?

(2 marks)

- (iv) The mean number of cars sold from **2010** to **2015** was 22.5 hundred. How many cars were sold in 2015?

(2 marks)

GO ON TO THE NEXT PAGE



- (b) (i) A line JK has equation $2y = 5x + 6$. Determine the gradient of JK.

Gradient of the line JK is
(2 marks)

Another line GH, is perpendicular to JK and passes through the point (5, -1).

- (ii) State the gradient of the line GH.

Gradient of the line GH is
(1 mark)

- (iii) Determine the equation of line GH.

Equation of the line GH is
(2 marks)

Total 11 marks



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

NOTHING HAS BEEN OMITTED.

GO ON TO THE NEXT PAGE

01234020/JANUARY/F 2016



0123402021

7. The table below shows how the minutes taken by all students to complete a science experiment were recorded and grouped.

Time (minutes)	Number of Students who Completed (Frequency)	Cumulative Frequency
1–5	1	1
6–10	2	3
11–15	5	
16–20	7	
21–25	10	
26–30	15	
31–35	8	
36–40	2	

- (a) Complete the cumulative frequency column in the table. **(2 marks)**
- (b) On the grid on page 23, using a scale of **2 cm to represent 5 minutes on the x-axis** and **2 cm to represent 5 students on the y-axis**, draw a cumulative frequency curve to represent the information in the table. **(5 marks)**

Using the graph, estimate

- (c) (i) the median time taken to complete the experiment **(2 marks)**
- (ii) the probability that a student, chosen at random, took **30 minutes or less** to complete the experiment. **(2 marks)**

Show on your graph, using broken lines, how these estimates were obtained.

Total 11 marks

GO ON TO THE NEXT PAGE



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

01234020/JANUARY/F 2016



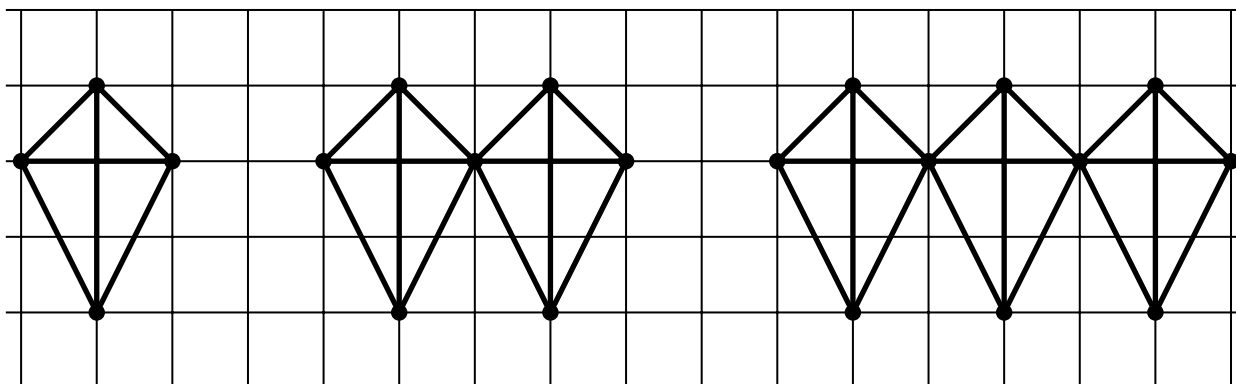
0123402023

8. The diagram below shows the first three figures in a sequence of figures.

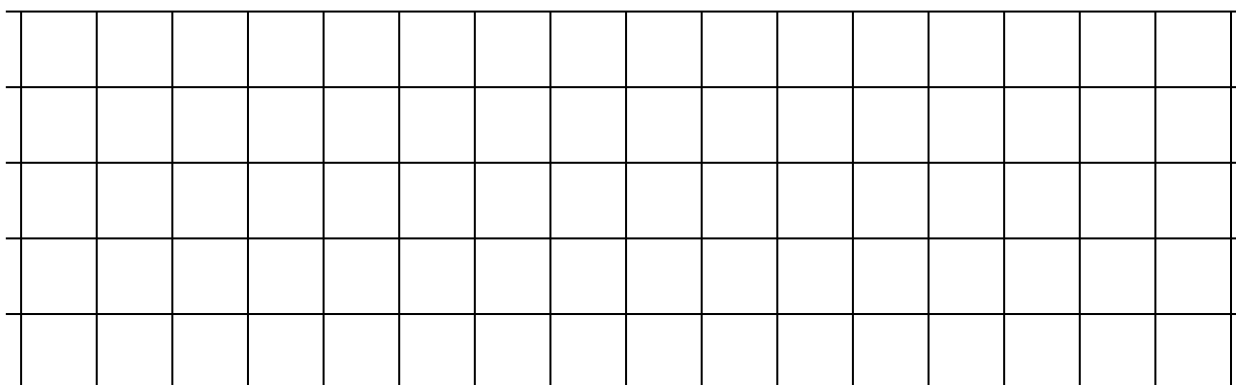
Figure 1

Figure 2

Figure 3



- (a) Draw the fourth figure in the sequence.



(2 marks)



- (b) The table below shows the number of dots and lines in each figure. Study the pattern in the table and complete the table by inserting the missing values in the rows numbered (i), (ii), (iii) and (iv).

	Figure	Number of Dots	Number of Lines	
	1	4	6	
	2	7	11	
	3	10	16	
(i)	4	.....	.....	(2 marks)
		Entries omitted for Figures 5–9		
(ii)	10	.....	.....	(2 marks)
		Entries omitted for some Figures		
(iii)	.....	49	.....	(2 marks)
		Entries omitted for some Figures		
(iv)	N	.....	.....	(2 marks)

Total 10 marks

GO ON TO THE NEXT PAGE



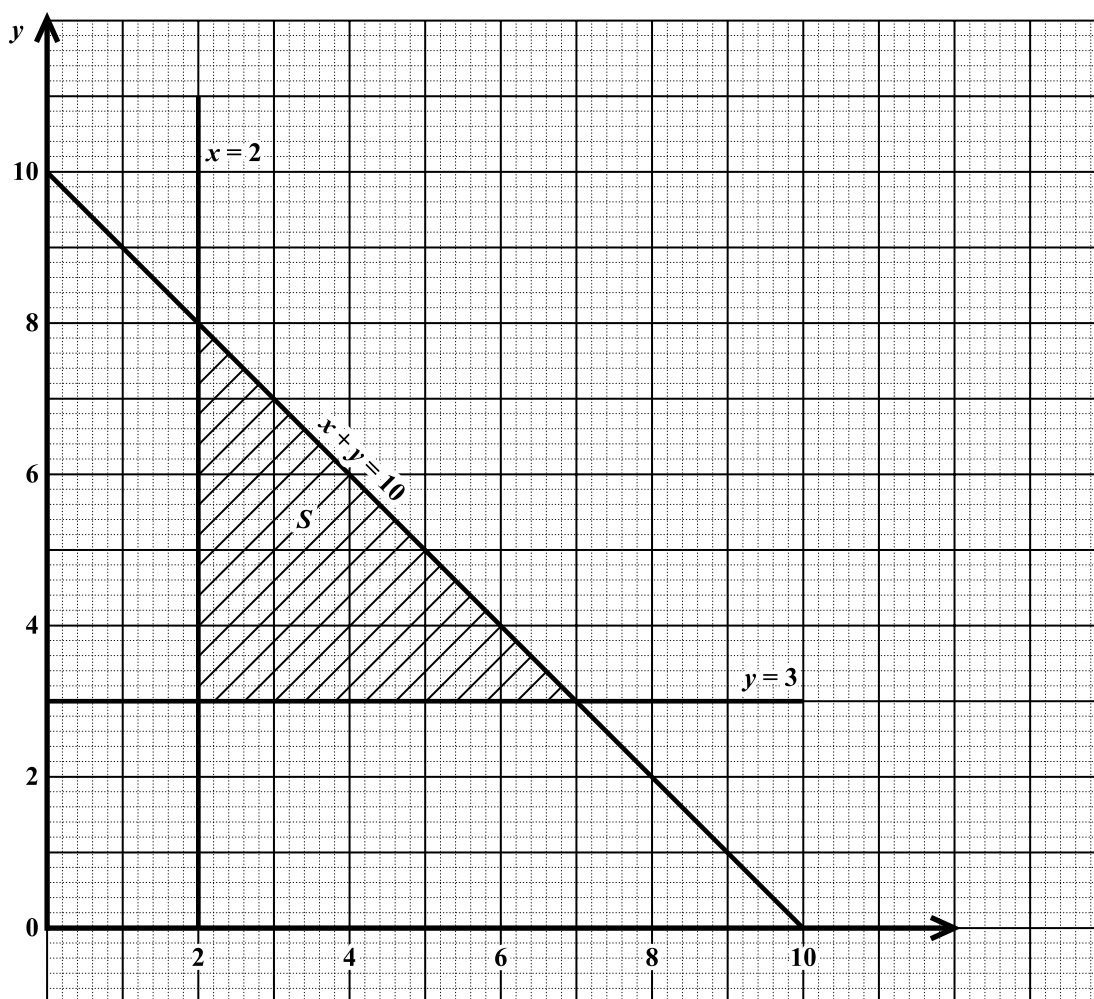
SECTION II

Answer TWO questions in this section.

ALGEBRA AND RELATIONS, FUNCTIONS AND GRAPHS

9. (a) The diagram below shows the graph of three lines and a shaded region, S, defined by three inequalities associated with these lines.

The inequality associated with the line $y = 3$ is $y \geq 3$.



- (i) State the other TWO inequalities which define the shaded region.

.....
(2 marks)

GO ON TO THE NEXT PAGE



The function $P = 5x + 2y - 3$ satisfies the solution set represented by the closed triangular region.

- (ii) Identify the three pairs of (x, y) values for which P has a maximum or a minimum value.

.....

.....

.....

(2 marks)

- (iii) Which pair of (x, y) values makes P a **maximum**?

Justify your answer.

P is a maximum at

(3 marks)

GO ON TO THE NEXT PAGE



DO NOT WRITE IN THIS AREA

- (b) The function $f(x)$ and $g(x)$ are defined as follows

$$f(x) = \frac{3}{2x+1} \text{ and } g(x) = x^2$$

- (i) Evaluate EACH of the following:

$$\bullet \quad g\left(\frac{-1}{2}\right)$$

$$\bullet \quad fg\left(\frac{-1}{2}\right)$$

(4 marks)

- (ii) Write an expression in x for $f^{-1}(x)$.

(4 marks)

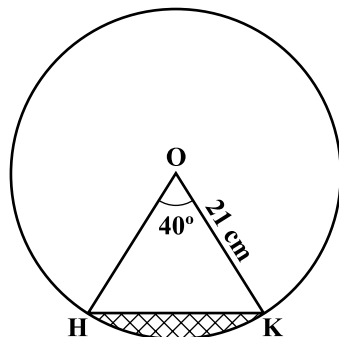
Total 15 marks

GO ON TO THE NEXT PAGE



MEASUREMENT, GEOMETRY AND TRIGONOMETRY

10. (a) The figure below, **not drawn to scale**, shows a circle with centre O. The radius of the circle is 21 cm and angle HOK = 40° .



Use $\pi = \frac{22}{7}$

Determine

- (i) the area of the minor sector HOK

(2 marks)

- (ii) the area of triangle HOK

(3 marks)

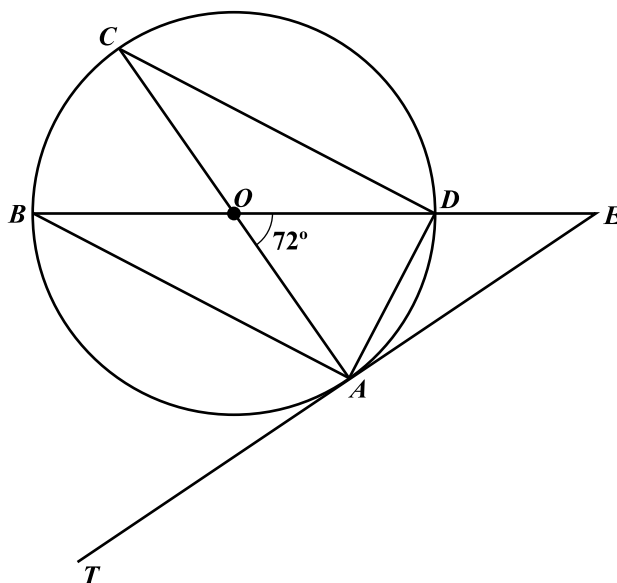
- (iii) the area of the shaded segment.

(2 marks)

GO ON TO THE NEXT PAGE



- (b) The diagram below, **not drawn to scale**, shows a circle with centre O . TAE is a tangent to the circle at point A and angle $AOD = 72^\circ$.



Calculate, **giving the reason for each step of your answer**, the measure of:

(i) $\angle ADC = \dots\dots\dots$

(2 marks)

(ii) $\angle ACD = \dots\dots\dots$

(2 marks)

(iii) $\angle CAD = \dots\dots\dots$

(2 marks)

(iv) $\angle OEA = \dots\dots\dots$

(2 marks)

Total 15 marks

GO ON TO THE NEXT PAGE



VECTORS AND MATRICES

11. (a) The points A, B and C have coordinates A (−2, 8), B (4, 2) and C (0, 9). M is the midpoint of the line segment AB.

(i) Express EACH of the following in the form $\begin{pmatrix} x \\ y \end{pmatrix}$:

• $\vec{OB} = \dots\dots\dots$

• $\vec{AB} = \dots\dots\dots$

• $\vec{OM} = \dots\dots\dots$

(5 marks)

- (ii) Using a vector method, show that $\vec{AC}$ and $\vec{OB}$ are parallel.

(2 marks)

GO ON TO THE NEXT PAGE



- (b) The matrix M is defined as $M = \begin{pmatrix} 2p & -3 \\ 4 & 1 \end{pmatrix}$.

Determine the value of p for which the matrix M is singular.

(2 marks)

- (c) A and B are two 2×2 matrices such that $A = \begin{pmatrix} 1 & 2 \\ -4 & 3 \end{pmatrix}$ and $B = \begin{pmatrix} 5 & -1 \\ 0 & 3 \end{pmatrix}$.

- (i) Calculate $2A + B$.

(2 marks)

- (ii) Determine B^{-1} , the inverse of B .

(2 marks)

GO ON TO THE NEXT PAGE



(iii) Given that $\begin{pmatrix} 5 & -1 \\ 0 & 3 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 9 \\ 3 \end{pmatrix}$, calculate the values of x and y .

(2 marks)

Total 15 marks

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.



0123402033

01234020/JANUARY/F 2016

FORM TP 2016089



TEST CODE **01234020**

MAY/JUNE 2016

CARIBBEAN EXAMINATIONS COUNCIL

**CARIBBEAN SECONDARY EDUCATION CERTIFICATE®
EXAMINATION**

MATHEMATICS

Paper 02 – General Proficiency

2 hours 40 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of TWO sections: I and II.
2. Section I has EIGHT questions and Section II has THREE questions.
3. Answer ALL questions in Section I, and any TWO questions from Section II.
4. Write your answers in the booklet provided.
5. Do NOT write in the margins.
6. All working MUST be shown clearly.
7. **A list of formulae is provided on page 4 of this booklet.**
8. If you need to rewrite any answer and there is not enough space to do so on the original page, you must use the extra page(s) provided at the back of this booklet. **Remember to draw a line through your original answer.**
9. **If you use the extra page(s) you MUST write the question number clearly in the box provided at the top of the extra page(s) and, where relevant, include the question part beside the answer.**

Required Examination Materials

Electronic calculator
Geometry set

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

Copyright © 2014 Caribbean Examinations Council
All rights reserved.

