

CARIBBEAN SECONDARY EDUCATION CERTIFICATE EXAMINATION (JANUARY 2015)

MATHEMATICS – Paper 02 General Proficiency.

*2 hours and 40 minutes*

Section I (Answer ALL questions)

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

$$(12.8)^2 - (30 \div 0.375) \quad [3 \text{ marks}]$$

- (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\$. [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

$$\frac{a}{3} + \frac{3a}{2} \quad [2 \text{ marks}]$$

(c) Factorize completely:

(i)  $x^2 - 5x + 4$  [2 marks]

(ii)  $m^2 - 4n^2$  [2 marks]

(d) Solve for  $x$

(i)  $2x - 7 \leq 3$  [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

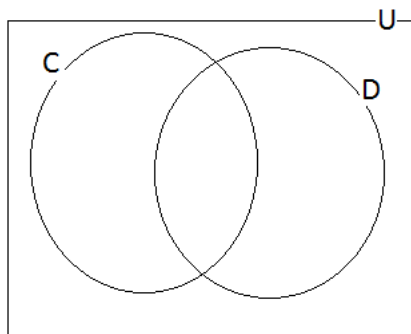
(i) Given that:

$U = \{ \text{families in the survey} \}$

$C = \{ \text{families who owned cats} \}$

$D = \{ \text{families who owned dogs} \}$

Use the given information copy and complete the Venn diagram below.

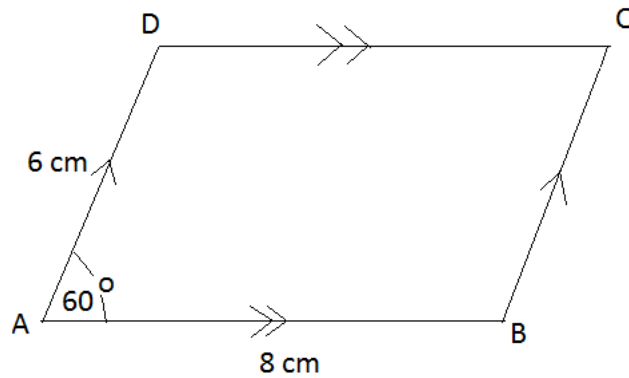


[4 marks]

(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 a 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**

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  $y = 40x + 75$ .

|                                |    |     |   |     |   |     |     |
|--------------------------------|----|-----|---|-----|---|-----|-----|
| <b>x (time in hours)</b>       | 0  | 1   | 2 | 3   | 4 | 5   | 6   |
| <b>y (total charges in \$)</b> | 75 | 115 |   | 195 |   | 275 | 315 |

[2 marks]

- (b) On graph paper, using a scale of 2cm to represent one hour on the x-axis and 2cm 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]

