

CARIBBEAN EXAMINATIONS COUNCIL  
SECONDARY EDUCATION CERTIFICATE  
EXAMINATION  
MATHEMATICS

Paper 02 – General Proficiency

2 hours 40 minutes

27 MAY 2004 (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 (provided)  
Graph paper (provided)

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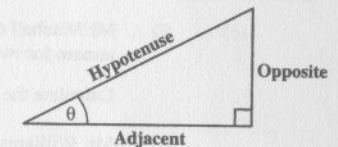
**LIST OF FORMULAE**

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

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

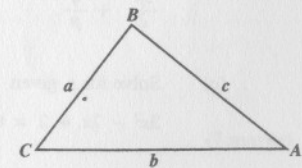
where  $s = \frac{a+b+c}{2}$

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

01234020/F 2004

## 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
- $2.3^2 + 4.1^2$
  - $\frac{0.18}{0.6} - 0.003$
  - $\frac{3\frac{1}{3} - 2\frac{3}{5}}{2\frac{1}{5}}$  (6 marks)
- (b) (i) Write your answer in Part (a) (i) correct to one significant figure.
- (ii) Write your answer in Part (a) (ii) in standard form. (2 marks)
- (c) (i) Mr Mitchell deposited \$40 000 in a bank and earned simple interest at 7% per annum for two years.
- Calculate the amount he will receive at the end of the two-year period.
- (ii) Mr Williams bought a plot of land for \$40 000. The value of the land appreciated by 7% each year.
- Calculate the value of the land after a period of two years. (4 marks)

Total 12 marks

2. (a) Simplify:
- $\frac{x^2 - 1}{x - 1}$
  - $\frac{4ab^2 + 2a^2b}{ab}$  (4 marks)
- (b) Express as a single fraction:
- $$\frac{3p}{2} + \frac{q}{p}$$
- (2 marks)
- (c) Solve for  $x$ , given
- $$3x^2 - 7x + 2 = 0$$
- (4 marks)

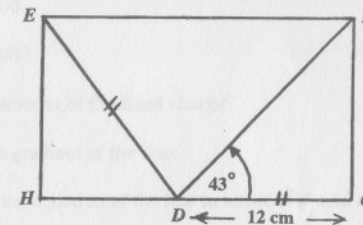
Total 10 marks

GO ON TO THE NEXT PAGE

3. (a) A club has 160 members, some of whom play tennis (T) or cricket (C) or both. 97 play tennis, 86 play cricket and 10 play neither,  $x$  play both tennis and cricket.
- Draw a Venn diagram to represent this information.
  - How many members play both tennis and cricket? (5 marks)
- (b) In a beauty contest, the scores awarded by eight judges were:
- 5.9      6.7      6.8      6.5      6.7      8.2      6.1      6.3
- Using the eight scores, determine:
    - the mean
    - the median
    - the mode
  - Only six scores are to be used. Which two scores may be omitted to leave the value of the median the same? (6 marks)

Total 11 marks

4. (a) (i) Using the formula
- $$t = \sqrt{\frac{5m}{12n}}$$
- calculate the value of  $t$  when  $m = 20$  and  $n = 48$ .
- (ii) Express  $m$  as subject of the formula in (a) (i) above. (5 marks)
- (b) In the diagram below, **not drawn to scale**,  $EFGH$  is a rectangle. The point  $D$  on  $HG$  is such that  $ED = DG = 12$  cm and  $\hat{GDF} = 43^\circ$ .



Calculate correct to one decimal place

- the length of  $GF$
- the length of  $HD$
- the size of the angle  $HDE$ . (7 marks)

Total 12 marks

GO ON TO THE NEXT PAGE

## 5. An answer sheet is provided for this question.

- (a) On the section of the answer sheet provided for 5 (a):
- write down the coordinates of the point  $P$
  - draw a line segment  $PQ$  through the point,  $P$ , such that the gradient of  $PQ$  is  $\frac{-3}{2}$ . (3 marks)
- (b) On the section of the answer sheet provided for 5 (b):
- draw the reflection of quadrilateral  $A$  in the mirror line, labelled  $M_1$ .  
Label its image  $B$ .
  - draw the reflection of quadrilateral  $B$  in the mirror line, labelled  $M_2$ .  
Label its image  $C$ . (4 marks)
- (c) Complete the sentence in part (c) on your answer sheet, describing FULLY the single geometric transformation which maps quadrilateral  $A$  onto quadrilateral  $C$ . (3 marks)