01234020/F 2016

“*”Barcode Area”*”
Sequential Bar Code

LIST OF FORMULAE

Volume of a prism	$V = Ah$ where A is the area of a cross-section and h is the perpendicular length.
Volume of cylinder	$V = \pi r^2 h$ where r is the radius of the base and h is the perpendicular height.
Volume of a right pyramid	$V = \frac{1}{3} Ah$ where A is the area of the base and h is the perpendicular height.
Circumference	$C = 2\pi r$ where r is the radius of the circle.
Arc length	$S = \frac{\theta}{360} \times 2\pi r$ where θ is the angle subtended by the arc, measured in degrees.
Area of a circle	$A = \pi r^2$ where r is the radius of the circle.
Area of a sector	$A = \frac{\theta}{360} \times \pi r^2$ where θ is the angle of the sector, measured in degrees.
Area of trapezium	$A = \frac{1}{2} (a + b) h$ where a and b are the lengths of the parallel sides and h is the perpendicular distance between the parallel sides.
Roots of quadratic equations	If $ax^2 + bx + c = 0$,

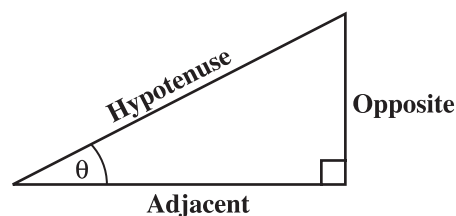
$$\text{then } x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Trigonometric ratios

$$\sin \theta = \frac{\text{opposite side}}{\text{hypotenuse}}$$

$$\cos \theta = \frac{\text{adjacent side}}{\text{hypotenuse}}$$

$$\tan \theta = \frac{\text{opposite side}}{\text{adjacent side}}$$



Area of triangle

Area of $\Delta = \frac{1}{2} bh$ where b is the length of the base and h is the perpendicular height.

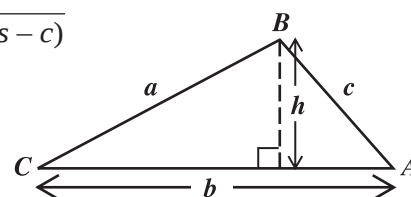
$$\text{Area of } \Delta ABC = \frac{1}{2} ab \sin C$$

$$\text{Area of } \Delta ABC = \sqrt{s(s-a)(s-b)(s-c)}$$

$$\text{where } s = \frac{a+b+c}{2}$$

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

Sine rule



Cosine rule

$$a^2 = b^2 + c^2 - 2bc \cos A$$

GO ON TO THE NEXT PAGE

SECTION I

Answer ALL questions in this section.

All working must be clearly shown.

1. (a) Using a calculator, or otherwise, calculate

(i) $\frac{3\frac{3}{8} - 2\frac{1}{4}}{1\frac{1}{2}}$ giving your answer as a fraction in its lowest terms.

(2 marks)

- (ii) $(2.86 + 0.75) + 0.481^2$ giving your answer correct to 2 decimal places.

(2 marks)

GO ON TO THE NEXT PAGE

- (b) Paul bought and sold a computer. He wrote his business activity as follows:

Cost price of computer = \$1064

Marked price of computer = \$1399

Discount on marked price = 5%
(if paid by cash)

Calculate

- (i) the selling price (paid cash)

(2 marks)

- (ii) the profit or loss as a percentage of the cost price.

(2 marks)

GO ON TO THE NEXT PAGE

- (c) Orange juice is sold in cartons of three different sizes.

Carton Size	Selling Price
350 ml	\$4.20
450 ml	\$5.35
500 ml	\$5.80

Which size of orange juice is the most cost-effective buy? **Justify your answer.**

(3 marks)

Total 11 marks

GO ON TO THE NEXT PAGE

2. (a) Factorize completely:

(i) $4a^2 - 16$

(2 marks)

(ii) $3y^2 + 2y - 8$

(2 marks)

(b) Solve the simultaneous equations:

$$\begin{aligned} 2x + y &= 3 \\ 5x - 2y &= 12 \end{aligned}$$

(5 marks)

GO ON TO THE NEXT PAGE

- (c) The table below shows corresponding values of the variables x and y , where y varies directly as x .

x	6	10	t
y	3	u	9

Calculate the values of t and u .

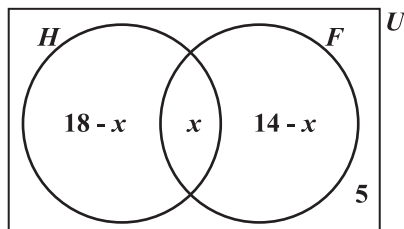
(3 marks)

Total 12 marks

GO ON TO THE NEXT PAGE

3. (a) The Venn diagram below shows the number of students who study History and French in a class of 30 students.

$U = \{\text{students in the class}\}$
 $H = \{\text{students who study History}\}$
 $F = \{\text{students who study French}\}$



- (i) Write an expression, in x , in its simplest form, for the TOTAL number of students in the class.

.....
(2 marks)

- (ii) State whether the following relationships are true or false:

- $H \cup F = U$
 - $H \cap F' = \emptyset$
- (2 marks)**

- (iii) Determine the number of students who study BOTH History and French.

(2 marks)

GO ON TO THE NEXT PAGE

- (b) (i) Using **a ruler, a pencil and a pair of compasses**, construct triangle PQR with $PQ = 5$ cm, $\angle PQR = 60^\circ$ and $\angle QPR = 90^\circ$.

(4 marks)

- (ii) Measure and state

- the length of PR

$PR =$

- the measure of $\angle PRQ$.

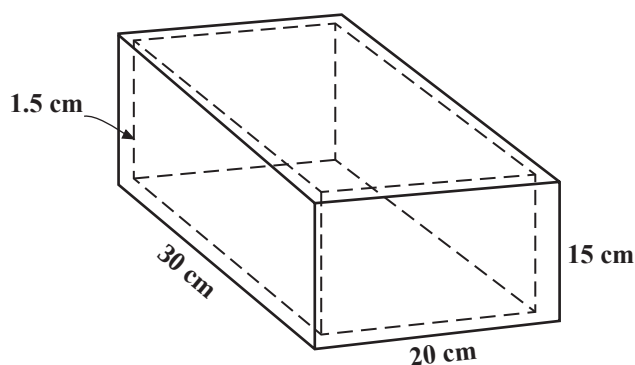
$\angle PRQ =$

(2 marks)

Total 12 marks

GO ON TO THE NEXT PAGE

4. The diagram below, **not drawn to scale**, shows a silver box with no lid. The sides and bottom of the box are 1.5 cm thick.



- (a) Calculate the volume of the box using the external measurements.

(2 marks)

- (b) Complete EACH of the following statements.

- (i) The internal length of the box is $30 \text{ cm} - 2 \times 1.5 \text{ cm} = \dots\dots\dots$ (1 mark)
- (ii) The internal width of the box is $\dots\dots\dots$ (2 marks)
- (iii) The internal depth of the box is $\dots\dots\dots$ (1 mark)

GO ON TO THE NEXT PAGE

- (c) Calculate the internal volume of the box.

(2 marks)

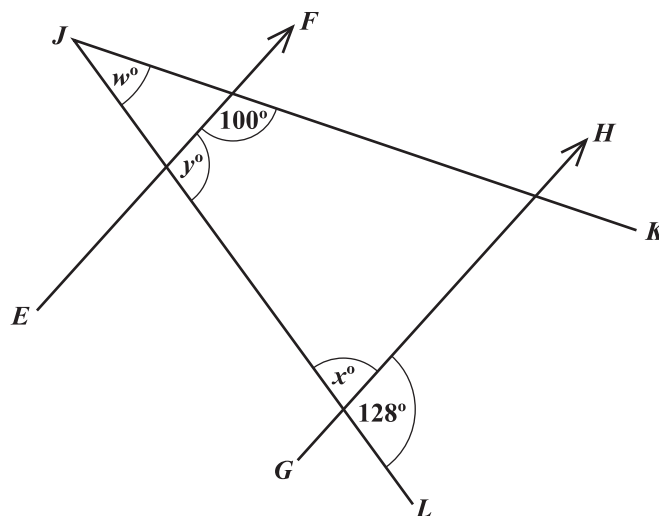
- (d) The box is made of silver which has a mass of 10.5 g for each cm^3 . Calculate the mass of the silver box, giving your answer in kg.

(3 marks)

Total 11 marks

GO ON TO THE NEXT PAGE

5. (a) The diagram below, **not drawn to scale**, shows two straight lines, JK and JL , intersecting a pair of parallel lines, EF and GH .



Determine, giving reasons for EACH of your answers, the value of

- (i) x

..... (2 marks)

- (ii) y

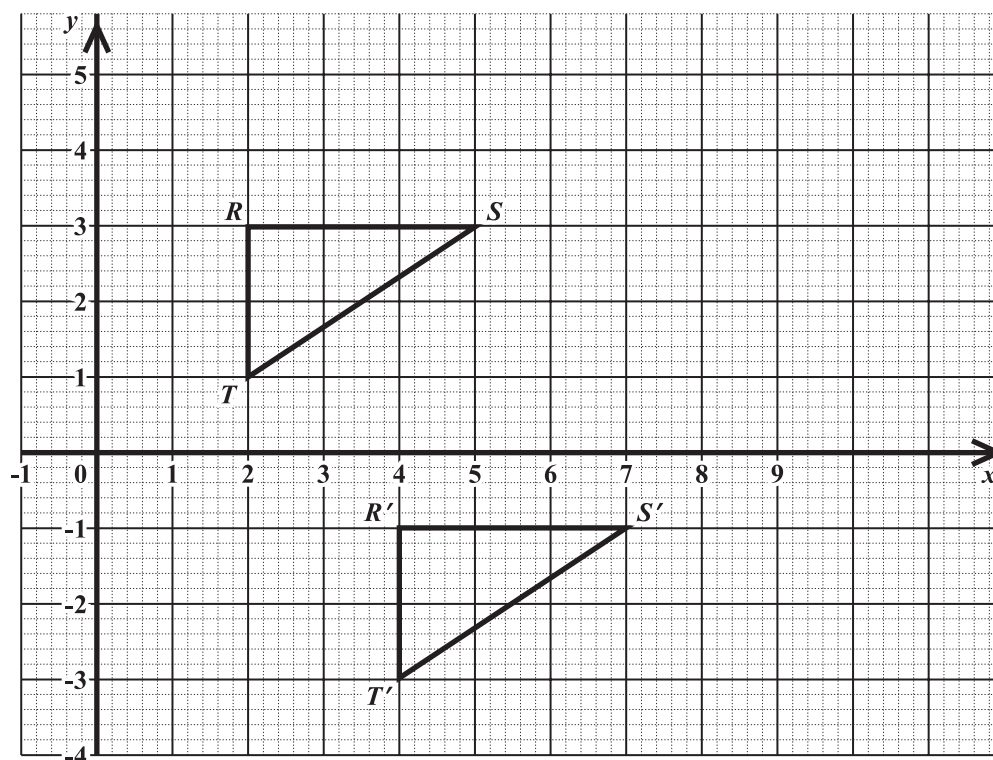
..... (2 marks)

- (iii) w .

..... (2 marks)

GO ON TO THE NEXT PAGE

- (b) The diagram below shows triangle RST and its image $R'S'T'$ after a transformation.



- (i) Describe FULLY the transformation which maps RST onto $R'S'T'$.

.....

(3 marks)

- (ii) Triangle RST is reflected in the line $x = 6$. On the graph above, draw triangle $R''S''T''$, the image of $\triangle RST$, after the reflection.

Write down the coordinates of R'' .

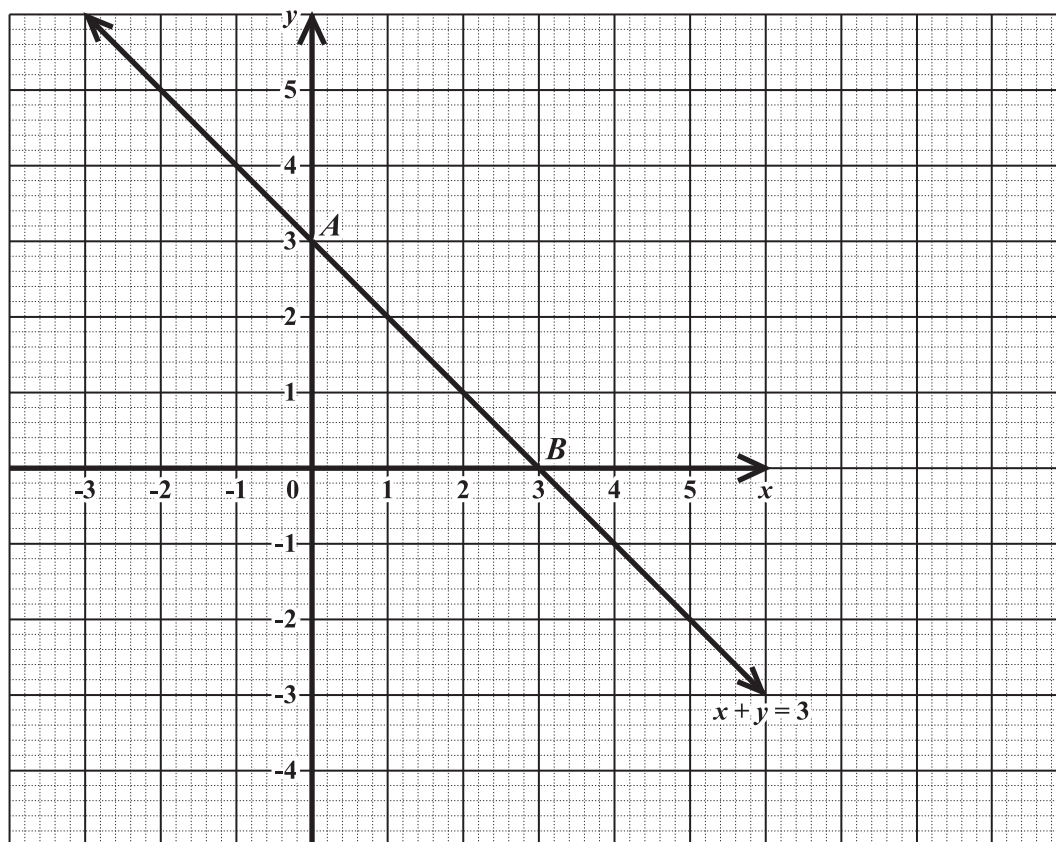
$R'' =$

(3 marks)

Total 12 marks

GO ON TO THE NEXT PAGE

6. (a) The diagram below shows the graph of the straight line $x + y = 3$.



Determine the equation of the line which is

- (i) parallel to the line $x + y = 3$ and passes through the origin

(2 marks)

- (ii) perpendicular to the line $x + y = 3$ and passes through the midpoint of AB.

(2 marks)

GO ON TO THE NEXT PAGE

- (b) The function $y = x^2 - 2x - 3$ is defined in the domain $-2 \leq x \leq 4$. The table below shows the corresponding values of y for five selected values of x .

x	-2	-1	0	1	2	3	4
y	5	0	-3		-3		5

- (i) Complete the table by calculating and inserting the missing values of y .

(2 marks)

- (ii) On the same axes used in Part (a) on page 16, draw the graph of $y = x^2 - 2x - 3$.

(2 marks)

- (iii) Using information from your graph, complete EACH of the following statements.

- The minimum value of $y = x^2 - 2x - 3$ occurs when $x = \dots\dots\dots$
(1 mark)

- The values of x for which $x^2 - 2x - 3 = -x + 3$ are $x = \dots\dots\dots$
and $x = \dots\dots\dots$
(2 marks)

Total 11 marks

GO ON TO THE NEXT PAGE

7. Twenty bags of sugar were weighed. The weights, to the nearest kg, are as follows:

3	38	17	33	28
12	43	38	31	30
11	8	23	18	26
50	22	35	39	5

- (a) Complete the frequency table for the data shown above.

Weight (kg)	Tally	Number of Bags
1–10		
11–20		
21–30		
31–40		
41–50		

(4 marks)

- (b) For the class interval 21–30, state:

- (i) the upper class boundary

.....
(1 mark)

- (ii) the class width

.....
(1 mark)

- (iii) the class midpoint

.....
(1 mark)

- (c) On the grid on page 19, using a scale of **2 cm to represent 10 kg on the x-axis**, and **1 cm to represent 1 bag on the y-axis**, draw a histogram to represent the data contained in your frequency table above.
(4 marks)

Total 11 marks

GO ON TO THE NEXT PAGE

01234020/F 2016

“*”Barcode Area”*”
Sequential Bar Code

8. The diagram below shows the first three figures in a sequence. Each figure is made up of knots and strings. Each knot connects exactly 3 strings.



Figure 1

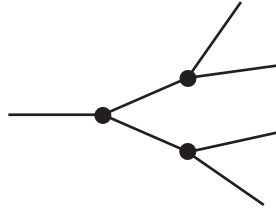


Figure 2

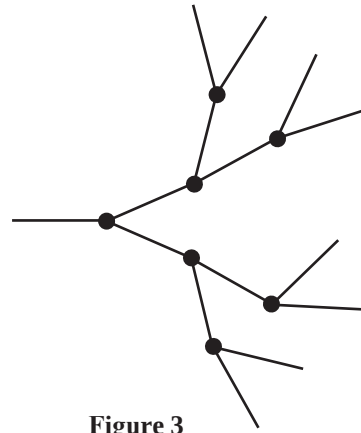


Figure 3

- (a) Draw Figure 4 of the sequence.