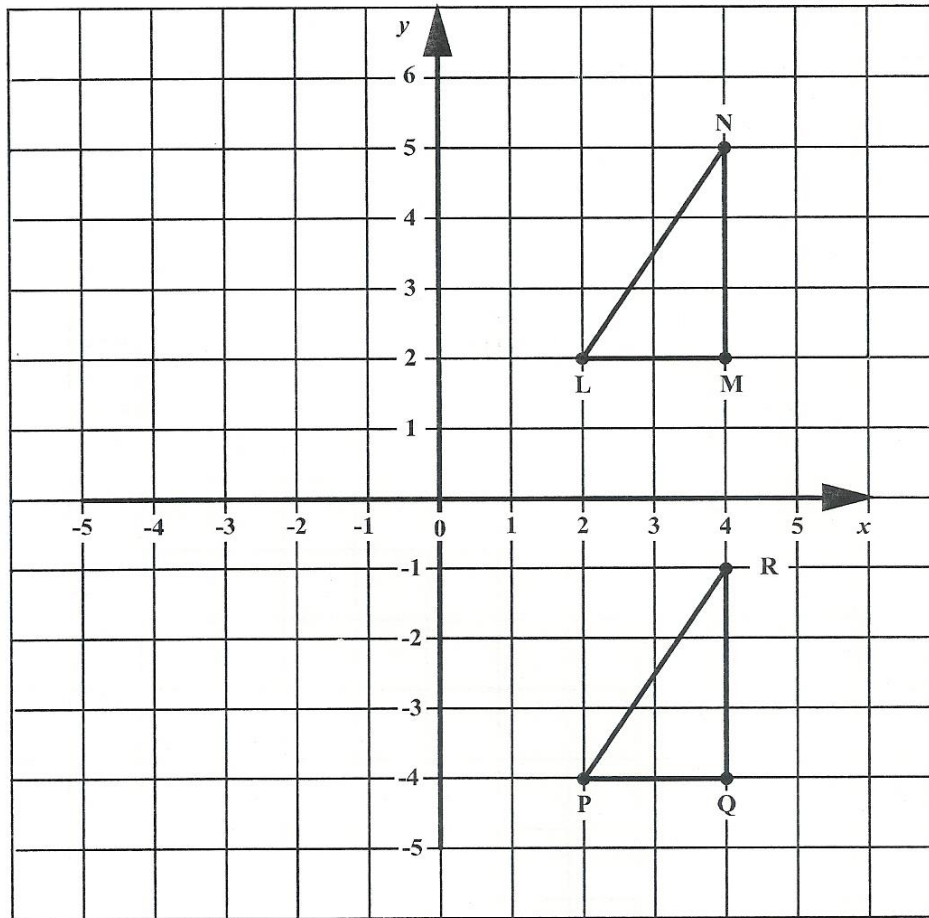
- (c) Using your graph, determine,

- (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 charges 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**

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)

(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)**

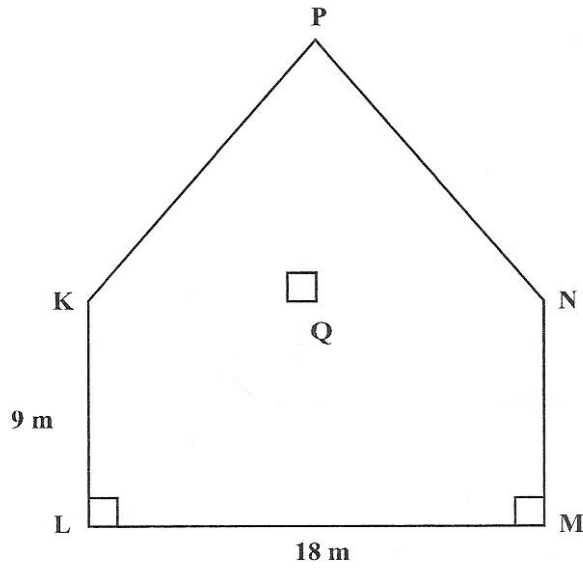
(v)  $\triangle PQR$  and  $\triangle FGH$  are congruent.  
State TWO reasons why they are congruent.

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

**(2 marks)**

**Total 12 marks**

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)

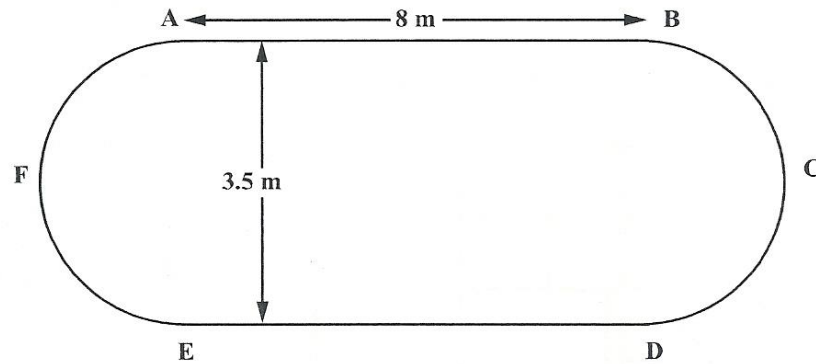
- (iii) Calculate the actual area of the face  $LMNPK$  on the building.

(4 marks)



- (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,  $AFE$ .

