

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.**

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01234020/F 2013



## 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**

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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**

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.

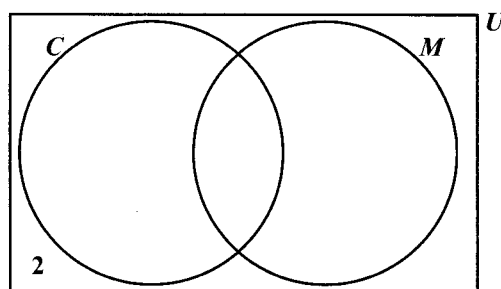
20 students used mobile phones

$4x$  students used ONLY cameras

$x$  students used BOTH mobile phones and cameras

2 students did not use either cameras or phones.

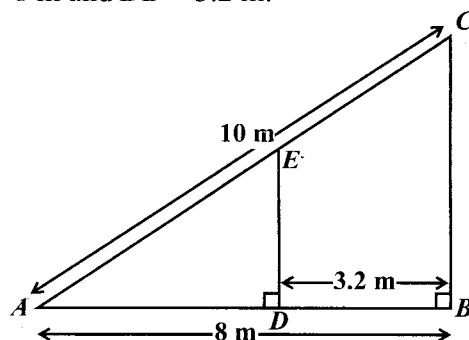
- (i) Copy the Venn diagram below and complete it to show, in terms of  $x$ , the number of students in each region. **(3 marks)**



- (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.

$$\angle ABC = \angle ADE = 90^\circ.$$

$$AC = 10 \text{ m}, AB = 8 \text{ m} \text{ and } DB = 3.2 \text{ m}.$$

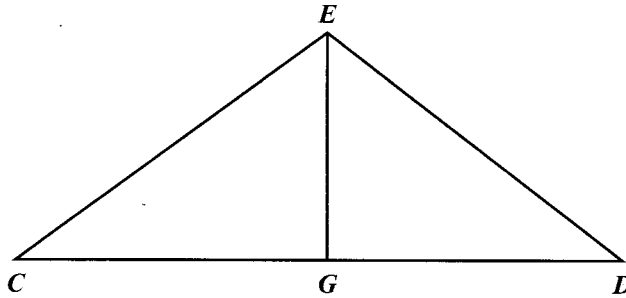


- (i) Calculate the length of  $BC$ . **(2 marks)**
- (ii) Explain why triangles  $ABC$  and  $ADE$  are similar. **(1 mark)**
- (iii) Determine the length of  $DE$ . **(3 marks)**

**Total 12 marks**

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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**

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**

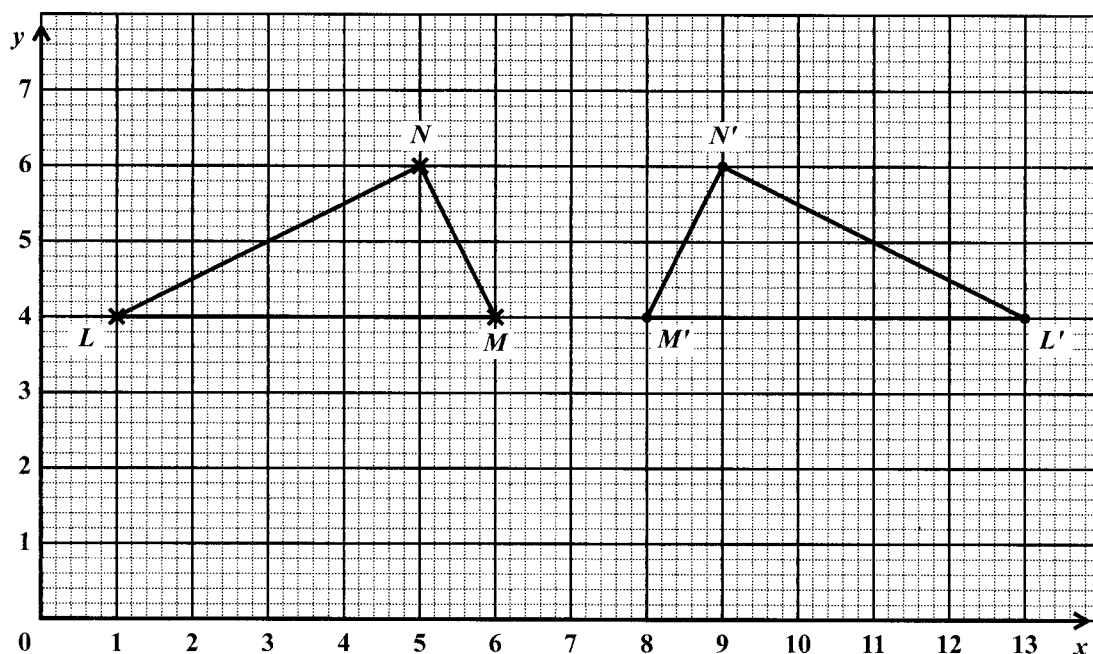
6. (a) A car, travelling along a straight road at a constant speed of 54 km/h, takes 20 seconds to travel the distance between two sign posts.

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**

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**



8. An answer sheet is provided for this question.

The drawings below show the first three diagrams in a sequence.

