

TEST CODE **01234020**

**FORM TP 2008100**

MAY/JUNE 2008

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

**Paper 02 – General Proficiency**

*2 hours 40 minutes*

**21 MAY 2008 (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.

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**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.**

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01234020/F 2008

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

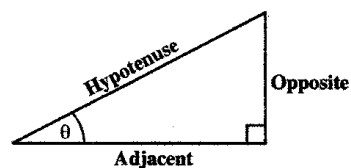
$$\text{then } x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Trigonometric ratios

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

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

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



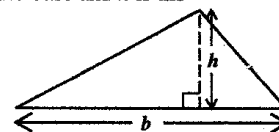
Area of triangle

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

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

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

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

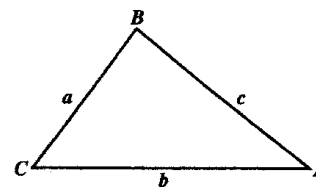


Sine rule

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

Cosine rule

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



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## SECTION I

Answer ALL the questions in this section.

All working must be clearly shown.

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

$$(3.9 \times 0.27) + \sqrt{0.6724} . \quad (2 \text{ marks})$$

- (ii) Express as a single fraction

$$\frac{2\frac{1}{2} - \frac{4}{5}}{\frac{3}{4}} . \quad (3 \text{ marks})$$

- (b) In this question, use CAN \$1.00 = JA \$72.50.

- (i) On a vacation in Canada, Steve used his credit card to buy a camera for CAN \$250.00.

What is the value of the camera in Jamaican dollars? (2 marks)

- (ii) Steve's credit card limit is JA \$30 000.00. After buying the camera, how many Canadian dollars does he have left on his credit card for spending? (3 marks)

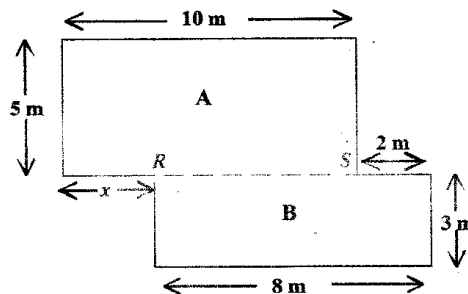
**Total 10 marks**

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4. (a) A Universal set,  $U$ , is defined as  
 $U = \{15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25\}$ .
- Sets  $M$  and  $N$  are subsets of  $U$  such that  
 $M = \{\text{Prime Numbers}\}$  and  $N = \{\text{Even Numbers}\}$ .
- (i) Draw a Venn diagram to represent the sets  $M$ ,  $N$  and  $U$ . ( 5 marks)
- (ii) List the elements of the set  $(M \cup N)'$ . ( 1 mark )
- (b) (i) Using only a pair of compasses, a ruler and a pencil, construct parallelogram  $ABCD$  in which  $AB = AD = 7$  cm and the angle  $BAD$  is  $60^\circ$ . ( 5 marks)
- (ii) Measure and write down the length of the diagonal  $AC$ . ( 1 mark )

Total 12 marks

5. The diagram below, not drawn to scale, represents the plan of a floor. The broken line  $RS$ , divides the floor into two rectangles,  $A$  and  $B$ .

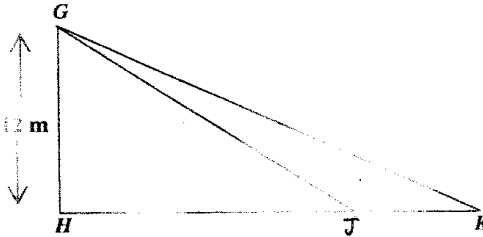


- (a) (i) Calculate the length of  $RS$ . ( 1 mark )
- (ii) Hence state the value of  $x$ . ( 1 mark )
- (b) Calculate the perimeter of the entire floor. ( 3 marks)
- (c) Calculate the area of the entire floor. ( 3 marks)
- (d) Section  $A$  of the floor is to be covered with flooring boards measuring 1 m by 20 cm. How many flooring boards are needed for covering Section  $A$ ? ( 4 marks)

Total 12 marks

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6. (a) In the diagram below, **not drawn to scale**,  $GH$  is a vertical pole standing on a horizontal plane and  $H$ ,  $J$  and  $K$  are points on the horizontal plane.

