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.

"*"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 $ax^2 + bx + c = 0$,

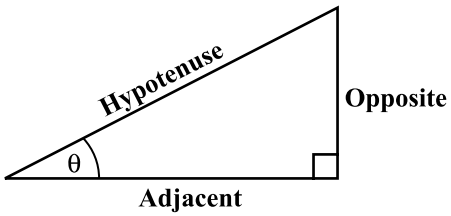
then $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Trigonometric ratios

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

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

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

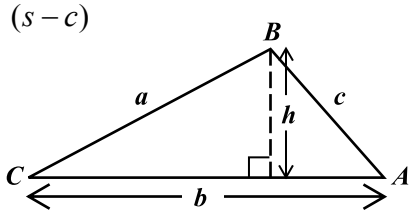


Area of triangle — Area of $\Delta = \frac{1}{2} bh$ where b is the length of the base and h is the perpendicular height.

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 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)

(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

2. (a) Simplify

$p^3q^2 \times pq^5$.

(2 marks)

(b) Express as a single fraction in its simplest form

$\frac{a}{5} + \frac{3a}{2}$.

(2 marks)

(c) Factorize completely:

(i) $x^2 - 5x + 4$

(2 marks)

(ii) $m^2 - 4n^2$

(2 marks)

(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

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

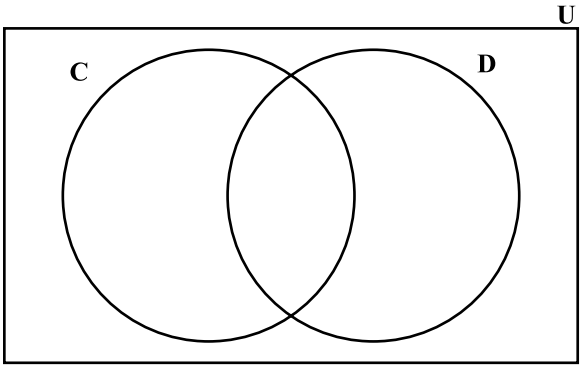
(i) Given that:

U = {families in the survey}

C = {families who owned cats}

D = {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.

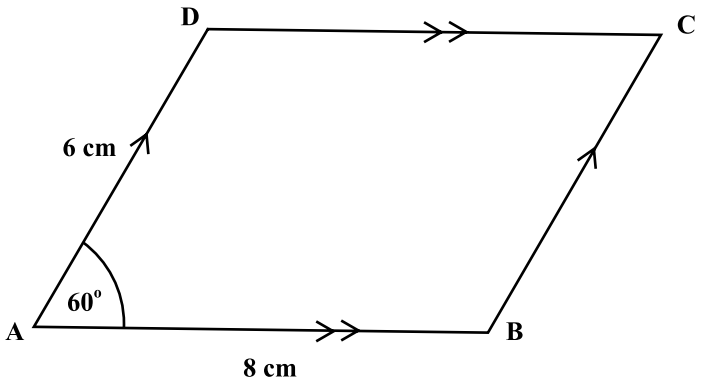
(1 mark)

(iii) Write an equation which may be used to solve for x.

(1 mark)

GO ON TO THE NEXT PAGE

(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 $AB = 8$ cm, $AD = 6$ cm and $\angle DAB = 60^{\circ}$.

Marks will be awarded for construction lines clearly shown.

(6 marks)

Total 12 marks

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.