Diagram 1

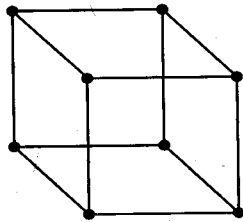


Diagram 2

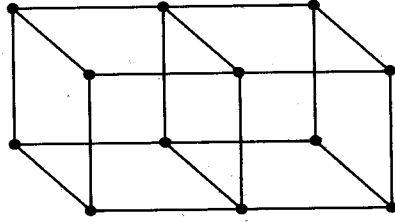
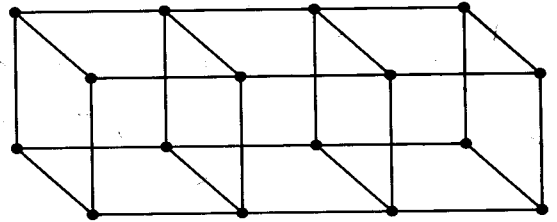
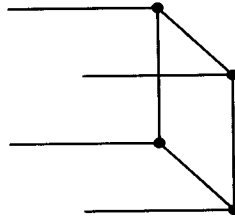


Diagram 3



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	_____	_____
(ii) 20	_____	_____

(2 marks)

(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

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## 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

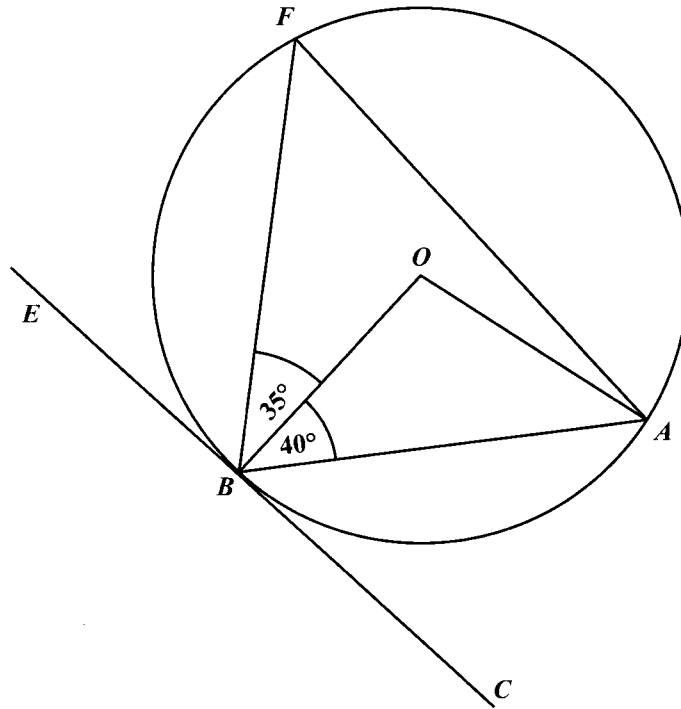
$$y \leq 2x.$$

- (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**

## 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  $\angle OBF = 35^\circ$ .

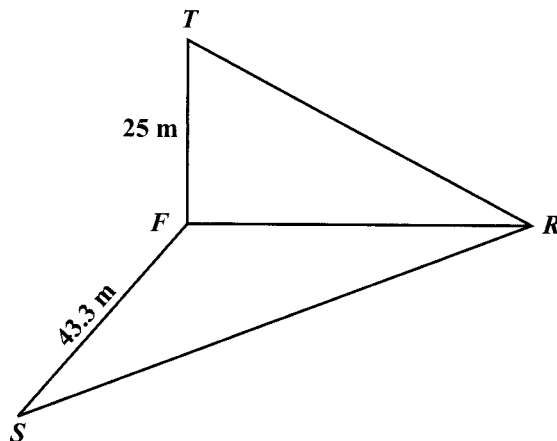


Calculate, **giving reasons for your answer**, the measure of

- |       |              |                  |
|-------|--------------|------------------|
| (i)   | $\angle EBF$ | <b>(1 mark)</b>  |
| (ii)  | $\angle BOA$ | <b>(2 marks)</b> |
| (iii) | $\angle AFB$ | <b>(2 marks)</b> |
| (iv)  | $\angle OAF$ | <b>(2 marks)</b> |

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- (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  $27^\circ$ .  $R$  is due east of  $F$  and  $S$  is due south of  $F$ .  $SF = 43.3$  m.



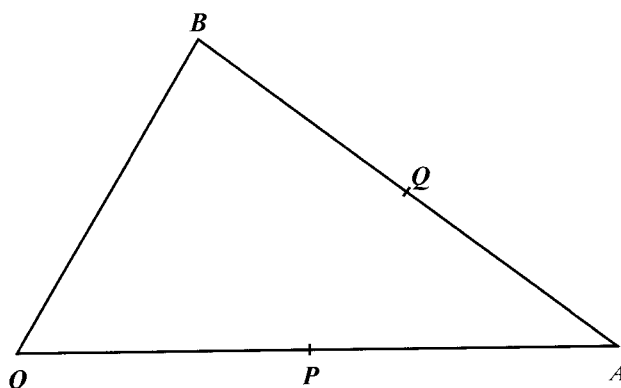
- (i) Sketch **separate** diagrams of the triangles  $RFT$ ,  $TFS$  and  $SFR$ . Mark on EACH diagram the given measures of sides and angles. **(3 marks)**
- (ii) Show, by calculation, that  $RF = 49.1$  m. **(2 marks)**
- (iii) Calculate the length of  $SR$  correct to 1 decimal place. **(1 mark)**
- (iv) Calculate the angle of elevation of the top of the tower,  $T$ , from  $S$ . **(2 marks)**

**Total 15 marks**

## 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.