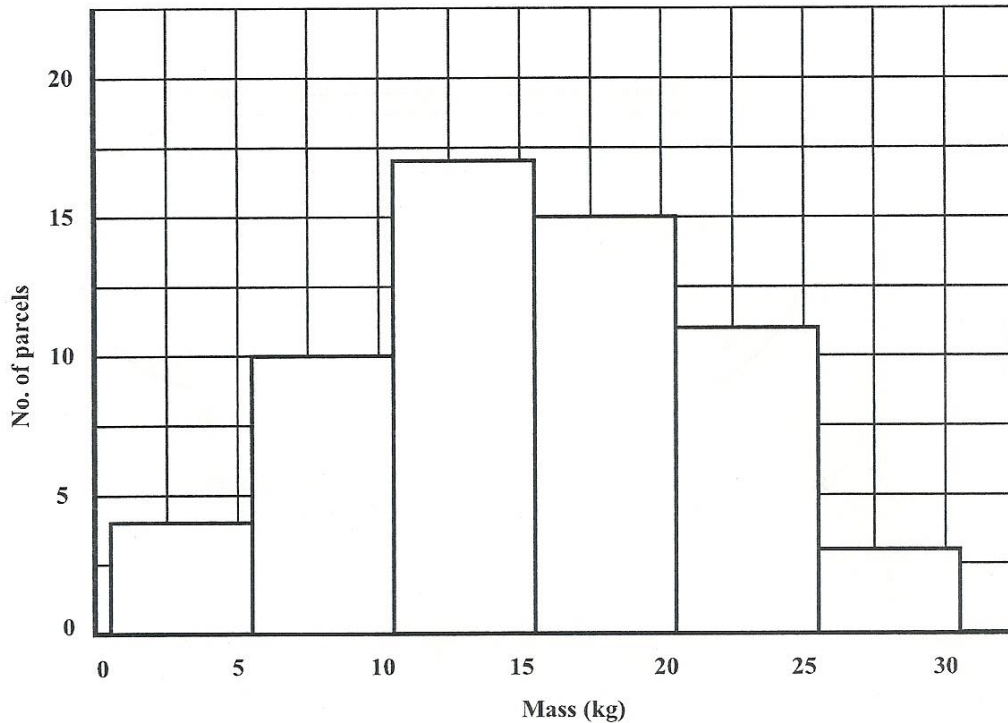
(1 mark)

- (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)**
- (c) Use the graph drawn at (b) to estimate the median mass of the parcels. **[2 marks]**

8. The diagram below shows the first three figures in a sequence of figures.

Figure 1

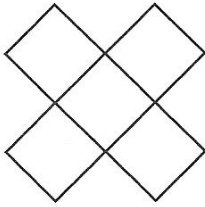


Figure 2

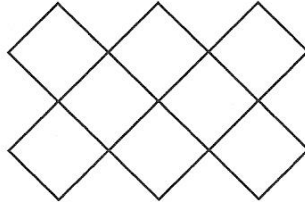
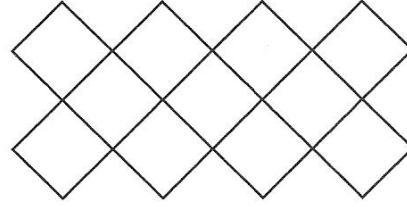


Figure 3



(a) Draw the fourth figure in the sequence.

(2 marks) <

- (b) The table below shows the number of 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:

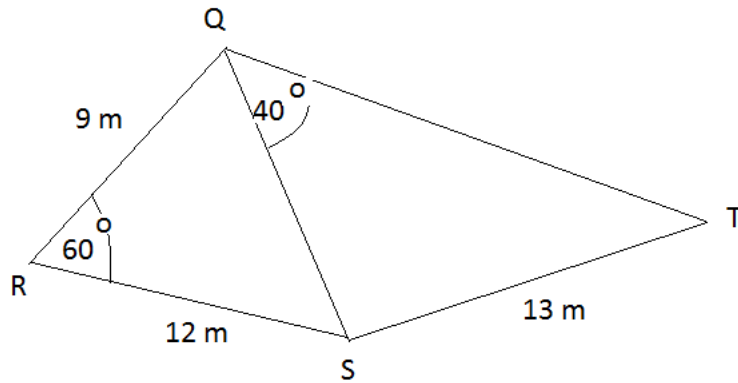
$$f(x) = \frac{5x-4}{3} \quad g(x) = x^2 - 1$$