(2 marks)

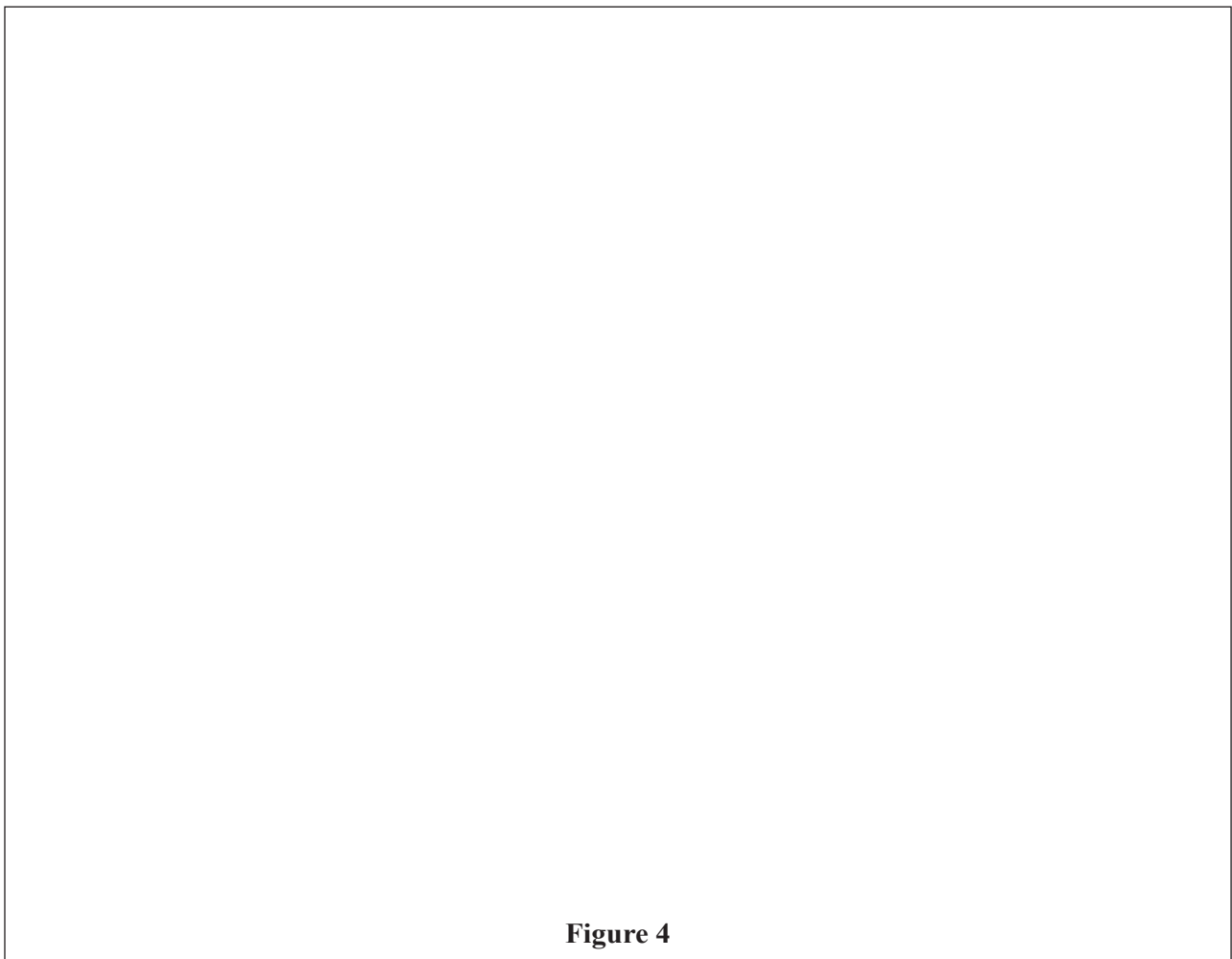


Figure 4

GO ON TO THE NEXT PAGE

- (b) The table below shows the number of knots and strings in each figure used to draw Figures 1, 2 and 3. Complete the table by inserting the missing values in the rows numbered (i), (ii) and (iii).

	Figure Number (N)	Number of Knots (K)	Number of Strings (S)	
	1	1	3	
	2	3	7	
	3	7	15	
(i)	4	.....	.....	(2 marks)
(ii)	.....	.....	255	(3 marks)
(iii)	10	.....	.....	(3 marks)

Total 10 marks

GO ON TO THE NEXT PAGE

SECTION II

Answer TWO questions in this section.

ALGEBRA AND RELATIONS, FUNCTIONS AND GRAPHS

9. (a) The functions $f(x)$ and $g(x)$ are defined as $f(x) = 2x - 7$ and $g(x) = x^2 + 1$, respectively.

(i) Write an expression, in terms of x , for EACH of the following:

- $f^{-1}(x)$

- $g^{-1}(x)$

- $fg(x)$

GO ON TO THE NEXT PAGE

- $(fg)^{-1}x$

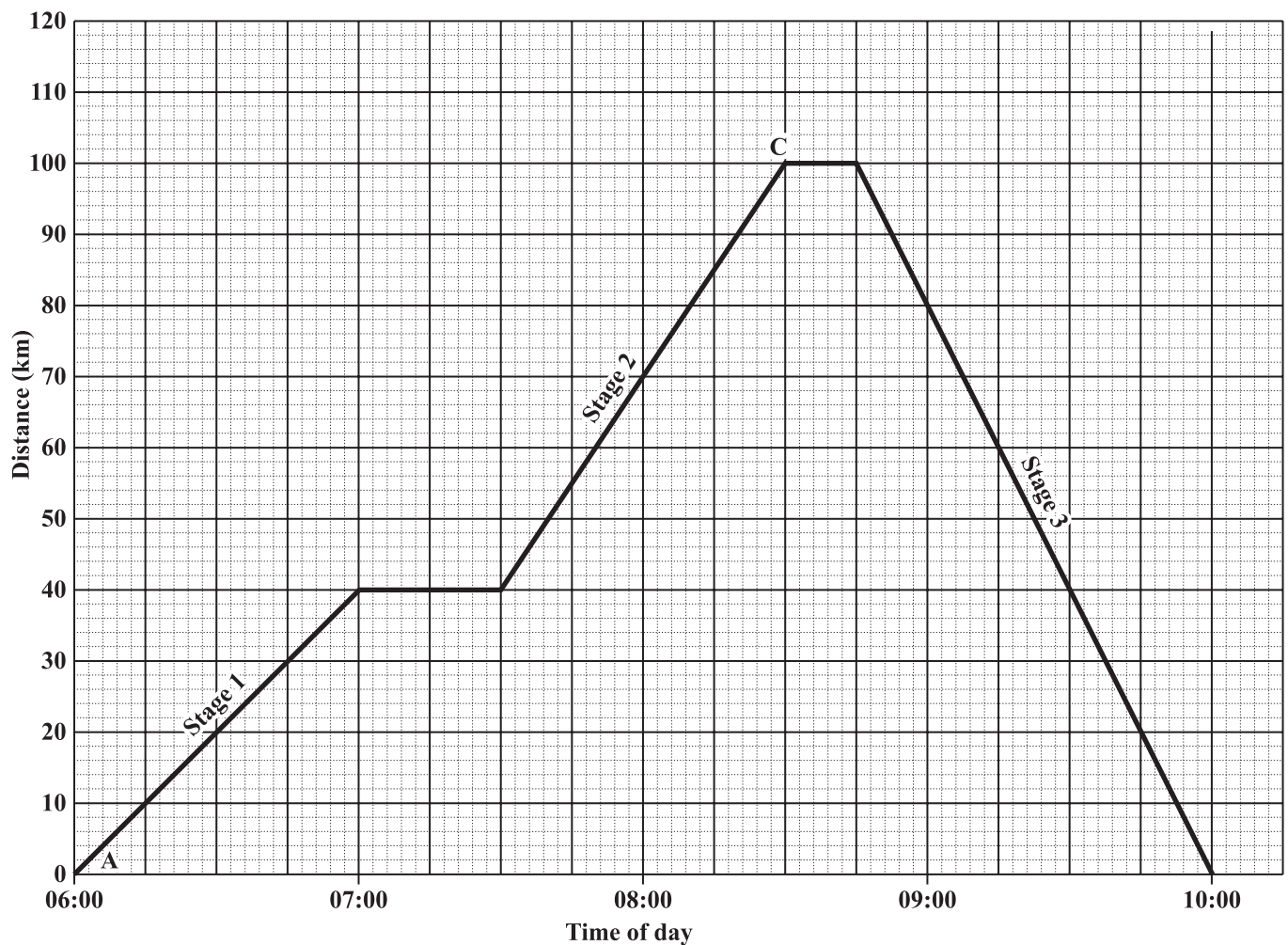
(4 marks)

(ii) Show that $(fg)^{-1}(5) = g^{-1}f^{-1}(5)$.

(3 marks)

GO ON TO THE NEXT PAGE

- (b) The distance–time graph below shows the three-stage journey of a car travelling from Town A to Town C and back to Town A.



GO ON TO THE NEXT PAGE

- (i) State the time of day at which the car arrived at Town C.

.....
(1 mark)

- (ii) Calculate the TOTAL time, in minutes, for which the car stopped during the journey.

(2 marks)

- (iii) Determine the constant speed of the car during Stage 2 of the journey.

(2 marks)

- (iv) Calculate the average speed of the car for the time during which it was moving.

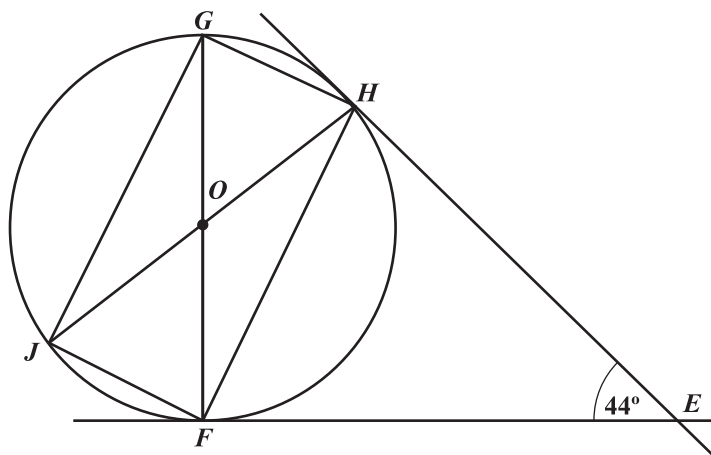
(3 marks)

Total 15 marks

GO ON TO THE NEXT PAGE

MEASUREMENT, GEOMETRY AND TRIGONOMETRY

10. (a) The diagram below, **not drawn to scale**, shows a circle, centre O . EH and EF are tangents to the circle. FOG and JOH are straight lines. The measure of $\angle FEH = 44^\circ$.



Calculate, **giving reasons for your answer**, the measure of:

(i) $\angle EHF = \dots\dots\dots$

(2 marks)

(ii) $\angle FGH = \dots\dots\dots$

(2 marks)

(iii) $\angle JHE = \dots\dots\dots$

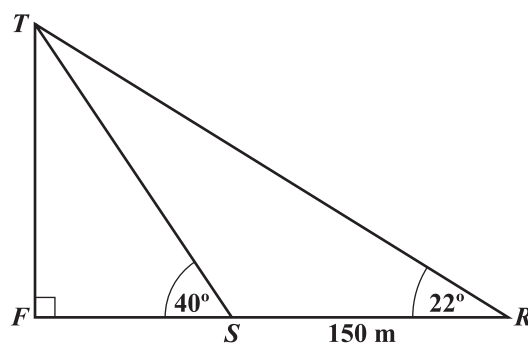
(2 marks)

(iv) $\angle JGH = \dots\dots\dots$

(2 marks)

GO ON TO THE NEXT PAGE

- (b) The diagram below, **not drawn to scale**, shows two ships, R and S at anchor on a lake of calm water. FT is a vertical tower. FSR is a straight line and $RS = 150$ m. The angles of elevation of T , the top of a tower, from R and S , are 22° and 40° respectively. F is the foot of the tower.



Calculate, giving your answer to 1 decimal place where appropriate

- (i) the measure of $\angle RTS$

(1 mark)

- (ii) the length of ST

(3 marks)

- (iii) the height of the tower, FT .

(3 marks)

Total 15 marks

GO ON TO THE NEXT PAGE

VECTORS AND MATRICES

11. (a) The position vectors of points A , B and C , relative to the origin O , are

$$\overrightarrow{OA} = \begin{pmatrix} 2 \\ -2 \end{pmatrix}; \overrightarrow{OB} = \begin{pmatrix} 6 \\ 1 \end{pmatrix} \text{ and } \overrightarrow{OC} = \begin{pmatrix} 10 \\ 4 \end{pmatrix} \text{ respectively.}$$

- (i) Express in the form $\begin{pmatrix} x \\ y \end{pmatrix}$ the vectors

• $\overrightarrow{AB} = \dots\dots\dots$

• $\overrightarrow{AC} = \dots\dots\dots$

(3 marks)

- (ii) Hence, determine whether A , B and C are collinear, **giving the reasons for your answer.**

.....

(3 marks)

GO ON TO THE NEXT PAGE

- (b) Determine the value of x for which the matrix $\begin{pmatrix} 3 & x \\ 2 & 4 \end{pmatrix}$ is singular.

(2 marks)

- (c) N and P are 2×2 matrices such that $N = \begin{pmatrix} 4 & 1 \\ 3 & 2 \end{pmatrix}$ and $P = \begin{pmatrix} 1 & 5 \\ 2 & 1 \end{pmatrix}$.

- (i) Determine NP .

(1 mark)

- (ii) Given that $PN = \begin{pmatrix} 19 & 11 \\ 11 & 4 \end{pmatrix}$, determine whether matrix multiplication is commutative.

(1 mark)

GO ON TO THE NEXT PAGE

- (iii) Determine N^{-1} , the inverse of N .

(2 marks)

- (iv) Hence, calculate the values of x and y for which $\begin{pmatrix} 4 & 1 \\ 3 & 2 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 1 \\ 2 \end{pmatrix}$.

(3 marks)

Total 15 marks

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.

“*”Barcode Area”
Sequential Bar Code

01234020/F 2016

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

FORM TP 2017017



TEST CODE **01234020**

JANUARY 2017

CARIBBEAN EXAMINATIONS COUNCIL

**CARIBBEAN SECONDARY EDUCATION CERTIFICATE®
EXAMINATION**

MATHEMATICS

Paper 02 – General Proficiency

2 hours 40 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of TWO sections: I and II.
2. Section I has EIGHT questions and Section II has THREE questions.
3. Answer ALL questions in Section I and any TWO questions from Section II.
4. Write your answers in the booklet provided.
5. Do NOT write in the margins.
6. All working MUST be clearly shown.
7. **A list of formulae is provided on page 4 of this booklet.**
8. If you need to rewrite any answer and there is not enough space to do so on the original page, you must use the extra page(s) provided at the back of this booklet. **Remember to draw a line through your original answer.**
9. **If you use the extra page(s) you MUST write the question number clearly in the box provided at the top of the extra page(s) and, where relevant, include the question part beside the answer.**

Required Examination Materials

Electronic calculator
Geometry set

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

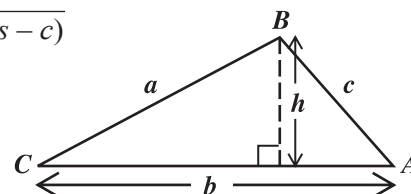
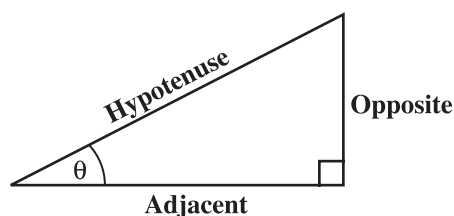
Copyright © 2016 Caribbean Examinations Council
All rights reserved.