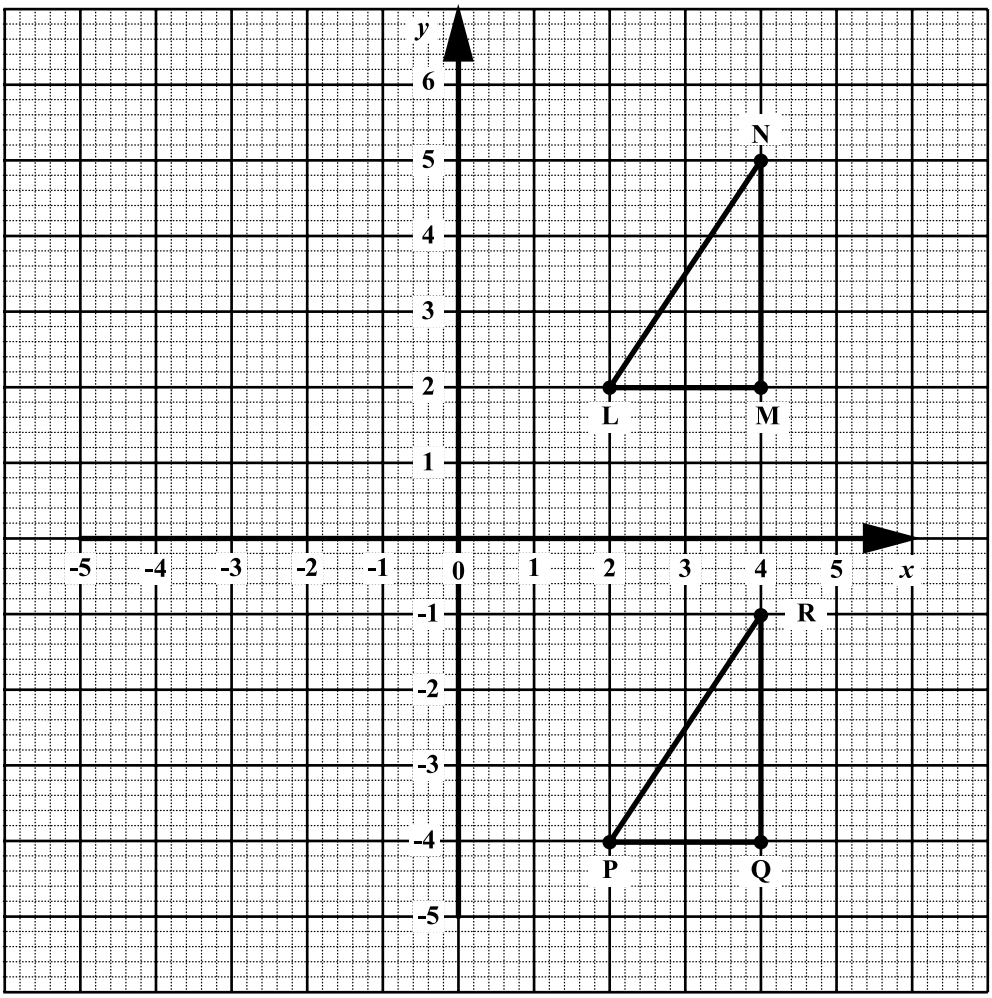
(1 mark)

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

5. The diagram below shows ΔLMN and its image ΔPQR after a transformation.



(i) Write down the coordinates of N. ..... **(1 mark)**

(ii) On the grid above, draw ΔFGH, the reflection of ΔLMN in the y-axis. **(4 marks)**

(iii) Using vector notation, describe the transformation which maps ΔLMN onto ΔPQR.

.....

.....

(2 marks)

(iv) Complete the following statement:

ΔPQR is mapped onto ΔFGH by a combination of two transformations. First, ΔPQR is mapped onto ΔLMN by a ..... , parallel to the ..... ; then ΔLMN is mapped onto ΔFGH by a ..... in the ..... .

(3 marks)

(v) ΔPQR and ΔFGH are congruent.
State TWO reasons why they are congruent.

.....

.....

.....

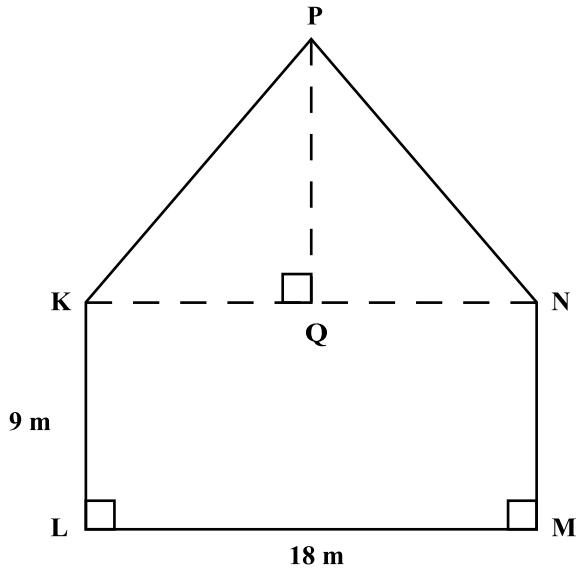
.....

.....

(2 marks)

Total 12 marks

6. (a) The diagram below is a scale drawing of the side view of a building. Q is the midpoint of KN, and $\angle KLM = \angle LMN = 90^{o}$.