Total 10 marks

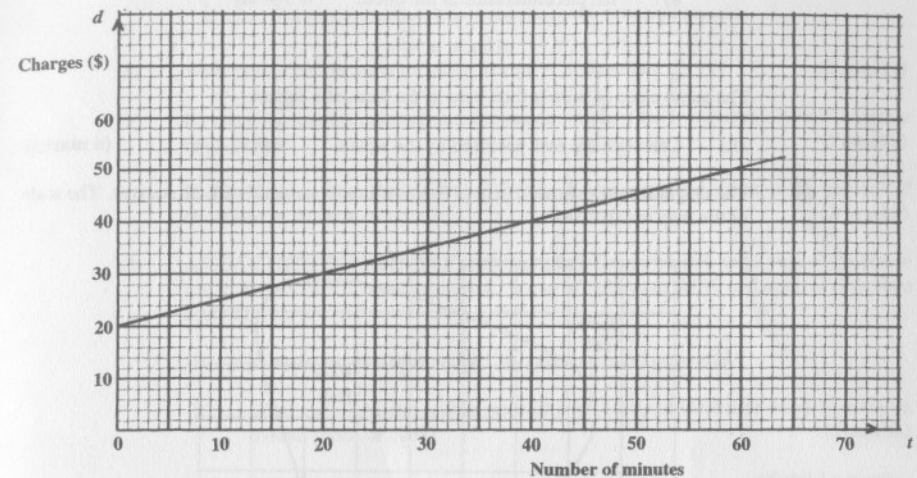


GO ON TO THE NEXT PAGE

01234020/F 2004

6. The amount a plumber charges for services depends on the time taken to complete the repairs plus a fixed charge.

The graph below shows the charges in dollars ( $d$ ) for repairs in terms of the number of minutes ( $t$ ) taken to complete the repairs.



- What was the charge for a plumbing job which took 20 minutes? (1 mark)
- How many minutes were spent completing repairs that cost:
  - \$38.00
  - \$20.00? (2 marks)
- What is the amount of the fixed charge? (1 mark)
- Calculate the gradient of the line. (2 marks)
- Write down the equation of the line in terms of  $d$  and  $t$ . (2 marks)
- Determine the length of time taken to complete a job for which the charge was \$78.00. (3 marks)

Total 11 marks

GO ON TO THE NEXT PAGE

01234020/F 2004



7. (a) A piece of wire is bent in the form of a circle and it encloses an area of  $154 \text{ cm}^2$ .

(i) Calculate:

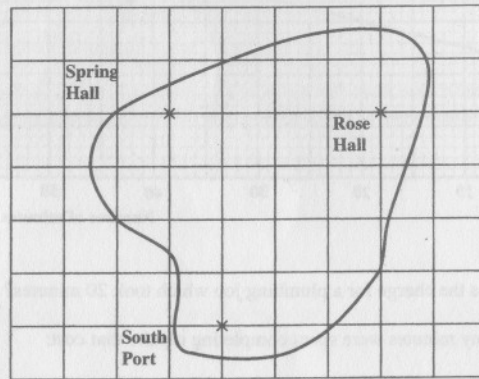
- a) the radius of the circle  
b) the circumference of the circle.

$$\left(\text{Use } \pi = \frac{22}{7}\right)$$

The same piece of wire is then bent in the form of a square.

(ii) Calculate the area enclosed by the square. (6 marks)

- (b) The diagram below shows a map of Baytime drawn on a grid of  $1 \text{ cm}$  squares. The scale of the map is  $1:100\,000$ .



- (i) Find to the nearest km, the shortest distance between Rose Hall and South Port.  
(ii) Determine the bearing of South Port from Spring Hall. (6 marks)

**Total 12 marks**

GO ON TO THE NEXT PAGE

8. Two recipes for making chocolate drinks are shown in the table below.

	Cups of Milk	Cups of chocolate
Recipe A	3	2
Recipe B	2	1

- (a) What percent of the mixture using Recipe A is chocolate? (2 marks)  
(b) By showing suitable calculations, determine which of the two recipes, A or B, is richer in chocolate. (2 marks)  
(c) If the mixtures from Recipe A and Recipe B are combined, what is the percent of chocolate in the new mixture? (2 marks)  
(d) A vendor makes chocolate drink using Recipe A. 3 cups of milk and 2 cups of chocolate can make 6 bottles of chocolate drink. A cup of milk costs  $\$0.70$  and a cup of chocolate costs  $\$1.15$ .
- (i) What is the cost of making 150 bottles of chocolate drink?  
(ii) What should be the selling price of each bottle of chocolate drink to make an overall profit of 20%? (6 marks)