01234020/JANUARY/F 2017

“*”Barcode Area”*”
Sequential Bar Code

LIST OF FORMULAE

Volume of a prism	$V = Ah$ where A is the area of a cross-section and h is the perpendicular length.
Volume of cylinder	$V = \pi r^2 h$ where r is the radius of the base and h is the perpendicular height.
Volume of a right pyramid	$V = \frac{1}{3} Ah$ where A is the area of the base and h is the perpendicular height.
Circumference	$C = 2\pi r$ where r is the radius of the circle.
Arc length	$S = \frac{\theta}{360} \times 2\pi r$ where θ is the angle subtended by the arc, measured in degrees.
Area of a circle	$A = \pi r^2$ where r is the radius of the circle.
Area of a sector	$A = \frac{\theta}{360} \times \pi r^2$ where θ is the angle of the sector, measured in degrees.
Area of trapezium	$A = \frac{1}{2} (a + b) h$ where a and b are the lengths of the parallel sides and h is the perpendicular distance between the parallel sides.
Roots of quadratic equations	If $ax^2 + bx + c = 0$, then $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
Trigonometric ratios	$\sin \theta = \frac{\text{opposite side}}{\text{hypotenuse}}$ $\cos \theta = \frac{\text{adjacent side}}{\text{hypotenuse}}$ $\tan \theta = \frac{\text{opposite side}}{\text{adjacent side}}$
Area of triangle	Area of $\Delta = \frac{1}{2} bh$ where b is the length of the base and h is the perpendicular height. Area of $\Delta ABC = \frac{1}{2} ab \sin C$ Area of $\Delta ABC = \sqrt{s(s-a)(s-b)(s-c)}$ where $s = \frac{a+b+c}{2}$
Sine rule	$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$
Cosine rule	$a^2 = b^2 + c^2 - 2bc \cos A$



GO ON TO THE NEXT PAGE

SECTION I

Answer ALL questions in this section.

All working must be clearly shown.

1. (a) Using a calculator, or otherwise, calculate the EXACT value of:

(i)
$$\frac{3\frac{1}{2} \times 1\frac{2}{3}}{4\frac{1}{5}}$$

(2 marks)

(ii)
$$5.47 - \sqrt{\frac{0.1014}{1.5}}$$

(2 marks)

GO ON TO THE NEXT PAGE

- (b) The table below shows the number of tickets sold for a bus tour. Some items in the table are missing.

Tickets Sold for Bus Tour			
Category	Number of Tickets Sold	Cost per Ticket in \$	Total Cost in \$
Juvenile	5	P	130.50
Youth	14	44.35	Q
Adult	R		2483.60

- (i) Calculate the value of P.

(1 mark)

- (ii) Calculate the value of Q.

(1 mark)

GO ON TO THE NEXT PAGE

- (iii) An adult ticket is TWICE the cost of a youth ticket. Calculate the value of R.

(2 marks)

- (iv) The bus company pays taxes of 15% on each ticket sold. Calculate the taxes paid by the bus company.

(3 marks)

Total 11 marks

GO ON TO THE NEXT PAGE

2. (a) Write as a single fraction:

$$\frac{2x+3}{3} + \frac{x-4}{4}$$

(2 marks)

- (b) Write the following statement as an algebraic expression.

The sum of a number and its multiplicative inverse is five times the number.

(2 marks)

(c) Factorize completely:

(i) $x^2 - 36$

(2 marks)

(ii) $2x^2 + 5x - 12$

(2 marks)

- (d) The formula for the volume of a cylinder is given as $V = \pi r^2 h$.

Make r the subject of the formula.

(2 marks)

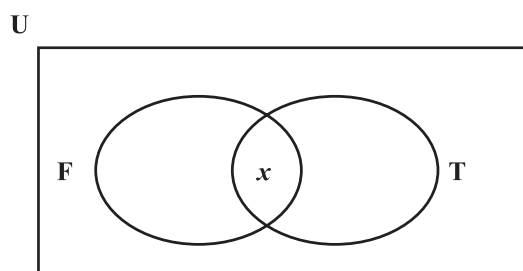
- (e) Given that $x^2 + ax + b = (x + 2)^2 - 3$, work out the values of a and b .

(2 marks)

Total 12 marks

GO ON TO THE NEXT PAGE

3. (a) The incomplete Venn diagram below shows the number of students in a class of 28 who play football and tennis.



$U = \{\text{all students in the class}\}$
 $F = \{\text{students who play football}\}$
 $T = \{\text{students who play tennis}\}$

Additional information about the class is that
 12 students play tennis
 15 students play football
 8 students play neither football nor tennis
 x students play BOTH football and tennis.

- (i) Complete the Venn diagram above to represent the information, showing the number of students in EACH subset. **(3 marks)**
- (ii) Calculate the value of x .

(2 marks)

GO ON TO THE NEXT PAGE

- (b) Using **a ruler, a pencil and a pair of compasses**, construct the trapezium ABCD with $AB = 8 \text{ cm}$, $\hat{BAD} = 60^\circ$, $AD = 6 \text{ cm}$, $\hat{ABC} = 90^\circ$ and AB parallel to CD.
(Credit will be given for clearly drawn construction lines.)

(7 marks)

Total 12 marks

GO ON TO THE NEXT PAGE

4. (a) Given that $f(x) = 4x - 7$ and $g(x) = \frac{3x + 1}{2}$, determine the values of:

(i) $g(0) + g(5)$

(2 marks)

(ii) $fg(5)$

(2 marks)

GO ON TO THE NEXT PAGE

(iii) $f^{-1}(1)$

(2 marks)

(b) P(6, -1) and Q(2, 7) are the end points of a line segment PQ. Determine

(i) the gradient of PQ

(2 marks)

GO ON TO THE NEXT PAGE

- (ii) the coordinates of the midpoint of PQ

(2 marks)

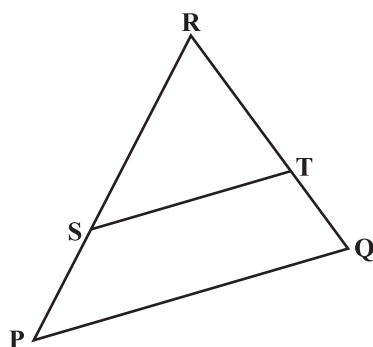
- (iii) the equation of the perpendicular bisector of PQ.

(2 marks)

Total 12 marks

GO ON TO THE NEXT PAGE

5. (a)



Triangles PQR and STR are similar triangles.

(i) Complete the following statement:

In the diagram above, the corresponding angles of $\triangle PQR$ and $\triangle STR$ are and the of their corresponding sides are the same.
(2 marks)

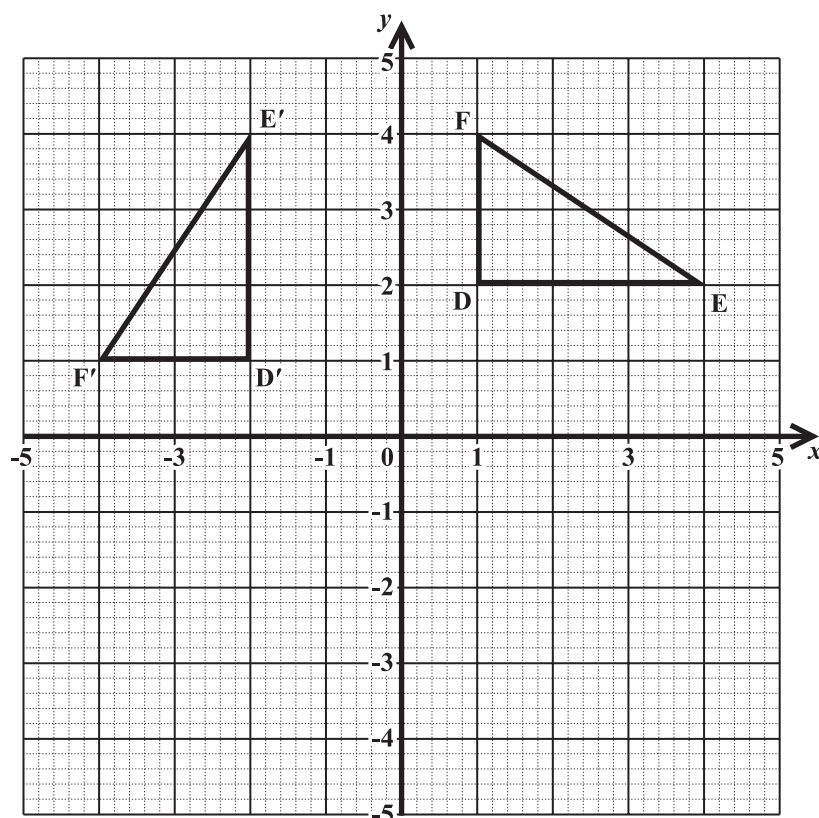
In the diagram above, **not drawn to scale**, $RS = 15$ cm, $SP = 9$ cm and $ST = 12$ cm.

(ii) Determine the length of PQ.

(3 marks)

GO ON TO THE NEXT PAGE

- (b) The graph below shows triangle DEF and its image D'E'F' after a transformation.



- (i) State the coordinates of the point E.

.....
(1 mark)

- (ii) Describe fully the transformation that maps triangle DEF to its image, D'E'F'.

.....
.....
.....
.....
.....
.....
(3 marks)

- (iii) On the grid above, draw triangle D''E''F'', the reflection of triangle D'E'F' in the x -axis.

(2 marks)

Total 11 marks

GO ON TO THE NEXT PAGE

6. (a) The scale on a map is 1:25 000.

(i) Anderlin and Jersey are 31.8 cm apart on the map.

Determine, in km, the actual distance between Anderlin and Jersey.

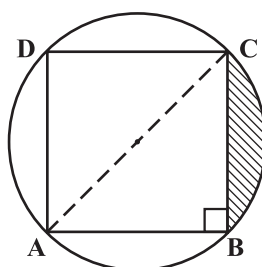
(2 marks)

(ii) The actual distance between Clifton and James Town is 2.75 km.

How many units apart are they on the map?

(2 marks)

(b) The diagram below shows a square ABCD drawn inside a circle. The vertices of the square lie on the circumference of the circle. The length of a side of the square is 11 cm.



(i) Show that the diameter of the circle is $11\sqrt{2}$ cm.

(2 marks)

GO ON TO THE NEXT PAGE

Write your answers correct to 2 decimal places.

Calculate

(ii) the area of the circle

(2 marks)

(iii) the area of the square

(1 mark)

(iv) the area of the shaded section.

(2 marks)

Total 11 marks

GO ON TO THE NEXT PAGE

7. The table below shows the number of bananas, to the nearest tonne, produced annually on a farm over a period of 6 years.

Year	2010	2011	2012	2013	2014	2015
Production (tonnes)	150	275	100	40	125	210

- (a) **On the graph paper provided on page 21**, draw a bar chart to represent the data given in the table above using a scale of 1 cm to represent 1 year on the x-axis and 1 cm to represent 25 tonnes on the y-axis. **(4 marks)**

- (b) Determine the range of the number of bananas produced between 2010 and 2015.

.....

(2 marks)

- (c) (i) During which year was there the greatest production of bananas?

.....
(1 mark)

- (ii) How is this information shown on the bar chart?

.....

(1 mark)

- (d) (i) Between which two consecutive years was there the greatest **change** in the production of bananas?

.....
(1 mark)

- (ii) How is this information shown on the bar chart?

.....

(1 mark)

GO ON TO THE NEXT PAGE

A full-page sheet of white graph paper. The grid consists of thin, light gray horizontal and vertical lines forming small squares. There are approximately 20 columns and 20 rows of these small squares across the page. The margins are uniform on all sides.

01234020/JANUARY/F 2017

“*”Barcode Area”*”
Sequential Bar Code

- (e) Give ONE reason why the bar chart is unsuitable for predicting the number of bananas produced in 2016.

.....

.....

.....

(1 mark)

Total 11 marks

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

NOTHING HAS BEEN OMITTED.

GO ON TO THE NEXT PAGE

01234020/JANUARY/F 2017

“*”Barcode Area”*” Sequential Bar Code

8. A sequence of figures is made up of unit squares with unit sides. The first three figures in the sequence are shown below.

Figure 1

 $n = 1$

Figure 2

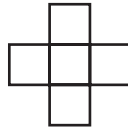
 $n = 2$

Figure 3

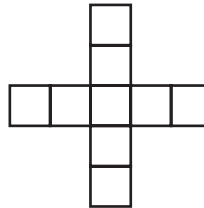
 $n = 3$

Figure 4

- (a) Draw Figure 4 of the sequence in the space provided above. **(2 marks)**
- (b) Study the pattern of numbers in each row of the table below. Each row relates to one of the figures in the sequence. Some rows have not been included in the table.

Complete the rows numbered (i), (ii), (iii) and (iv).

	Figure	Number of Unit Squares	Perimeter of Figure
	1	1	4
	2	5	12
	3	9	20
(i)	4		
(ii)		45	
(iii)	30		
(iv)	n		

(2 marks)**(2 marks)****(2 marks)****(2 marks)****Total 10 marks**

GO ON TO THE NEXT PAGE

SECTION II

Answer TWO questions in this section.

ALGEBRA AND RELATIONS, FUNCTIONS AND GRAPHS

9. (a) The table below shows pairs of values for x and y , where y is inversely proportional to x .

x	3	4	a	20
y	2	1.5	1.2	b

- (i) Express y in terms of x and a constant k .

(1 mark)

- (ii) Calculate the value of the constant k .

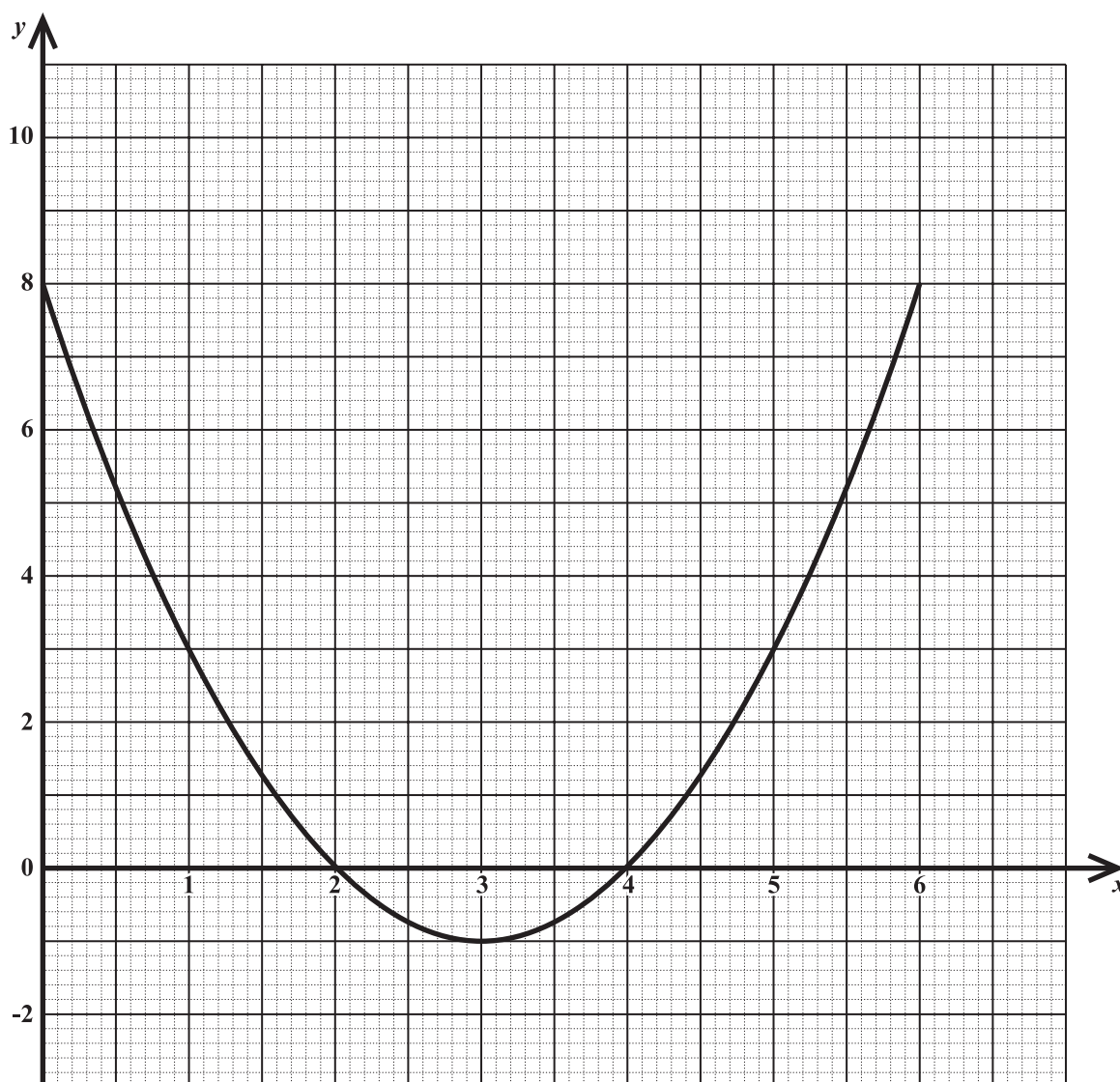
(1 mark)

- (iii) Determine the values of a and b .