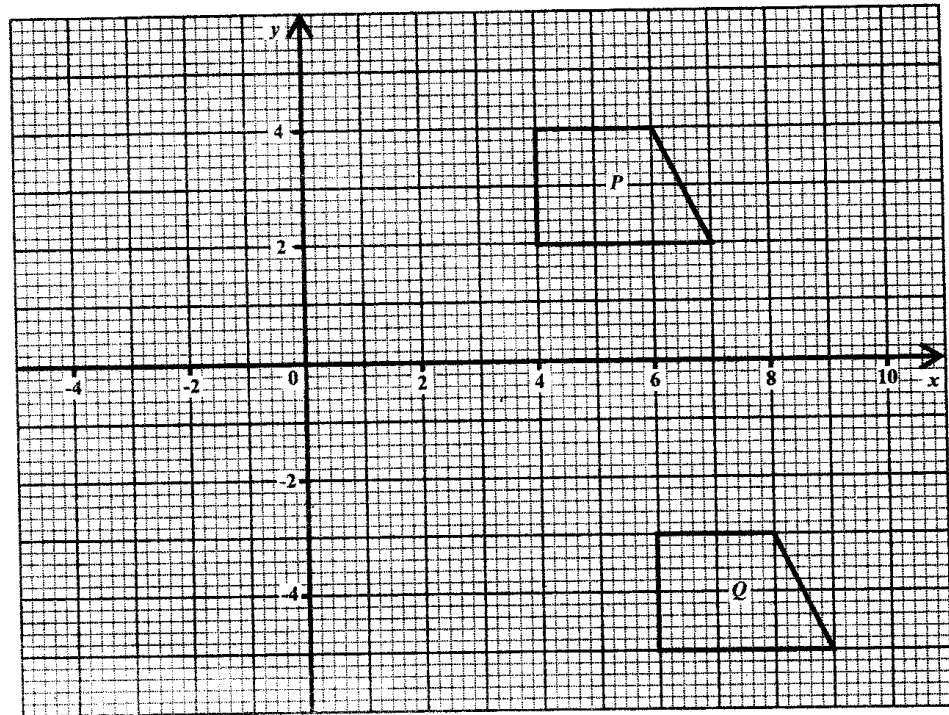


$GH = 12$  metres and the angles of elevation of the top of the pole  $G$  from  $J$  and  $K$  are  $32^\circ$  and  $27^\circ$  respectively.

- (i) Copy the diagram and insert the angles of elevation. ( 1 mark )
- (ii) Calculate to **one decimal place**
- the length of  $HJ$
  - the length of  $JK$ . ( 5 marks)

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



(i) The figure labelled  $P$  undergoes a transformation, such that its image is  $Q$ . Describe this transformation completely. ( 2 marks)