(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)

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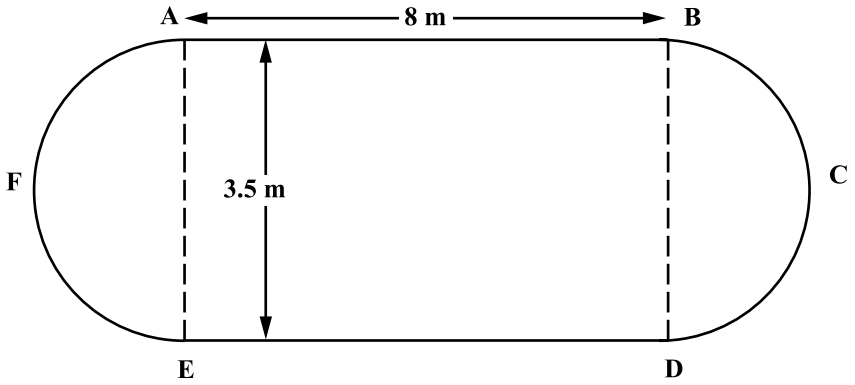
(b) The diagram below, **not drawn to scale**, shows the plan of a swimming pool in the shape of a rectangle and two semicircles. The rectangle has dimensions 8 metres by 3.5 metres.

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



(i) State the length of the diameter of the semicircle, *AFE*.

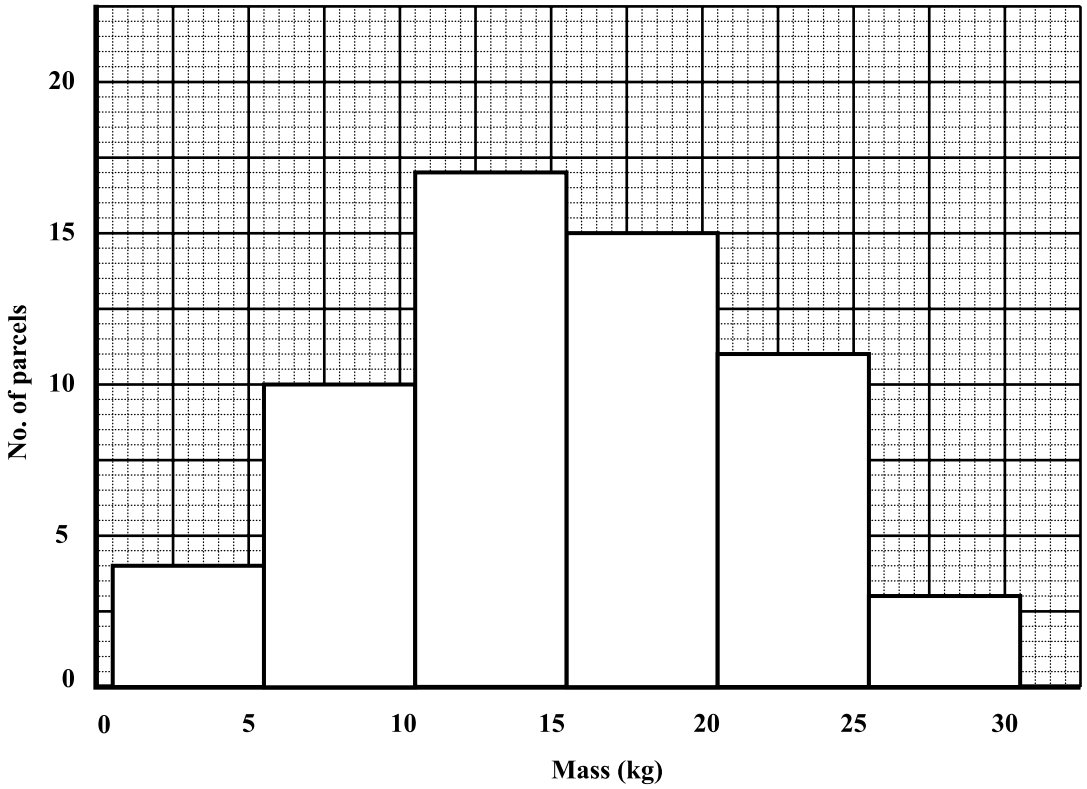
(1 mark)

(ii) Calculate the perimeter of the swimming pool.

(3 marks)

Total 11 marks

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

(c) Use the graph drawn at (b) to estimate the median mass of the parcels.