(2 marks)

GO ON TO THE NEXT PAGE

- (b) The diagram below shows the graph of the function $f(x) = x^2 - 6x + 8$ for values of x from 0 to 6.



- (i) Use the graph to solve the equation $x^2 - 6x + 8 = 0$.

(2 marks)

- (ii) Write down the coordinates of the minimum point in the form (x, y) .

(1 mark)

GO ON TO THE NEXT PAGE

- (iii) Write $x^2 - 6x + 8$ in the form $a(x + h)^2 + k$ where a , h and k are constants.

(3 marks)

- (iv) On the same axes, draw the graph of the straight line $g(x) = x - 2$.

(3 marks)

- (v) Hence, solve the equation $x^2 - 6x + 8 = x - 2$.

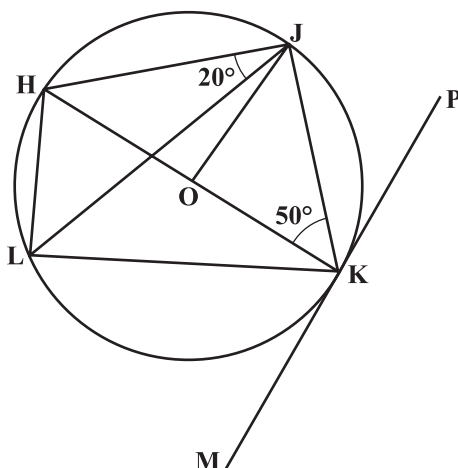
(2 marks)

Total 15 marks

GO ON TO THE NEXT PAGE

MEASUREMENT, GEOMETRY AND TRIGONOMETRY

10. (a) The diagram below, **not drawn to scale**, shows a circle with centre O. The vertices H, J, K and L of a quadrilateral lie on the circumference of the circle and PKM is a tangent to the circle at K. The measure of angle $\hat{HJL} = 20^\circ$ and $\hat{JKH} = 50^\circ$.



Calculate, **giving reasons for each step of your answer**, the measure of

(i) $\hat{HKL}$

(ii) $\hat{JOK}$

(2 marks)

(2 marks)

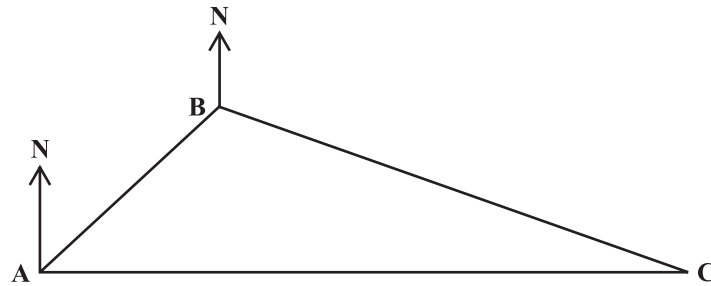
GO ON TO THE NEXT PAGE

(iii) $\hat{JHK}$.

(2 marks)

GO ON TO THE NEXT PAGE

- (b) A ship travels from Akron (A) on a bearing of 030° to Bellville (B), 90 km away. It then travels to Comptin (C) which is 310 km due east of Akron (A), as shown in the diagram below.



- (i) Indicate on the diagram the bearing 030° and the distances 90 km and 310 km. (2 marks)
- (ii) Calculate, to the nearest km, the distance between Bellville (B) and Comptin (C).

(2 marks)

- (iii) Calculate, to the nearest degree, the measure of $\hat{ABC}$.

(2 marks)

- (iv) Determine the bearing of Comptin (C) from Bellville (B).

(3 marks)

Total 15 marks

GO ON TO THE NEXT PAGE

VECTORS AND MATRICES

11. (a) The matrix $T = \begin{pmatrix} c & 0 \\ 0 & d \end{pmatrix}$ maps the point $P(2, 3)$ onto the point $Q(2, -3)$.

(i) Determine the values of c and d .

(2 marks)

(ii) Determine the image of $(-5, 4)$ under the transformation T .

(1 mark)

(iii) Describe fully the transformation T .

.....

.....

.....

.....

.....

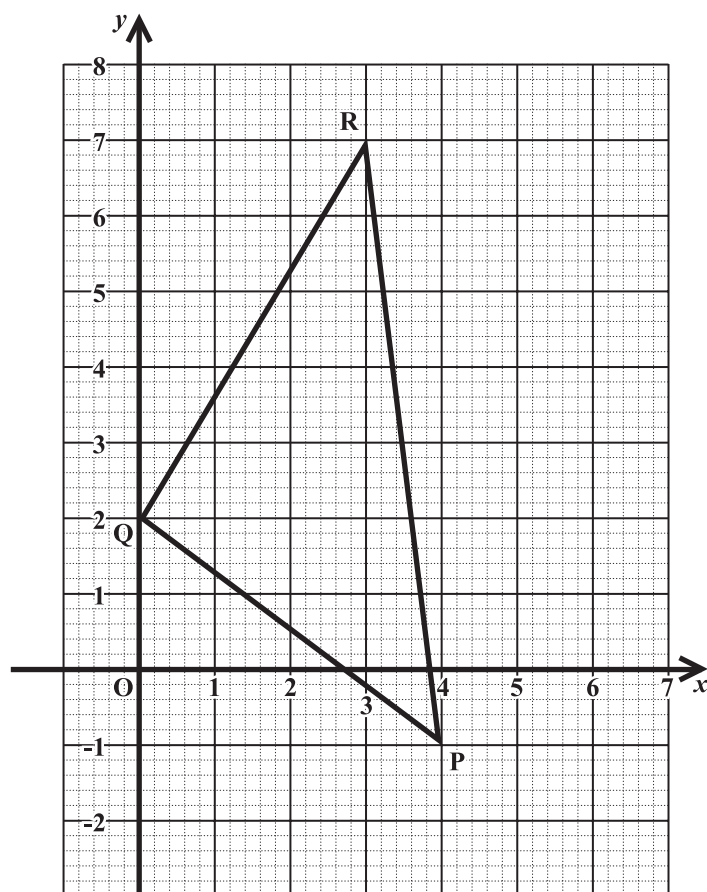
(2 marks)

(iv) Find the matrix that maps the point Q back onto the point P .

(2 marks)

GO ON TO THE NEXT PAGE

- (b) The graph below shows three points, P, Q and R, relative to the origin, O.



- (i) Write as a column vector in the form $\begin{pmatrix} x \\ y \end{pmatrix}$

- the vector $\overrightarrow{OP}$

(1 mark)

- the vector $\overrightarrow{QR}$.

(2 marks)

GO ON TO THE NEXT PAGE

- (ii) Determine the magnitude of the vector $\overrightarrow{QR}$.

(2 marks)

- (iii) On the graph provided on page 33, draw the vector $\overrightarrow{OS} = \begin{pmatrix} 7 \\ 4 \end{pmatrix}$. Show that PQRS is a parallelogram.

(3 marks)

Total 15 marks

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.

“*”Barcode Area”*”
Sequential Bar Code

01234020/JANUARY/F 2017

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

EXTRA SPACE

If you use this extra page, you MUST write the question number clearly in the box provided.

Question No.

DO NOT WRITE IN THIS AREA

“*”Barcode Area”*”
Sequential Bar Code

01234020/JANUARY/F 2017

EXTRA SPACE

If you use this extra page, you MUST write the question number clearly in the box provided.

Question No.

“*”Barcode Area”*”
Sequential Bar Code

01234020/JANUARY/F 2017

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

EXTRA SPACE

If you use this extra page, you MUST write the question number clearly in the box provided.

Question No.

DO NOT WRITE IN THIS AREA

“*”Barcode Area”*”
Sequential Bar Code

01234020/JANUARY/F 2017

EXTRA SPACE

If you use this extra page, you MUST write the question number clearly in the box provided.

Question No.

“*”Barcode Area”*”
Sequential Bar Code

01234020/JANUARY/F 2017

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

**CARIBBEAN EXAMINATIONS COUNCIL****CARIBBEAN SECONDARY EDUCATION CERTIFICATE®
EXAMINATION****MATHEMATICS****Paper 02 – General Proficiency***2 hours 40 minutes***READ THE FOLLOWING INSTRUCTIONS CAREFULLY.**

1. This paper consists of TWO sections: I and II.
2. Section I has EIGHT questions and Section II has THREE questions.
3. Answer ALL questions in Section I, and any TWO questions from Section II.
4. Write your answers in the spaces provided in this booklet.
5. Do NOT write in the margins.
6. All working MUST be clearly shown.
7. **A list of formulae is provided on page 4 of this booklet.**
8. If you need to rewrite any answer and there is not enough space to do so on the original page, you must use the extra page(s) provided at the back of this booklet. **Remember to draw a line through your original answer.**
9. **If you use the extra page(s) you MUST write the question number clearly in the box provided at the top of the extra page(s) and, where relevant, include the question part beside the answer.**

Required Examination Materials

Electronic calculator
Geometry set

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

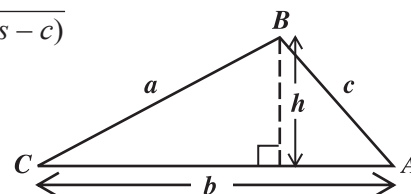
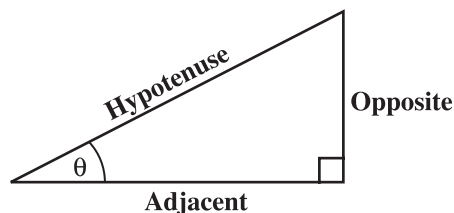
Copyright © 2016 Caribbean Examinations Council
All rights reserved.

01234020/F 2017

“*”Barcode Area”*”
Sequential Bar Code

LIST OF FORMULAE

Volume of a prism	$V = Ah$ where A is the area of the cross-section and h is the perpendicular length.
Volume of cylinder	$V = \pi r^2 h$ where r is the radius of the base and h is the perpendicular height.
Volume of a right pyramid	$V = \frac{1}{3} Ah$ where A is the area of the base and h is the perpendicular height.
Circumference	$C = 2\pi r$ where r is the radius of the circle.
Arc length	$S = \frac{\theta}{360} \times 2\pi r$ where θ is the angle subtended by the arc, measured in degrees.
Area of a circle	$A = \pi r^2$ where r is the radius of the circle.
Area of a sector	$A = \frac{\theta}{360} \times \pi r^2$ where θ is the angle of the sector, measured in degrees.
Area of trapezium	$A = \frac{1}{2} (a + b) h$ where a and b are the lengths of the parallel sides and h is the perpendicular distance between the parallel sides.
Roots of quadratic equations	If $ax^2 + bx + c = 0$, then $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
Trigonometric ratios	$\sin \theta = \frac{\text{opposite side}}{\text{hypotenuse}}$ $\cos \theta = \frac{\text{adjacent side}}{\text{hypotenuse}}$ $\tan \theta = \frac{\text{opposite side}}{\text{adjacent side}}$
Area of triangle	Area of $\Delta = \frac{1}{2} bh$ where b is the length of the base and h is the perpendicular height. Area of $\Delta ABC = \frac{1}{2} ab \sin C$ Area of $\Delta ABC = \sqrt{s(s-a)(s-b)(s-c)}$ where $s = \frac{a+b+c}{2}$
Sine rule	$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$
Cosine rule	$a^2 = b^2 + c^2 - 2bc \cos A$



GO ON TO THE NEXT PAGE

SECTION I

Answer ALL questions in this section.

All working must be clearly shown.

1. (a) Using a calculator, or otherwise, calculate the EXACT value of

(i) $\left[4 \frac{1}{3} - 1 \frac{2}{5} \right] \div \frac{4}{15}$

(2 marks)

(ii) $\frac{(3.1 - 1.15)^2}{0.005}$

(2 marks)

GO ON TO THE NEXT PAGE

- (b) A store is promoting a new mobile phone under two plans: Plan A and Plan B.

The plans are advertised as shown in the table below.

	Plan A	Plan B
Deposit	\$400	\$600
Monthly instalment	\$65	\$80
Number of months to repay	12	6
Tax on ALL payments	0%	5%

- (i) Calculate the TOTAL cost of a phone under Plan A.

(2 marks)

- (ii) Determine which of the two plans, A or B, is the better deal. **Justify your answer.**

(2 marks)

GO ON TO THE NEXT PAGE

- (c) John's monthly electricity bill is based on the number of kWh of electricity that he consumes for that month. He is charged \$5.10 per kWh of electricity consumed. For the month of March 2016, two meter readings are displayed in the table below.

	Meter Readings (kWh)
Beginning 01 March	0 3 0 1 1
Ending 31 March	0 3 3 0 7

- (i) Calculate the TOTAL amount that John pays for electricity consumption for the month of March 2016.

(2 marks)

- (ii) For the next month, April 2016, John pays \$2351.10 for electricity consumption. Determine his meter reading at the end of April 2016.

(2 marks)

Total 12 marks

GO ON TO THE NEXT PAGE

2. (a) Factorize the following expressions completely.

(i) $6y^2 - 18xy$

(2 marks)

(ii) $4m^2 - 1$

(1 mark)

(iii) $2t^2 - 3t - 2$

(2 marks)

- (b) Write as a single fraction and simplify

$$\frac{5p+2}{3} - \frac{3p-1}{4}.$$

(2 marks)

GO ON TO THE NEXT PAGE

(c) A formula is given as $d = \sqrt{\frac{4h}{5}}$.

- (i) Determine the value of d when $h = 29$. Give your answer correct to 3 significant figures.

(2 marks)

- (ii) Make h the subject of the formula.

(2 marks)

Total 11 marks

GO ON TO THE NEXT PAGE

3. (a) The universal set U is defined as follows:

$$U = \{x : x \in N, 2 < x < 12\}.$$

The sets M and R are subsets of U such that

$$M = \{\text{odd numbers}\}$$

$$R = \{\text{square numbers}\}.$$

- (i) List the members of the subset M .

.....

 (1 mark)

- (ii) List the members of the subset R .

.....

 (1 mark)

- (iii) Draw a Venn diagram that represents the relationship among the defined subsets of U .

(4 marks)

GO ON TO THE NEXT PAGE

- (b) Using **a ruler, a pencil and a pair of compasses**,
- (i) construct accurately, the square $ABCD$, with sides 6 cm **(3 marks)**

- (ii) construct, as an extension of your drawing in (b) (i), the trapezium $DABQ$ so that $\angle ABQ = 120^\circ$. **(2 marks)**

[Note: Credit will be given for clearly drawn construction lines.]

- (iii) Hence, measure and state the length of BQ .

.....
(1 mark)

Total 12 marks

GO ON TO THE NEXT PAGE

4. (a) The function f is defined as $f(x) = \frac{1}{3}x - 2$.

(i) Find the value of $f(3) + f(-3)$.

(2 marks)

(ii) Calculate the value of x for which $f(x) = 5$.