**Total 12 marks**

GO ON TO THE NEXT PAGE

## SECTION II

Answer TWO questions in this section

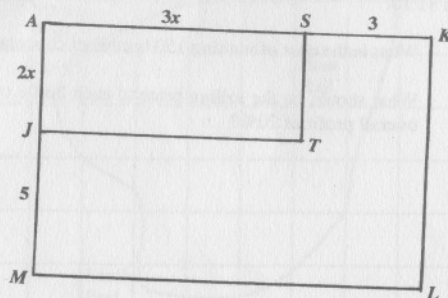
## ALGEBRA AND RELATIONS, FUNCTIONS AND GRAPHS

9. (a) The table below shows corresponding values for  $P$  and  $r$ .

$P$	$m$	4	62.5
$r$	0.2	2	$n$

Given that  $P$  varies directly as  $r^3$ , calculate the values of  $m$  and  $n$ . (6 marks)

- (b) In the diagram below, **not drawn to scale**,  $AKLM$  and  $ASTJ$  are both rectangles.



Given that  $AS = 3x$  cm,  $AJ = 2x$  cm,  $SK = 3$  cm and  $JM = 5$  cm

- (i) Obtain an expression, in terms of  $x$ , for the area of rectangle  $AKLM$ .  
 (ii) Given that the area of rectangle  $AKLM$  is  $60 \text{ cm}^2$ , show that  $2x^2 + 7x - 15 = 0$   
 (iii) Hence, calculate the value of  $x$  and state the length of  $AK$  and  $AM$ . (9 marks)

Total 15 marks

GO ON TO THE NEXT PAGE

10. A vendor buys  $x$  kg of peanuts and  $y$  kg of cashew nuts.

- (a) (i) To get a good bargain, she must buy a minimum of 10 kg of peanuts and a minimum of 5 kg of cashew nuts.

Write TWO inequalities which satisfy these conditions.

- (ii) She buys no more than 60 kg of nuts. Peanuts cost \$4.00 per kg and cashew nuts cost \$8.00 per kg and she spends at least \$200.

Write TWO inequalities which satisfy these conditions.

(5 marks)

- (b) Using a scale of 2 cm to represent 10 kg on each axis, draw the graph of the FOUR inequalities in (a) (i) and (a) (ii).

On your graph, shade ONLY the region which satisfies **all four** inequalities.

(6 marks)

- (c) The profit on the sale of 1 kg of peanuts is \$2.00 and on 1 kg of cashew nuts is \$5.00.

- (i) Using your graph, determine the number of kilograms of each type of nut the vendor must sell in order to make the maximum profit.

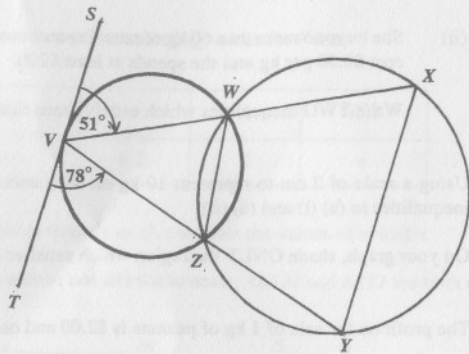
- (ii) Calculate the maximum profit. (4 marks)

Total 15 marks

GO ON TO THE NEXT PAGE

GEOMETRY AND TRIGONOMETRY

11. (a) In the diagram below,  $VWZ$  and  $WXYZ$  are two circles intersecting at  $W$  and  $Z$ .  $SVT$  is a tangent to the circle at  $V$ ,  $VWX$  and  $VZY$  are straight lines,  $\hat{TVY} = 78^\circ$  and  $\hat{SVX} = 51^\circ$ .



- (i) Calculate the size of EACH of the following angles, giving reasons for your answers.

a)  $\hat{VZW}$

b)  $\hat{XYZ}$

(4 marks)

- (b) (i) Draw a diagram to represent the information given below.

Show clearly the north line in your diagram.

Town  $F$  is 50 km east of town  $G$ .

Town  $H$  is on a bearing of  $040^\circ$  from town  $F$ .

The distance from  $F$  to  $H$  is 65 km.