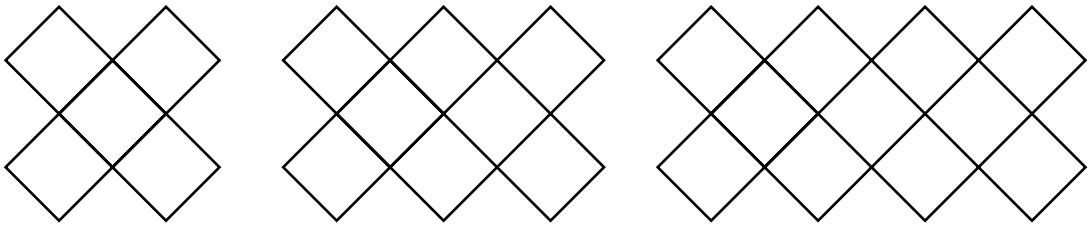
Draw lines on your graph to show how this estimate was obtained. (2 marks)

Total 10 marks

NOTHING HAS BEEN OMITTED.

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)

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(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

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)

(iii) Write an expression, in terms of x, for fg (x).

(2 marks)

(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

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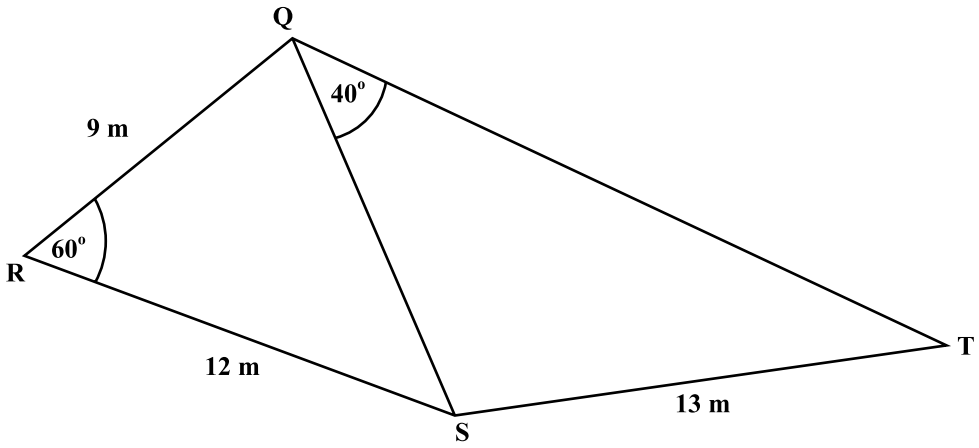
MEASUREMENT, GEOMETRY AND TRIGONOMETRY

10. (a) On the diagram below, **not drawn to scale**, RQ = 9 m, RS = 12 m, ST = 13 m, $<QRS = 60^o$ and $<SQT = 40^o$.



Calculate, correct to 1 decimal place,

(i) the length QS

(2 marks)

(ii) the measure of $<QTS$

(2 marks)

GO ON TO THE NEXT PAGE

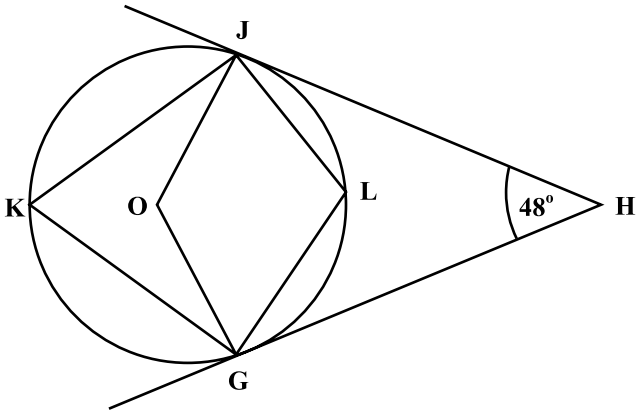
(iii) the area of triangle QRS

(2 marks)

(iv) the perpendicular distance from Q to RS.

(1 mark)

(b) The diagram below, **not drawn to scale**, shows a circle with centre *O*. *HJ* and *HG* are tangents to the circle and $<JHG = 48^{o}$.



Calculate, **giving the reason for each step of your answer**, the measure of:

(i) $<OJH$

(2 marks)

(ii) $<JOG$

(2 marks)

(iii) $\angle JKG$

(2 marks)

(iv) $\angle JLG$

(2 marks)

Total 15 marks

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)

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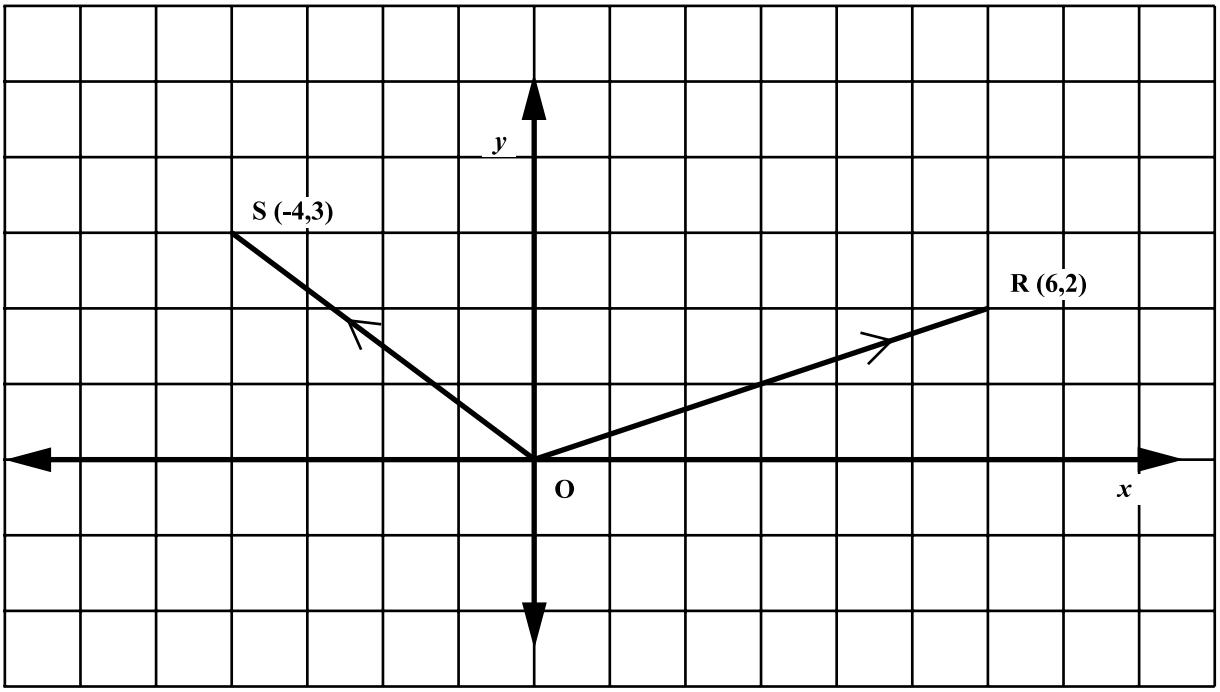
(b) The diagram below shows two position vectors $\overrightarrow{OR}$ and $\overrightarrow{OS}$ such that $R(6, 2)$ and $S(-4, 3)$.



Write as a column vector in the form $\begin{pmatrix} x \\ y \end{pmatrix}$:

(i) $\overrightarrow{OR}$

(1 mark)

(ii) $\overrightarrow{OS}$

(1 mark)

(iii) $\overrightarrow{SR}$

(2 marks)

GO ON TO THE NEXT PAGE

(iv) Find $\left| \overrightarrow{OS} \right|$.

(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.

EXTRA SPACE

If you use this extra page, you MUST write the question number clearly in the box provided.

Question No.

EXTRA SPACE

If you use this extra page, you MUST write the question number clearly in the box provided.

Question No.

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DO NOT WRITE ON THIS PAGE

CANDIDATE'S RECEIPT

INSTRUCTIONS TO CANDIDATE:

1. **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:

FULL NAME: _____

(BLOCK LETTERS)

Signature: _____

Date: _____

2. **Ensure that this slip is detached by the Supervisor or Invigilator and given to you when you hand in this booklet.**

3. **Keep it in a safe place until you have received your results.**

INSTRUCTION TO SUPERVISOR/INVIGILATOR:

Sign the declaration below, detach this slip and hand it to the candidate as his/her receipt for this booklet collected by you.

I hereby acknowledge receipt of the candidate's booklet for the examination stated above.

Signature: _____
Supervisor/Invigilator

Date: _____

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

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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)

"*"Barcode Area"*"
Current Bar Code

DATE OF BIRTH | D | D | M | M | Y | Y | Y | Y |

HOW MANY ADDITIONAL PAGES HAVE YOU USED IN TOTAL?	

SIGNATURE _____

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