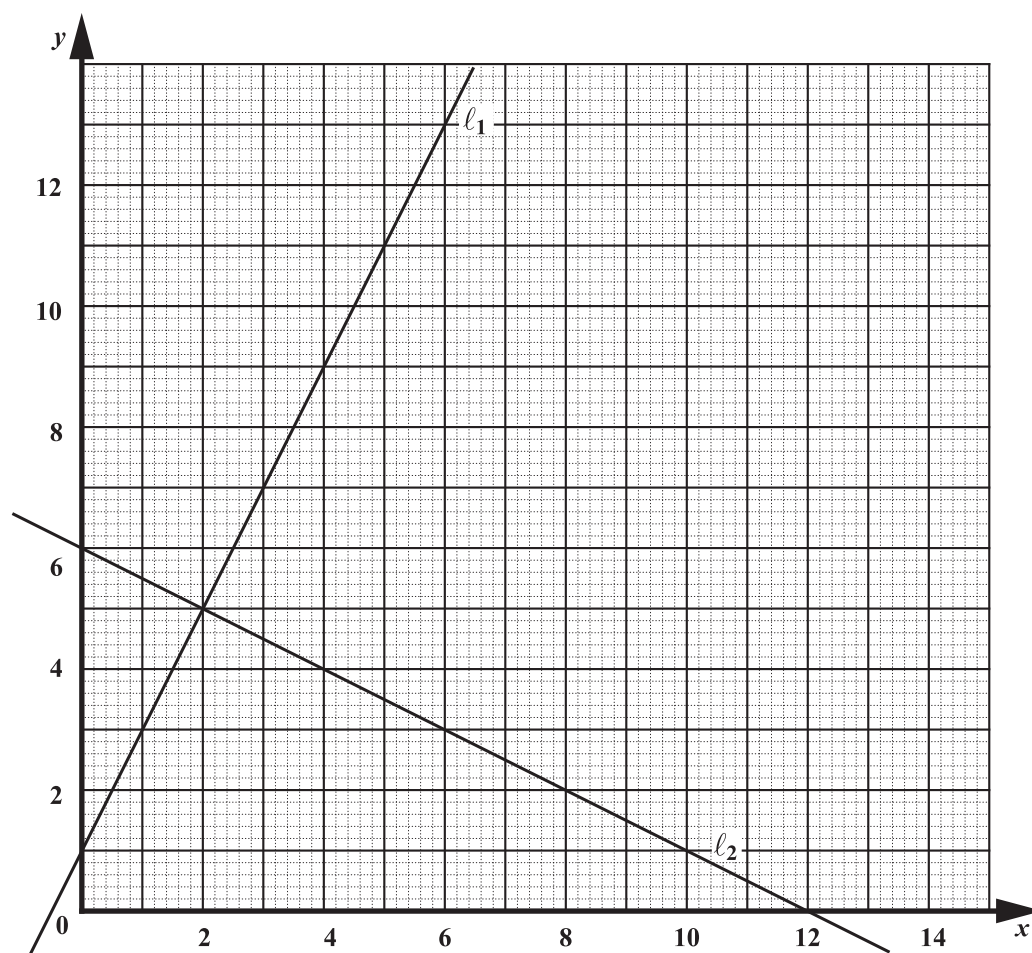
(2 marks)

(iii) Determine the inverse function $f^{-1}(x)$.

(2 marks)

GO ON TO THE NEXT PAGE

- (b) The graph below shows two straight lines, ℓ_1 and ℓ_2 . Line ℓ_1 intercepts the y -axis at $(0, 1)$. Line ℓ_2 intercepts the x and y axes at $(12, 0)$ and $(0, 6)$ respectively.



- (i) Calculate the gradient of the lines ℓ_1 and ℓ_2 .

(2 marks)

GO ON TO THE NEXT PAGE

- (ii) Determine the equation of the line ℓ_1 .

(2 marks)

- (iii) What is the relationship between ℓ_1 and ℓ_2 ? Give a reason for your answer.

.....

.....

.....

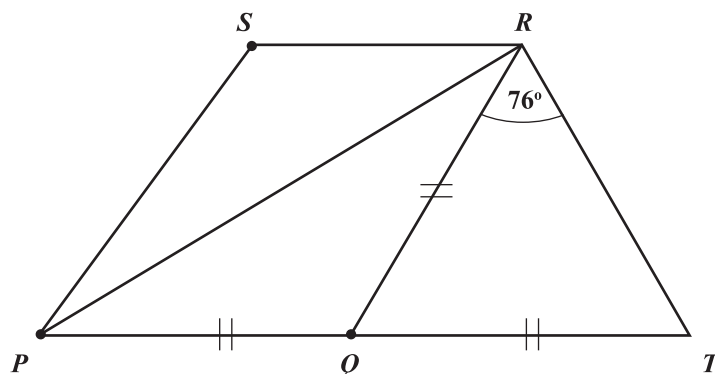
.....

.....

(2 marks)

Total 12 marks

5. (a) $PTRS$, **not drawn to scale**, is a quadrilateral. Q is a point on PT such that $QT = QR = QP$. Angle $QRT = 76^\circ$.



Determine, giving a reason for each step of your answer, the measure of

- (i) angle RQT

(2 marks)

- (ii) angle PRT

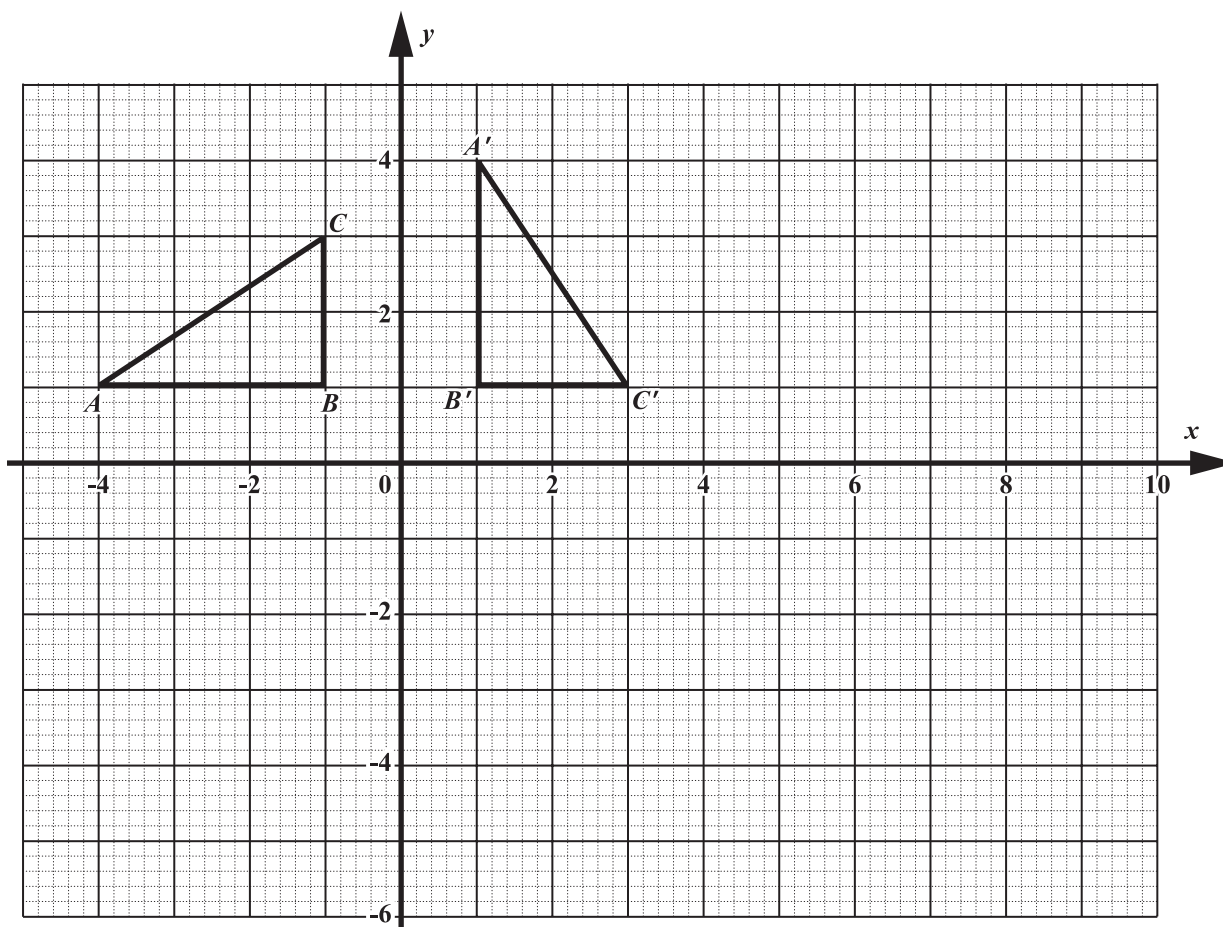
(2 marks)

- (iii) angle SPT , given that angle $SRT = 145^\circ$ and angle $PSR = 100^\circ$.

(2 marks)

GO ON TO THE NEXT PAGE

- (b) The diagram below shows triangle ABC and its image, $A'B'C'$, under a single transformation.



- (i) Describe **completely** the transformation that maps $\triangle ABC$ to $\triangle A'B'C'$.

.....

.....

.....

.....

.....

(3 marks)

- (ii) The translation vector $T = \begin{bmatrix} 4 \\ -5 \end{bmatrix}$ maps $\triangle A'B'C'$ to $\triangle A''B''C''$.

On the diagram above, draw the $\triangle A''B''C''$.

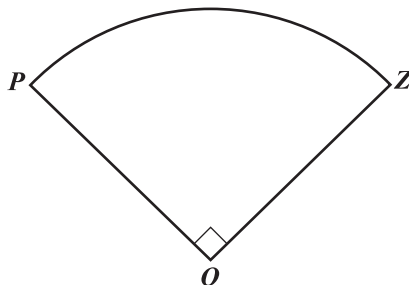
(2 marks)

Total 11 marks

GO ON TO THE NEXT PAGE

6. (a) In this problem take π to be $\frac{22}{7}$.

The diagram below, **not drawn to scale**, shows a field in the shape of a sector of a circle, with centre O and diameter 28 m. Angle POZ is 90° .



Calculate

- (i) the area of the field

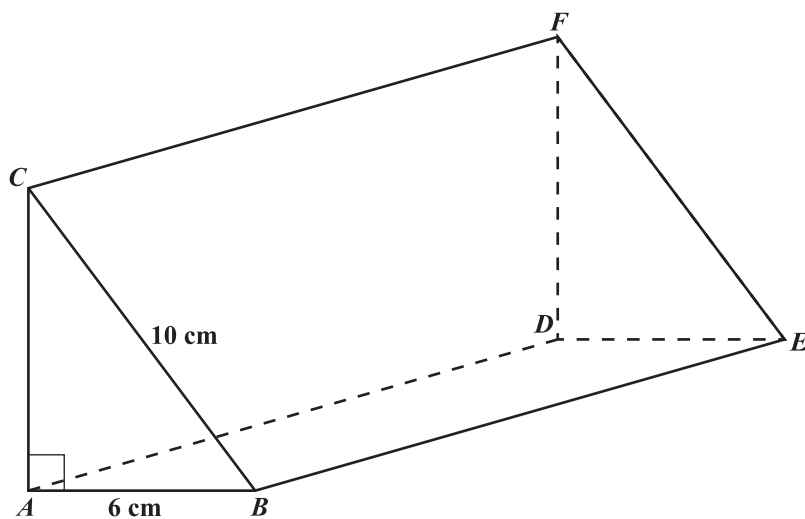
(2 marks)

- (ii) the perimeter of the field.

(3 marks)

GO ON TO THE NEXT PAGE

- (b) The diagram below, **not drawn to scale**, shows a triangular prism $ABCDEF$. The cross-section is the right-angled triangle, ABC , where $AB = 6$ cm and $BC = 10$ cm.



Calculate

- (i) the area of the triangle ABC

(2 marks)

GO ON TO THE NEXT PAGE

- (ii) the length of the prism, if the volume is 540 cm^3

(2 marks)

- (iii) the surface area of the prism.

(2 marks)

Total 11 marks

GO ON TO THE NEXT PAGE

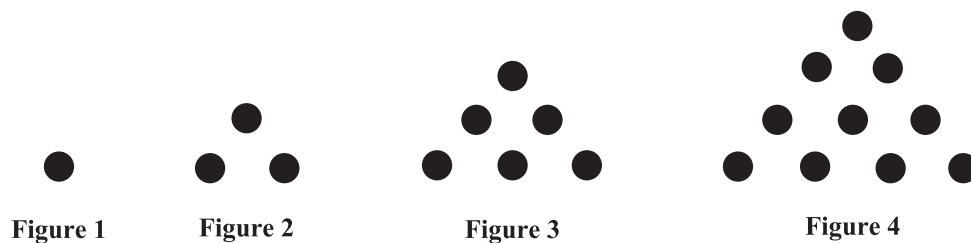
7. The table below shows the speeds, to the nearest kmh^{-1} , of 90 vehicles that pass a checkpoint.

Speed (in kmh^{-1})	Frequency	Cumulative Frequency
0–19	5	5
20–39	11	16
40–59	26	
60–79	37	
80–99	9	
100–119	2	

- (a) For the class interval 20–39, as written in the table above, complete the following sentences.
- (i) The upper class limit is (1 mark)
- (ii) The class width is (1 mark)
- (iii) Sixteen vehicles passed a checkpoint at no more than kmh^{-1} . (1 mark)
- (b) Complete the table shown above by inserting the missing values for the cumulative frequency column. (2 marks)
- (c) On the grid provided **on page 21**, using a scale of 2 cm to represent 20 kmh^{-1} on the x -axis, and 2 cm to represent 10 vehicles on the y -axis, draw the cumulative frequency curve to represent the information in the table. (4 marks)
- (d) (i) On your graph, draw reference lines to estimate the speed at which no more than 50% of the vehicles drove as they passed the checkpoint. (1 mark)
- (ii) What is the estimated speed?
- (1 mark)

Total 11 marks

8. The first four figures in a sequence are shown below. Figure 1 is a single black dot, while each of the others consist of black dots arranged in an equilateral manner.



- (a) Draw Figure 5 of the sequence in the space below.

(2 marks)

- (b) How many dots would be in Figure 6?

(1 mark)

The table below refers to the figures and the number of dots in each figure. Study the patterns shown.

Figure, n	Number of Dots, d , in terms of n	Number of Dots Used, d
1	$\frac{1}{2} \times 1 \times (1 + 1)$	1
2	$\frac{1}{2} \times 2 \times (2 + 1)$	3
3	$\frac{1}{2} \times 3 \times (3 + 1)$	6
$\vdots$		
11		
$\vdots$		
n		

(c) Complete the row which corresponds to Figure 11 in the table above. **(2 marks)**

(d) Determine which figure in the sequence has 210 dots.

(2 marks)

(e) Write a simplified algebraic expression for the number of dots, d , in the Figure n .

(1 mark)

(f) Show that there is no diagram that has exactly 1000 dots.

(2 marks)

Total 10 marks

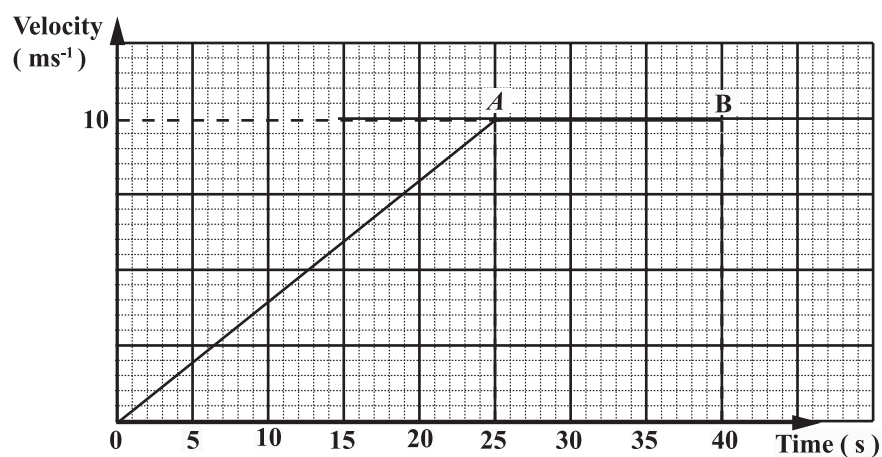
GO ON TO THE NEXT PAGE

SECTION II

Answer TWO questions in this section.

ALGEBRA AND RELATIONS, FUNCTIONS AND GRAPHS

9. (a) The velocity–time graph below shows the motion of a cyclist over a period of 40 seconds.



- (i) Calculate the gradient of

a) OA

(1 mark)

b) AB .

(1 mark)

- (ii) Complete the following statements.

The cyclist started from rest, where his velocity was ms^{-1} , and steadily increased his velocity by ms^{-1} each second during the first 25 seconds.

During the next 15 seconds, his velocity remained constant, that is, his acceleration was ms^{-2} . **(3 marks)**

- (iii) Determine the average speed of the cyclist over the 40-second period.

(3 marks)

GO ON TO THE NEXT PAGE

- (b) Consider the following pair of simultaneous equations:

$$\begin{aligned}x^2 + 2xy &= 5 \\ x + y &= 3\end{aligned}$$

- (i) WITHOUT solving, show that (1, 2) is a solution for the pair of simultaneous equations.

(2 marks)

- (ii) Solve the pair of simultaneous equations above to determine the **other** solution.

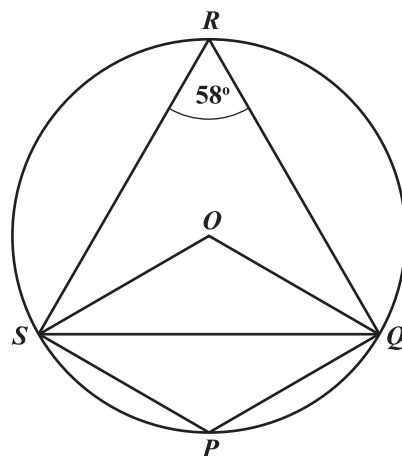
(5 marks)

Total 15 marks

GO ON TO THE NEXT PAGE

MEASUREMENT, GEOMETRY AND TRIGONOMETRY

10. (a) P , Q , R and S are four points on the circumference of the circle shown below.
Angle $QRS = 58^\circ$.