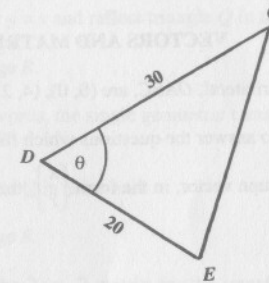
- (ii) Calculate, to the nearest kilometre, the actual distance  $GH$ .  
 (iii) Calculate, to the nearest degree, the bearing of  $H$  from  $G$ . (11 marks)

Total 15 marks

12. (a) Given that  $\sin \theta = \frac{\sqrt{3}}{2}$ ,  $0^\circ \leq \theta \leq 90^\circ$ .

(i) Express in fractional or surd form the value of  $\cos \theta$ .

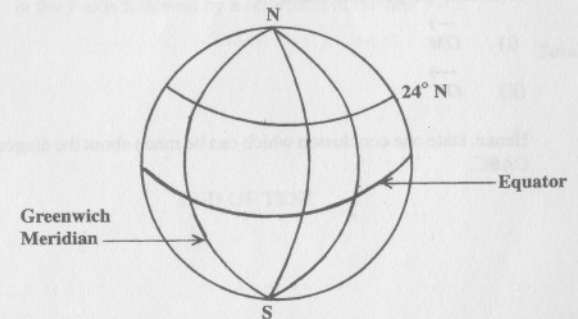
(ii) Show that the area of triangle  $CDE$  is  $150\sqrt{3}$  square units, where  $CD = 30$  units and  $DE = 20$  units.



(iii) Calculate the length of the side  $EC$ . (7 marks)

- (b) In this question, use  $\pi = 3.14$  and assume the earth to be a sphere of radius 6 370 km.

The diagram below shows a sketch of the earth with the Greenwich Meridian and the Equator labelled.



The towns  $A$  and  $B$  are both on the circle of latitude  $24^\circ$  N. The longitude of  $A$  is  $108^\circ$  E and the longitude of  $B$  is  $75^\circ$  E.

- (i) Copy the sketch above of the earth and insert the points  $A$  and  $B$  on your diagram.



- (ii) Calculate, correct to the nearest kilometre,
- the radius of the circle of latitude  $24^\circ$  N
  - the shortest distance between  $A$  and  $B$ , measured along the circle of latitude  $24^\circ$  N.

(8 marks)

Total 15 marks

## VECTORS AND MATRICES

13. The vertices of a quadrilateral,  $OABC$ , are  $(0, 0)$ ,  $(4, 2)$ ,  $(6, 10)$  and  $(2, 8)$  respectively.

Use a vector method to answer the questions which follow.

- (a) Write as a column vector, in the form  $\begin{bmatrix} x \\ y \end{bmatrix}$ , the vector
- $\vec{OA}$  (3 marks)
  - $\vec{CB}$  (1 mark)
- (b) Calculate  $|\vec{OA}|$ , the magnitude of  $\vec{OA}$ . (4 marks)
- (c)
  - State two geometrical relationships between the line segments  $OA$  and  $CB$ .
  - Explain why  $OABC$  is a parallelogram. (4 marks)
- (d) If  $M$  is the midpoint of the diagonal  $OB$ , and  $N$  is the midpoint of the diagonal  $AC$ , determine the position vector
- $\vec{OM}$
  - $\vec{ON}$

Hence, state one conclusion which can be made about the diagonals of the parallelogram  $OABC$ . (7 marks)

Total 15 marks

14. An answer sheet is provided for this question.

- (a) On the answer sheet provided, perform the following transformations:
- Reflect triangle  $P$  in the  $y$ -axis.  
Label its image  $Q$ . (5 marks)
  - Draw the line  $y = x$  and reflect triangle  $Q$  in this line.  
Label its image  $R$ . (5 marks)
  - Describe, in words, the single geometric transformation which maps triangle  $P$  onto triangle  $R$ . (3 marks)
  - Reflect triangle  $Q$  in the  $x$ -axis.  
Label its image  $S$ .
  - Write down the  $2 \times 2$  matrix for the transformation which maps triangle  $P$  onto triangle  $S$ . (3 marks)
- (b)
  - Write down the  $2 \times 2$  matrices for
    - a reflection in the  $y$ -axis
    - a reflection in the line  $y = x$ .
  - Using the two matrices in b (i) above, obtain a SINGLE matrix for a reflection in the  $y$ -axis followed by a reflection in the line  $y = x$ . (4 marks)

Total 15 marks

END OF TEST