(ii) On the answer sheet provided, draw and label

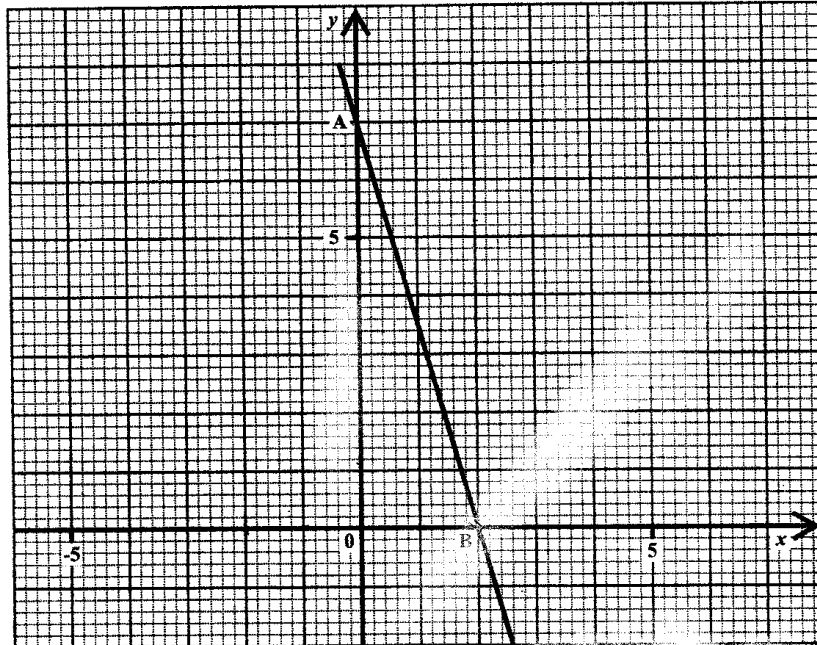
a) the line  $y = x$

b)  $S$ , the image of  $P$  under a reflection in the line  $y = x$ . ( 4 marks)

**Total 12 marks**

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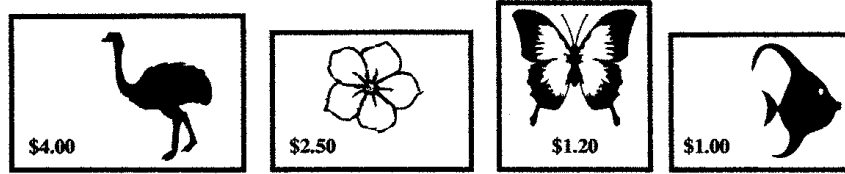
7. The diagram below shows the graph of a straight line passing through the points  $A$  and  $B$ .



- (a) The equation of the line above is  $y = mx + c$ .
- State the value of  $c$ . ( 1 mark )
  - Determine the value of  $m$ . ( 2 marks )
  - Determine the coordinates of the mid-point of the line segment  $AB$ . ( 2 marks )
- (b) The point  $(-2, k)$  lies on the line. Determine the value of  $k$ . ( 3 marks )
- (c) Determine the coordinates of the point of intersection of the line  $y = x - 2$  and the line shown above. ( 4 marks )

**Total 12 marks**

8. Annie went to the post office and bought a collection of SIX of each of the following stamps.



- (a) What was the TOTAL cost of the stamps? ( 2 marks)
- (b) She had to post a parcel and the total cost of postage was \$25.70. What stamps can she select from the collection, to make up this amount if she must use
- (i) as many \$4.00 stamps as possible? ( 3 marks)
- (ii) all her \$1.00 stamps? ( 2 marks)
- (c) (i) What is the LARGEST number of stamps that she can use from the collection to post the parcel?
- (ii) List the selection of stamps she can use. ( 3 marks)

**Total 10 marks**



## SECTION II

Answer TWO questions in this section.

## RELATIONS, FUNCTIONS AND GRAPHS

9. (a) Simplify

(i)  $x^2 \times x^3 \div x^4$  ( 1 mark )

(ii)  $a^{\frac{3}{2}}b^{\frac{5}{2}} \times \sqrt{ab^3}$ . ( 2 marks )

(b) If  $f(x) = 2x - 3$ , find the value of

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

(ii)  $f^{-1}(0)$  ( 2 marks )

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

(c) The temperature,  $K$ , of a liquid  $t$  minutes after heating is given in the table below.

$t$ (time in minutes)	0	10	20	30	40	50	60
$K$ (Temp. in $^{\circ}\text{C}$ )	84	61	40	29	27	26	25

(i) Using a scale of 2 cm to represent 10 seconds on the horizontal axis and a scale of 2 cm to represent 10 degrees on the vertical axis, construct a temperature-time graph to show how the liquid cools in the 60 minute interval.

Draw a smooth curve through all the plotted points. ( 4 marks )

(ii) Use your graph to estimate

a) the temperature of the liquid after 15 minutes

b) the rate of cooling of the liquid at  $t = 30$  minutes. ( 3 marks )