Using the geometrical properties of a circle to give reasons for each step of your answer, determine the measure of

- (i) $\angle SPQ$

(2 marks)

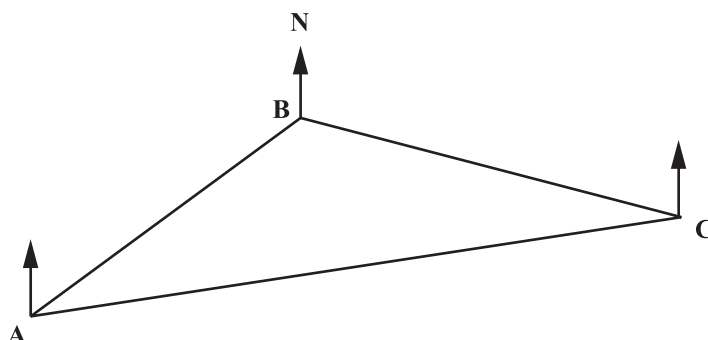
- (ii) $\angle OQS$

(3 marks)

GO ON TO THE NEXT PAGE

- (b) A ship leaves Port A and sails 52 km on a bearing of 044° to Port B. The ship then changes course to sail to Port C, 72 km away, on a bearing of 105° .

- (i) On the diagram below, **not drawn to scale**, label the known distances travelled and the known angles.



(2 marks)

- (ii) Determine the measure of $\angle ABC$.

(2 marks)

- (iii) Calculate, to the nearest km, the distance AC .

(3 marks)

- (iv) Show that the bearing of A from C , to the nearest degree, is 260° .

(3 marks)

Total 15 marks

GO ON TO THE NEXT PAGE

VECTORS AND MATRICES

11. (a) Matrices A and B are such that

$$A = \begin{pmatrix} 3 & 2 \\ 5 & 4 \end{pmatrix} \text{ and } B = \begin{pmatrix} 4 & 0 \\ 3 & -1 \end{pmatrix}.$$

- (i) Show by multiplying A and B , that $AB \neq BA$.

(2 marks)

- (ii) Find A^{-1} , the inverse of A .

(2 marks)

- (iii) Write down the 2×2 matrix representing the matrix product AA^{-1} .

(1 mark)

GO ON TO THE NEXT PAGE

- (b) (i) Write the following pair of simultaneous equations as a matrix equation.

$$\begin{aligned}3x + 2y &= 1 \\5x + 4y &= 5\end{aligned}$$

(1 mark)

- (ii) Write the solution of your matrix equation in (b) (i) as a product of two matrices.

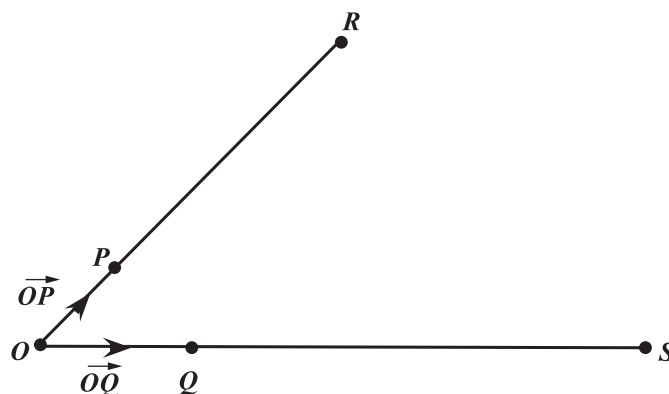
(2 marks)

GO ON TO THE NEXT PAGE

- (c) The position vectors of the points P and Q relative to an origin, O , are

$$\vec{OP} = \begin{pmatrix} 4 \\ 3 \end{pmatrix} \text{ and } \vec{OQ} = \begin{pmatrix} 5 \\ 0 \end{pmatrix} \text{ respectively.}$$

The diagram below shows that $PR = 3 OP$ and $QS = 3 OQ$.



- (i) Express in the form $\begin{pmatrix} x \\ y \end{pmatrix}$, vector

• $\vec{OS}$

(1 mark)

• $\vec{PQ}$

(2 marks)

- $\vec{RS}$.

(2 marks)

- (ii) State TWO geometrical relationships between PQ and RS .

.....

.....

.....

.....

(2 marks)

Total 15 marks

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.

01234020/F 2017

“*”Barcode Area”*”
Sequential Bar Code

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

EXTRA SPACE

If you use this extra page, you MUST write the question number clearly in the box provided.

Question No.

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

01234020/F 2017

“*”Barcode Area”*”

Sequential Bar Code

If you use this extra page, you MUST write the question number clearly in the box provided.

“*”Barcode Area”*”
Sequential Bar Code

EXTRA SPACE

If you use this extra page, you MUST write the question number clearly in the box provided.

Question No.

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

01234020/F 2017

“*”Barcode Area”*”

Sequential Bar Code

If you use this extra page, you MUST write the question number clearly in the box provided.

This image shows a full page of white paper with horizontal dotted lines. The lines are evenly spaced and run across the width of the page, providing a guide for handwriting practice. There are no margins, text, or other markings on the page.

EXTRA SPACE

If you use this extra page, you MUST write the question number clearly in the box provided.

Question No.

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

01234020/F 2017

“*”Barcode Area”*”
Sequential Bar Code

FORM TP 2018017



TEST CODE **01234020**

JANUARY 2018

C A R I B B E A N E X A M I N A T I O N S C O U N C I L

**C A R I B B E A N S E C O N D A R Y E D U C A T I O N C E R T I F I C A T E[®]
E X A M I N A T I O N**

M A T H E M A T I C S

Paper 02 – General Proficiency

2 hours 40 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of TWO sections: I and II.
2. Section I has EIGHT questions and Section II has THREE questions.
3. Answer ALL questions in Section I and any TWO questions from Section II.
4. Write your answers in the booklet provided.
5. Do NOT write in the margins.
6. All working MUST be clearly shown.
7. **A list of formulae is provided on page 4 of this booklet.**
8. If you need to rewrite any answer and there is not enough space to do so on the original page, you must use the extra page(s) provided at the back of this booklet. **Remember to draw a line through your original answer.**
9. **If you use the extra page(s) you MUST write the question number clearly in the box provided at the top of the extra page(s) and, where relevant, include the question part beside the answer.**

Required Examination Materials

Electronic calculator
Geometry set

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

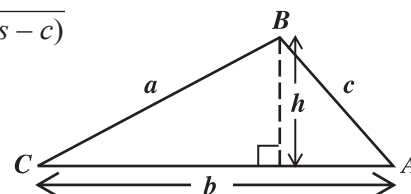
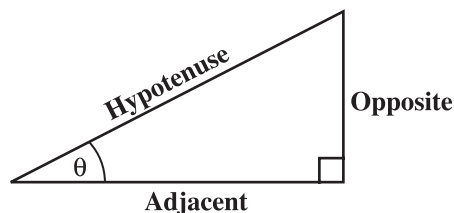
Copyright © 2017 Caribbean Examinations Council
All rights reserved.

01234020/JANUARY 2018

“*”Barcode Area”*”
Sequential Bar Code

LIST OF FORMULAE

Volume of a prism	$V = Ah$ where A is the area of a cross-section and h is the perpendicular length.
Volume of a cylinder	$V = \pi r^2 h$ where r is the radius of the base and h is the perpendicular height.
Volume of a right pyramid	$V = \frac{1}{3} Ah$ where A is the area of the base and h is the perpendicular height.
Circumference	$C = 2\pi r$ where r is the radius of the circle.
Arc length	$S = \frac{\theta}{360} \times 2\pi r$ where θ is the angle subtended by the arc, measured in degrees.
Area of a circle	$A = \pi r^2$ where r is the radius of the circle.
Area of a sector	$A = \frac{\theta}{360} \times \pi r^2$ where θ is the angle of the sector, measured in degrees.
Area of a trapezium	$A = \frac{1}{2} (a + b) h$ where a and b are the lengths of the parallel sides and h is the perpendicular distance between the parallel sides.
Roots of quadratic equations	If $ax^2 + bx + c = 0$, then $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
Trigonometric ratios	$\sin \theta = \frac{\text{length of opposite side}}{\text{length of hypotenuse}}$ $\cos \theta = \frac{\text{length of adjacent side}}{\text{length of hypotenuse}}$ $\tan \theta = \frac{\text{length of opposite side}}{\text{length of adjacent side}}$
Area of a triangle	Area of $\Delta = \frac{1}{2} bh$ where b is the length of the base and h is the perpendicular height. Area of $\Delta ABC = \frac{1}{2} ab \sin C$ Area of $\Delta ABC = \sqrt{s(s-a)(s-b)(s-c)}$ where $s = \frac{a+b+c}{2}$
Sine rule	$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$
Cosine rule	$a^2 = b^2 + c^2 - 2bc \cos A$



GO ON TO THE NEXT PAGE

SECTION I

Answer ALL questions in this section.

All working must be clearly shown.

1. (a) Using a calculator, or otherwise, calculate

(i) $5\frac{1}{2} \div 3\frac{2}{3} + 1\frac{4}{5}$, giving your answer as a fraction in its lowest terms

.....
(2 marks)

(ii) 165×0.38^2 , giving your answer as an EXACT value.

.....
(1 mark)

GO ON TO THE NEXT PAGE

(b) Write your answer in (a) (ii) correct to

(i) two decimal places

.....
(1 mark)

(ii) three significant figures

.....
(1 mark)

(iii) the nearest whole number.

.....
(1 mark)

- (c) Mr Adams invested \$5 000 at the credit union and received \$5 810, inclusive of simple interest, after 3 years.

Determine

- (i) the simple interest earned

.....
(1 mark)

- (ii) the annual interest rate paid by the credit union

.....
(2 marks)

- (iii) the length of time it will take for Mr Adams' investment to be **doubled**, at the same rate of interest.

.....
(2 marks)

Total 11 marks

GO ON TO THE NEXT PAGE

2. (a) Given that $a * b$ means $\sqrt{a + 4b}$, where the positive root is taken, determine

(i) the value of $1 * 2$

.....
(2 marks)

(ii) whether the operation denoted by $*$ is commutative. Justify your answer.

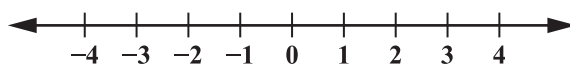
.....
(3 marks)

GO ON TO THE NEXT PAGE

- (b) (i) Solve the inequality $3 - 2x > 5$.

.....
(2 marks)

- (ii) Represent your answer in (b) (i) on the number line shown below.



(1 mark)

- (c) **Statement one:** Two adult tickets and three children tickets cost \$43.00.
Statement two: One adult ticket and one ticket for a child cost \$18.50.

- (i) Let x represent the cost of an adult ticket and y the cost of a ticket for a child. Write TWO equations in x and y to represent the information above.

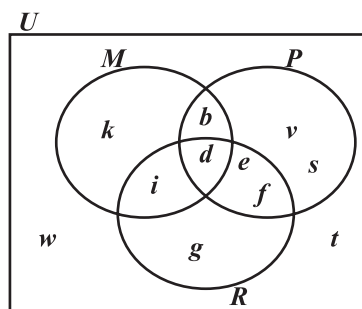
.....
(2 marks)

- (ii) Solve the equations to determine the cost of an adult ticket.

.....
(2 marks)

Total 12 marks

3. (a) The universal set $U = \{b, d, e, f, g, i, k, s, t, v, w\}$. The Venn diagram below shows U and three sets, M , P and R , which are subsets of U .



- (i) State the value of $n(P \cup R)$.

.....
(1 mark)

- (ii) List the members of

a) $M \cap P$

.....
(2 marks)

b) $M \cup R'$.

.....
(2 marks)

GO ON TO THE NEXT PAGE

- (b) (i) Using a ruler, a pencil and a pair of compasses, construct triangle PQR with $PQ = 8$ cm, angle $PQR = 120^\circ$ and $QR = 5$ cm.

(4 marks)

- (ii) Measure and state the length of the side PR .

(1 mark)

- (iii) On your diagram in (b) (i), construct the point S , such that $PQRS$ forms a parallelogram.

(2 marks)

Total 12 marks

GO ON TO THE NEXT PAGE

4. (a) The equation of a straight line, l , is given as $3x - 4y = 5$.

(i) Write the equation of the line, l , in the form $y = mx + c$.

.....
(2 marks)

(ii) Hence, determine the gradient of the line, l .

.....
(1 mark)

(iii) The point P with coordinates $(r, 2)$ lies on the line l . Determine the value of r .

.....
(2 marks)

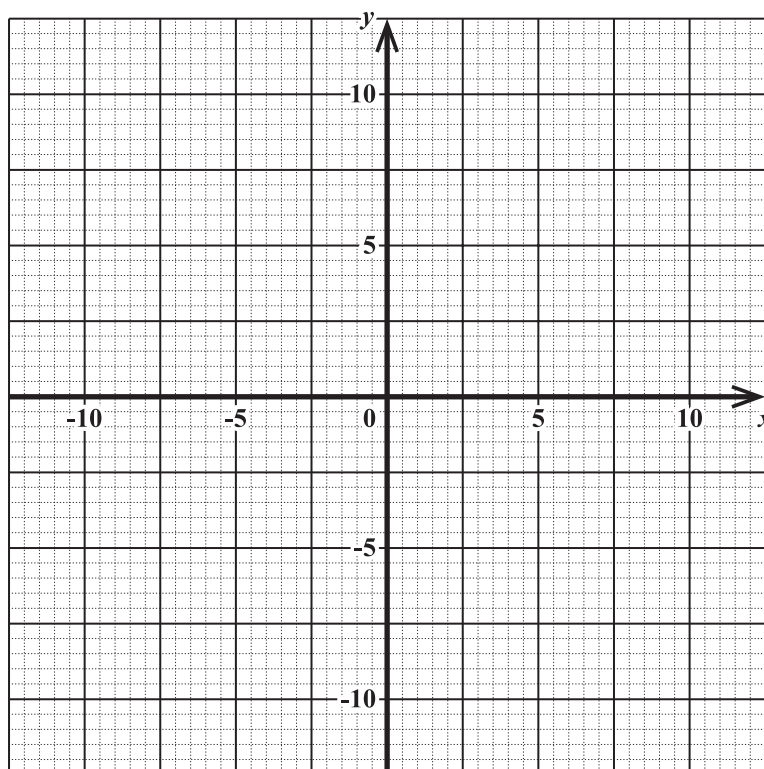
(iv) Find the equation of the straight line passing through the point $(6, 0)$ which is perpendicular to l .

.....
(2 marks)

GO ON TO THE NEXT PAGE

- (b) (i) Draw the straight lines $x + y = 10$ and $y = x$ on the grid below. (2 marks)
- (ii) On the same grid, shade the region which satisfies the FOUR inequalities

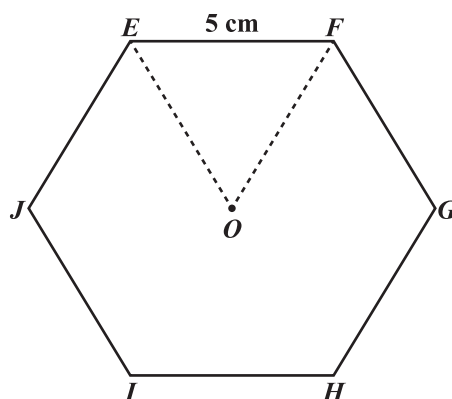
$$\begin{aligned} x &\geq 0 \\ y &\geq 0 \\ x + y &\leq 10 \text{ and} \\ x &\geq y. \end{aligned}$$



(2 marks)

Total 11 marks

5. (a) The regular polygon $EFGHIJ$, shown below, has centre O . Triangle OEF is equilateral and $EF = 5$ cm.



- (i) What is the name of the polygon shown above?

.....
(1 mark)

- (ii) Calculate the perimeter of the polygon $EFGHIJ$.

.....
(1 mark)

- (iii) Determine the size of each interior angle of the polygon.

.....
(2 marks)

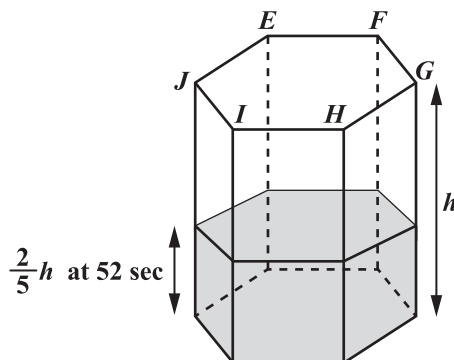
GO ON TO THE NEXT PAGE

- (iv) Show, by calculation, that the area of the polygon, to the nearest whole number, is 65 cm^2 .