- (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  $x$ , 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**

### MEASUREMENT, GEOMETRY AND TRIGONOMETRY

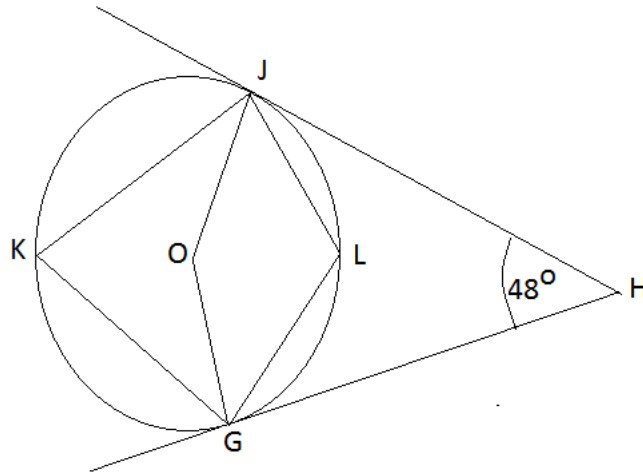
10. (a) On the diagram below, not drawn to scale,  $RQ = 9\text{ m}$ ,  $RS = 12\text{ m}$ ,  $ST = 13\text{ m}$ ,  $\angle QRS = 60^\circ$  and  $\angle SQT = 40^\circ$ .



Calculate, correct to 1 decimal place,

- (i) the length  $QS$  [2 marks]
- (ii) the measure of  $\angle QTS$  [2 marks]
- (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  $\angle JHG = 48^\circ$ .



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

- |       |              |           |
|-------|--------------|-----------|
| (i)   | $\angle OJH$ | [2 marks] |
| (ii)  | $\angle JOG$ | [2 marks] |
| (iii) | $\angle JKG$ | [2 marks] |
| (iv)  | $\angle JLG$ | [2 marks] |

**Total 15 marks**

## VECTORS AND MATRICES

11. (a) (i) Write the following equations

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

$$5x + 4y = 6$$

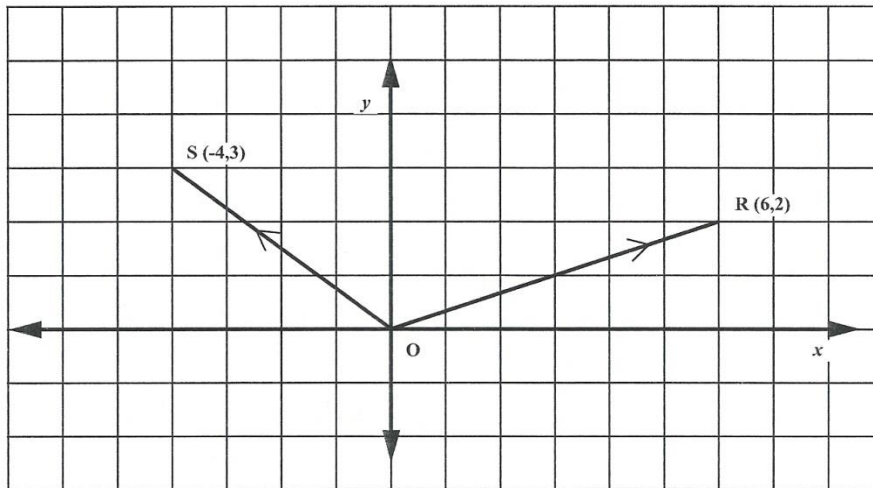
in the form  $AX = B$ , where  $A$ ,  $X$  and  $B$  are matrices.

[2 marks]

- (ii) Use a matrix method to solve for  $x$  and  $y$ .

[4 marks]

- (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]

(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**