Total 15 marks

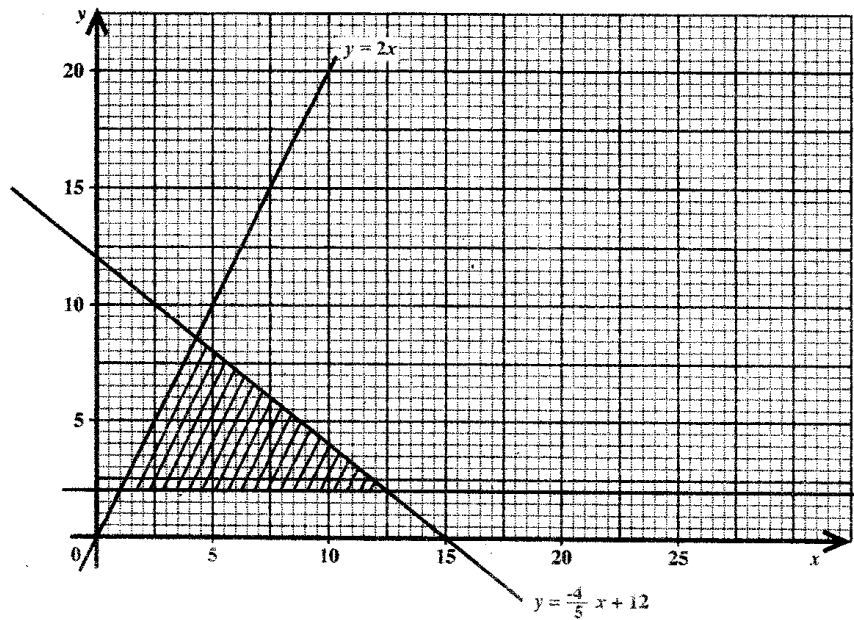
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10. (a) Solve the following pair of equations for  $x$  and  $y$ :

$$\begin{aligned} y + 4x &= 27 \\ xy + x &= 40 \end{aligned}$$

(6 marks)

- (b) The shaded area in the diagram below shows the solution of a set of inequalities in  $x$  and  $y$ . The variable  $x$  represents the number of boys in a cricket club and  $y$  represents the number of girls in the cricket club.



Use the graph above to answer the questions which follow.

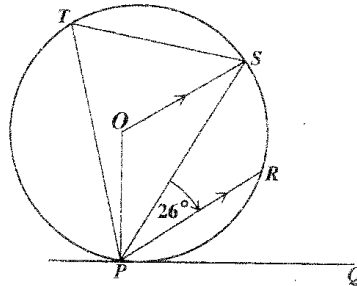
- (i) State, using arguments based on the graph, whether the cricket club can have as members:
- 10 boys and 5 girls
  - 6 boys and 6 girls. (2 marks)
- (ii) Write down the set of THREE inequalities that define the shaded region. (4 marks)
- (iii) A company sells uniforms for the club and makes a profit of \$3.00 on a boy's uniform and \$5.00 on a girl's uniform.
- Write an expression in  $x$  and  $y$  that represents the total profit made by the company on the sale of uniforms.
  - Calculate the **minimum** profit the company can make. (3 marks)

**Total 15 marks**

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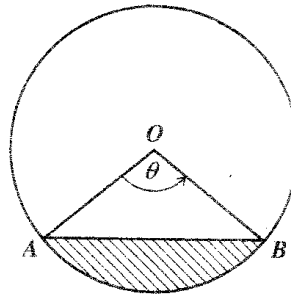
## GEOMETRY AND TRIGONOMETRY

11. (a) In the diagram below, **not drawn to scale**,  $PQ$  is a tangent to the circle, centre  $O$ .  $PR$  is parallel to  $OS$  and angle  $SPR = 26^\circ$ .



Calculate, **giving reasons for your answer**, the size of

- (i) angle  $PTS$  ( 2 marks)
- (ii) angle  $RPQ$ . ( 2 marks)
- (b) In the diagram below, **not drawn to scale**,  $O$  is the centre of the circle of radius 8.5 cm and  $AB$  is a chord of length 14.5 cm.



- (i) Calculate the value of  $\theta$  to the nearest degree. ( 3 marks)
- (ii) Calculate the area of triangle  $AOB$ . ( 2 marks)
- (iii) Hence, calculate the area of the shaded region. [Use  $\pi = 3.14$ ]. ( 3 marks)
- (iv) Calculate the length of the major arc  $AB$ . ( 3 marks)

**Total 15 marks**

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12. A ship leaves Port  $R$ , sails to Port  $S$  and then to Port  $T$ .

The bearing of  $S$  from  $R$  is  $112^\circ$ .

The bearing of  $T$  from  $S$  is  $033^\circ$ .

The distance  $RT$  is 75 km and the distance  $RS$  is 56 km.

(a) Draw a diagram showing the journey of the ship from  $R$  to  $S$  to  $T$ .  
Show on your diagram

- (i) the North direction ( 1 mark )
- (ii) the bearings  $112^\circ$  and  $033^\circ$  ( 2 marks)
- (iii) the points  $R$ ,  $S$  and  $T$  ( 1 mark )
- (iv) the distances 75 km and 56 km. ( 1 mark )

(b) Calculate

- (i) the size of angle  $RST$  ( 1 mark )
- (ii) the size of angle  $RTS$  ( 3 marks)
- (iii) the bearing of  $R$  from  $T$ . ( 2 marks)

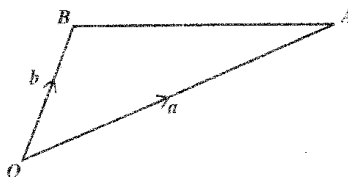
(c) The ship leaves Port  $T$  and travels due west to a point  $X$  which is due north of  $R$ .

- (i) Show on your diagram the journey from  $T$  to  $X$ . ( 1 mark )
- (ii) Calculate the distance  $TX$ . ( 3 marks)

**Total 15 marks**

## VECTORS AND MATRICES

13. The position vectors of  $A$  and  $B$  relative to the origin are  $\mathbf{a}$  and  $\mathbf{b}$  respectively.



The point  $P$  is on  $OA$  such that  $OP = 2PA$ .

The point  $M$  is on  $BA$  such that  $BM = MA$ .

- (a) Copy the diagram and complete it to show the points of  $P$  and  $M$ . (2 marks)
- (b)  $OB$  is produced to  $N$  such that  $OB = BN$ .
- (i) Show the position of  $N$  on your diagram. (1 mark)
- (ii) Express in terms of  $\mathbf{a}$  and  $\mathbf{b}$  the vectors  $\overrightarrow{AB}$ ,  $\overrightarrow{PA}$  and  $\overrightarrow{PM}$ . (5 marks)
- (c) Use a vector method to prove that  $P$ ,  $M$  and  $N$  are collinear. (4 marks)
- (d) Calculate the length of  $AN$  if

$$\mathbf{a} = \begin{pmatrix} 6 \\ 2 \end{pmatrix} \text{ and } \mathbf{b} = \begin{pmatrix} 1 \\ 2 \end{pmatrix} \quad (3 \text{ marks})$$

Total 15 marks

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14. (a)  $X$  and  $Y$  are two matrices where

$$X = \begin{pmatrix} -2 & 0 \\ 5 & 1 \end{pmatrix} \text{ and } Y = \begin{pmatrix} 4 & -1 \\ 3 & 7 \end{pmatrix}.$$

Evaluate  $X^2 + Y$ . ( 4 marks)

- (b) The matrix  $\begin{pmatrix} 1 & 2 \\ 1 & 3 \end{pmatrix}$  maps  $Q(1, 2)$  to  $Q'(5, 7)$ .

Find the  $2 \times 2$  matrix which maps  $Q'$  back to  $Q$ . ( 2 marks)

- (c) The vertices of triangle  $DEF$  are

$D(5, 12)$ ,  $E(2, 7)$  and  $F(8, 4)$ .

- (i) Triangle  $DEF$  undergoes an enlargement with centre,  $O$ , and scale factor,  $k$ . Its image is  $D'E'F'$  where

$$D(5, 12) \rightarrow D'(7.5, 18).$$

a) Determine the value of  $k$ .

b) Hence write down the coordinates of  $E'$  and  $F'$ . ( 4 marks)

- (ii)  $D'E'F'$  undergoes a clockwise rotation of  $90^\circ$  about the origin.

a) Determine the  $2 \times 2$  matrix that represents a clockwise rotation of  $90^\circ$  about the origin.

b) Determine the coordinates of  $D''E''F''$ , the image of  $D'E'F'$ , under this rotation.

c) Determine the  $2 \times 2$  matrix that maps triangle  $DEF$  onto triangle  $D''E''F''$ . ( 5 marks)

**Total 15 marks**

**END OF TEST**