(3 marks)

GO ON TO THE NEXT PAGE

- (b) A tank has a cross section with dimensions **identical** to the polygon $EFGHIJ$ in 5 (a). Water is poured into the tank at a rate of 75 cm^3 per second. After 52 seconds the tank is $\frac{2}{5}$ full.



- (i) Determine the capacity of the tank, in litres.

(3 marks)

GO ON TO THE NEXT PAGE

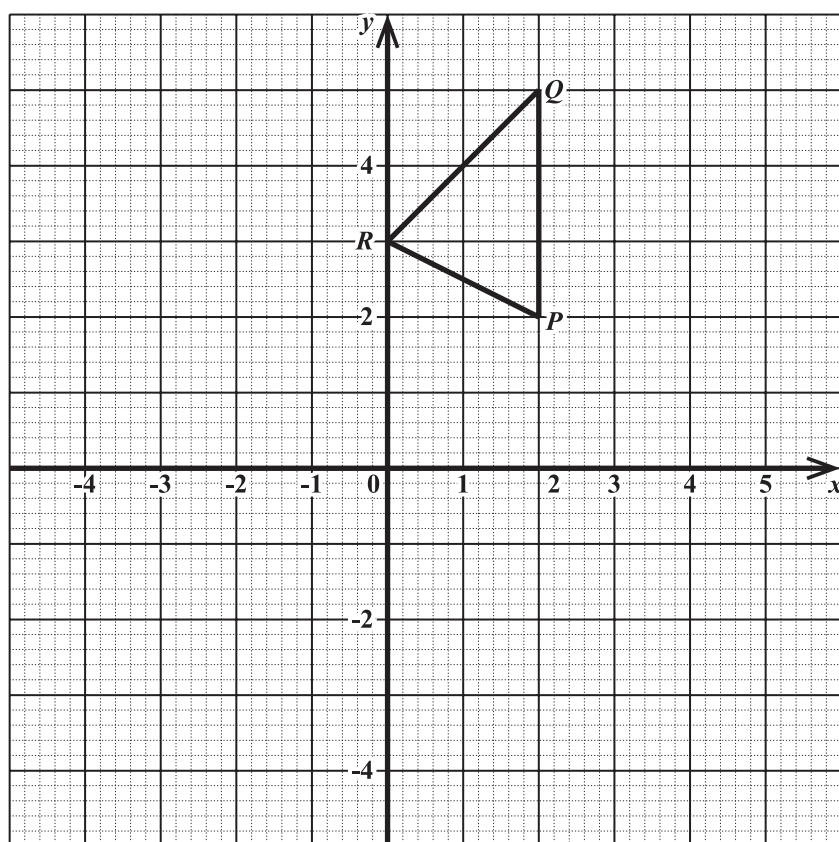
- (ii) Calculate the height, h , in metres, of the tank.

.....
(2 marks)

Total 12 marks

GO ON TO THE NEXT PAGE

6. The diagram below shows triangle PQR .



- (a) State the coordinates of R .

.....
(1 mark)

- (b) On the diagram above, draw

(i) $\triangle P'Q'R'$, a reflection of $\triangle PQR$ in the line $y = 1$ (2 marks)

(ii) $\triangle P''Q''R''$, a reflection of $\triangle P'Q'R'$ in the line $x = 0$. (2 marks)

GO ON TO THE NEXT PAGE

- (c) Describe, fully, the single transformation that maps $\triangle P''Q''R''$ onto $\triangle PQR$.

.....

.....

.....

(3 marks)

- (d) Triangle PQR undergoes an enlargement of scale factor 2. Calculate the area of its image.

.....

(2 marks)

Total 10 marks

7. (a) The marks obtained by 10 students in a test, scored out of 60, are shown below.

29	38	26	42	38
45	35	37	38	31

For the data above, determine

- (i) the range

.....
(1 mark)

- (ii) the median

.....
(1 mark)

- (iii) the interquartile range

.....
(2 marks)

- (iv) the probability that a student chosen at random scores less than half the total marks in the test.

.....
(2 marks)

GO ON TO THE NEXT PAGE

- (b) The frequency distribution below shows the masses, in kg, of 50 adults prior to the start of a fitness programme.

Mass (kg)	Midpoint	Frequency
60–64	62	8
65–69	67	11
70–74	72	15
75–79	77	9
80–84	82	5
85–89	87	2

On the grid **on page 23**, using a scale of 2 cm to represent 5 units on the x -axis and 1 cm to represent 1 unit on the y -axis, draw a frequency polygon to represent the information in the table. **(6 marks)**

Total 12 marks

GO ON TO THE NEXT PAGE

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

A full-page sheet of white graph paper featuring a uniform grid of small squares. The grid consists of thin black lines forming a continuous pattern across the entire page. There are no margins, text, or other markings present.

01234020/JANUARY 2018

“*”Barcode Area”*”
Sequential Bar Code

8. A sequence of figures is made from toothpicks of unit length. The first three figures in the sequence are shown below.



Figure 1

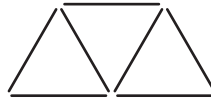


Figure 2



Figure 3

- (a) Draw Figure 4 of the sequence.

(2 marks)

- (b) Study the patterns of numbers in each row of the table below. Each row relates to one of the figures in the sequence of figures above. Some rows have not been included in the table.

Complete the rows numbered (i), (ii), (iii) and (iv).

	Figure	Number of Toothpicks in Pattern	Perimeter of Figure	
	1	3	$0 + 1 + 2 = 3$	
	2	7	$1 + 2 + 2 = 5$	
	3	11	$2 + 3 + 2 = 7$	
(i)	4			(2 marks)
	$\vdots$			
(ii)			$19 + 20 + 2 = 41$	(2 marks)
	$\vdots$			
(iii)		127		(2 marks)
	$\vdots$			
(iv)	n			(2 marks)

Total 10 marks

GO ON TO THE NEXT PAGE

SECTION II**Answer TWO questions in this section.****ALGEBRA AND RELATIONS, FUNCTIONS AND GRAPHS**

9. (a) (i) Show, by calculation, that the EXACT roots of the quadratic equation

$$x^2 + 2x - 5 = 0 \text{ are } -1 \pm \sqrt{6} .$$

.....
(3 marks)

GO ON TO THE NEXT PAGE

- (ii) Hence, or otherwise, solve the simultaneous equations

$$\begin{aligned} 2 + x &= y \\ xy &= 5. \end{aligned}$$

.....
(4 marks)

- (b) The incomplete table below shows values of x and y for the function $y = 2^x$ for integer values of x from -1 to 4 .

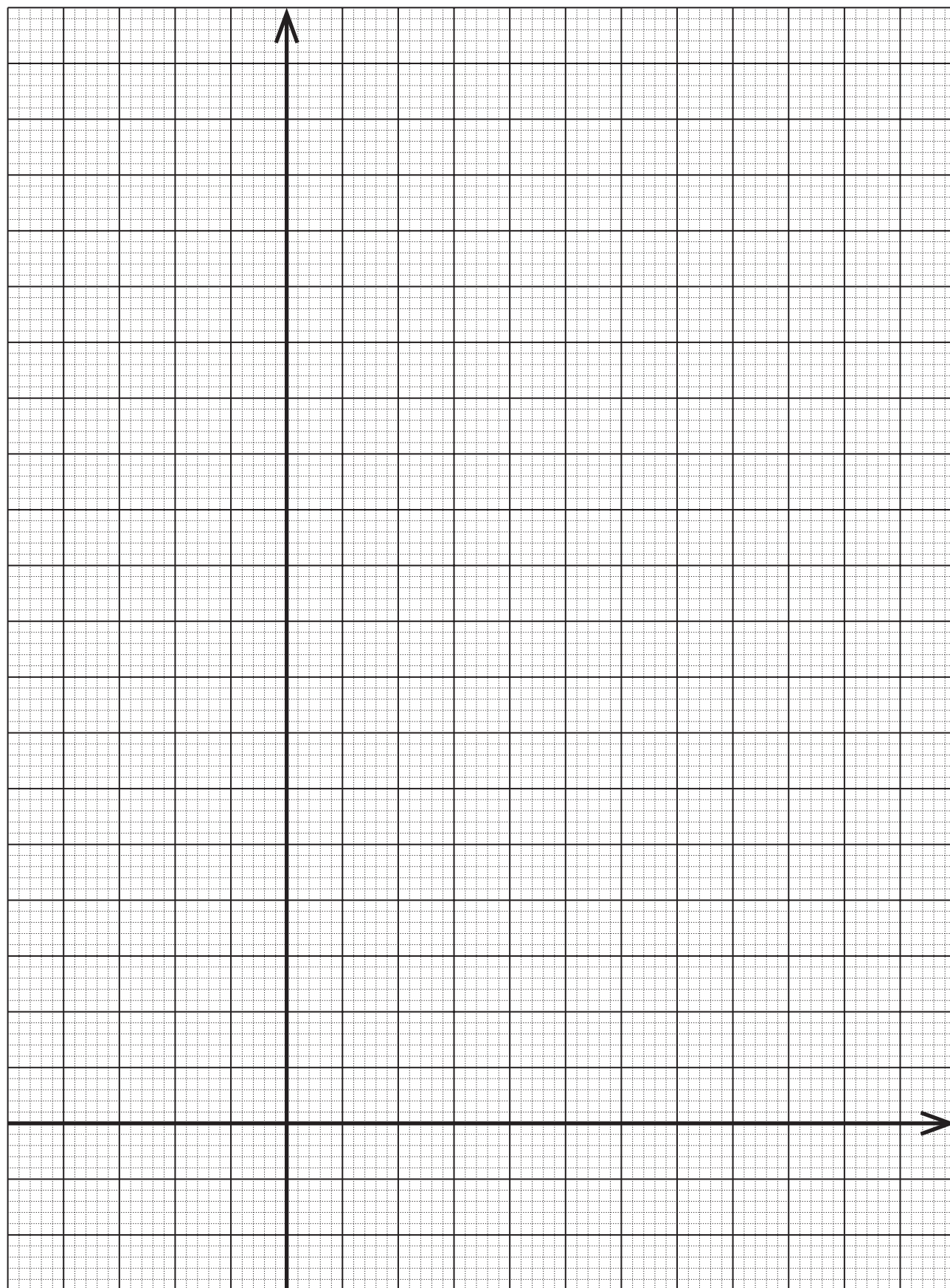
x	-1	0	1	2	3	4
y		1			8	

- (i) Complete the table for the function $y = 2^x$. (2 marks)
- (ii) On the grid provided **on page 27**, draw the graph of $y = 2^x$, using a scale of 2 cm to represent 1 unit on the x -axis and 1 cm to represent 1 unit on the y -axis. (4 marks)
- (iii) Drawing appropriate lines on your graph, determine the value of x for which $2^x = 11$.

.....
(2 marks)

Total 15 marks

GO ON TO THE NEXT PAGE



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

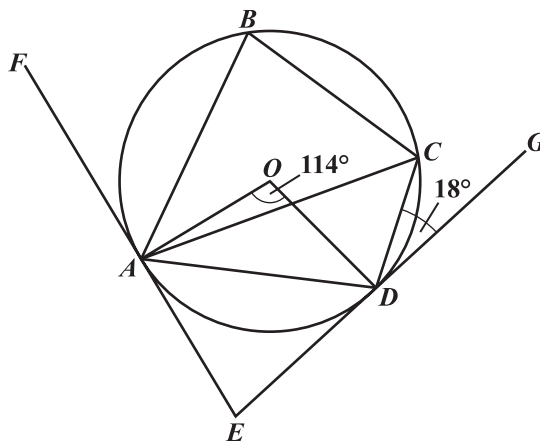
GO ON TO THE NEXT PAGE

01234020/JANUARY 2018

“*”Barcode Area*”
Sequential Bar Code

MEASUREMENT, GEOMETRY AND TRIGONOMETRY

10. (a) The diagram below, **not drawn to scale**, shows a circle with centre O . The points A , B , C and D are on the circumference of the circle. EA and ED are tangents to the circle at A and D respectively. $\angle AOD = 114^\circ$ and $\angle CDG = 18^\circ$.



Calculate, giving reasons for EACH step of your answer, the measure of

(i) $\angle ACD$

..... (2 marks)

(ii) $\angle AED$

..... (2 marks)

GO ON TO THE NEXT PAGE

(iii) $O\hat{A}C$

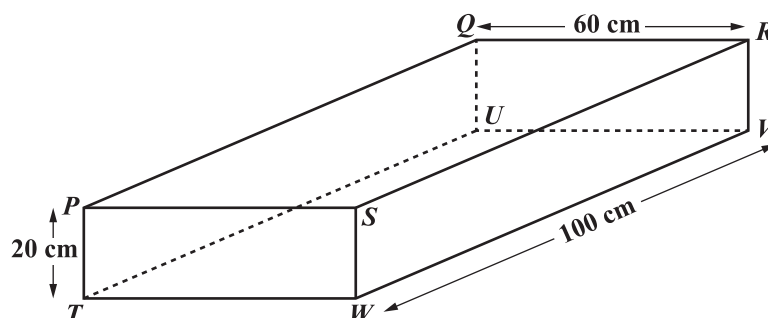
(2 marks)

(iv) $A\hat{B}C$.

(2 marks)

GO ON TO THE NEXT PAGE

- (b) The diagram below shows a cuboid.



Give your answer correct to one decimal place.

- (i) A straight adjustable wire connects R to P along the top of the cuboid. Calculate the length of the wire RP .

(1 mark)

- (ii) The connection at P is now adjusted and moved to T .

Calculate the length of the wire RT .

(2 marks)

GO ON TO THE NEXT PAGE

- (iii) Calculate the angle TRV .

.....
(2 marks)

- (iv) Complete the following statements:

The size of the angle through which the wire moves from RP to RT is $^{\circ}$.

An angle which is the same in size as RTV is
(2 marks)

Total 15 marks

GO ON TO THE NEXT PAGE

VECTORS AND MATRICES

11. (a) Given the vectors $\overrightarrow{OP} = \begin{pmatrix} 3 \\ 4 \end{pmatrix}$, $\overrightarrow{PQ} = \begin{pmatrix} -1 \\ 2 \end{pmatrix}$ and $\overrightarrow{RS} = \begin{pmatrix} 1 \\ 3 \end{pmatrix}$,

- (i) determine the vector $\overrightarrow{OQ}$

.....
(2 marks)

- (ii) show that $\overrightarrow{OQ}$ is parallel to $\overrightarrow{RS}$, giving a reason for your answer.

.....
(1 mark)

GO ON TO THE NEXT PAGE

- (b) XYZ is a triangle and M is the midpoint of XZ .

$$\overrightarrow{XY} = \mathbf{a} \text{ and } \overrightarrow{YZ} = \mathbf{b}.$$

Express the following vectors in terms of $\mathbf{a}$ and $\mathbf{b}$, simplifying your answers where possible:

(i) $\overrightarrow{XZ}$

(1 mark)

(ii) $\overrightarrow{MY}$

(3 marks)

(c) The matrices A and B are given as $A = \begin{bmatrix} -1 & 0 \\ 3 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} -3 & 2 \\ 1 & 1 \\ 4 & 6 \end{bmatrix}$.

(i) Determine A^{-1} , the inverse of A .

.....
(2 marks)

(ii) Show that $A^{-1}A = I$, the identity matrix.

.....
(2 marks)

GO ON TO THE NEXT PAGE

- (iii) Determine the matrix A^2 .

.....
(2 marks)

- (iv) a) Explain why the matrix product AB is NOT possible.

.....
.....
.....
(1 mark)

- b) Without calculating, state the order of the matrix product BA .

.....
(1 mark)

Total 15 marks

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.

01234020/JANUARY 2018

“*”Barcode Area”*” Sequential Bar Code

EXTRA SPACE

If you use this extra page, you MUST write the question number clearly in the box provided.

Question No.

01234020/JANUARY 2018

“*”Barcode Area”*”
Sequential Bar Code

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

EXTRA SPACE

If you use this extra page, you MUST write the question number clearly in the box provided.

Question No.

DO NOT WRITE IN THIS AREA

EXTRA SPACE

If you use this extra page, you MUST write the question number clearly in the box provided.

Question No.

01234020/JANUARY 2018

“*”Barcode Area”*”
Sequential Bar Code

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA