TEST CODE **01234020**

FORM TP 2012092

MAY/JUNE 2012

CARIBBEAN EXAMINATIONS COUNCIL

SECONDARY EDUCATION CERTIFICATE EXAMINATION

MATHEMATICS

Paper 02 – General Proficiency

2 hours 40 minutes

18 MAY 2012 (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 shown clearly.
6. A list of formulae is provided on page 2 of this booklet.

Required Examination Materials

Electronic calculator
Geometry set
Graph paper (provided)

2092

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

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

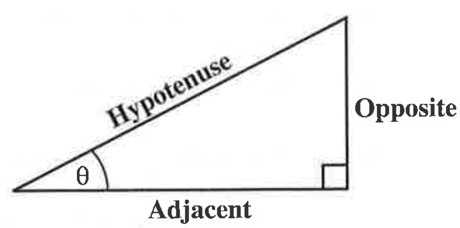
then $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$.

Trigonometric ratios

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

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

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



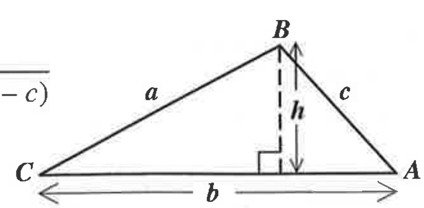
Area of triangle

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 $s = \dfrac{a+b+c}{2}$



Sine rule

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

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) Calculate the EXACT value of

$$\frac{3\frac{1}{5} - \frac{2}{3}}{2\frac{4}{5}}$$

giving your answer as a fraction in its lowest terms. **(3 marks)**

(b) The table below shows the cost price, selling price and profit or loss as a percentage of the cost price.

Copy and complete the table below, inserting the missing values at (i) and (ii).

	Cost Price	**Selling Price**	**Percentage Profit or Loss**
(i)	$55.00	$44.00	________
(ii)	________	$100.00	25% profit

(4 marks)

(c) The table below shows some rates of exchange:

US $1.00 = EC $2.70	
TT $1.00 = EC $0.40	

Calculate the value of

(i) EC $1 in TT $ **(1 mark)**

(ii) US $80 in EC $ **(1 mark)**

(iii) TT $648 in US $. **(3 marks)**

Total 12 marks

2. (a) Factorise completely:

(i) $2x^3y + 6x^2y^2$ **(2 marks)**

(ii) $9x^2 - 4$ **(1 mark)**

(iii) $4x^2 + 8xy - xy - 2y^2$ **(2 marks)**

(b) Solve for x:

$$\frac{2x-3}{3} + \frac{5-x}{2} = 3$$ **(3 marks)**

(c) Solve the simultaneous equations:

$3x - 2y = 10$
$2x + 5y = 13$ **(4 marks)**

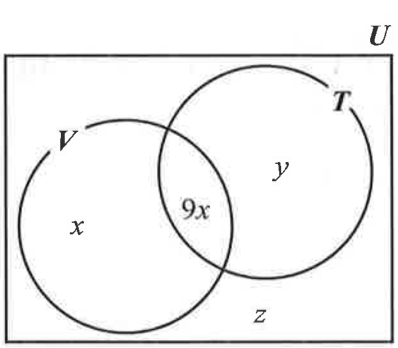
Total 12 marks

3. (a) In a survey of 36 students, it was found that
30 play tennis,
x play volleyball ONLY,
$9x$ play BOTH tennis and volleyball
4 play neither tennis nor volleyball.

(i) Given that:

U = {students in the survey}
V = {students who play Volleyball}
T = {students who play Tennis}

Copy and complete the Venn diagram below to show the number of students in the subsets marked y and z.

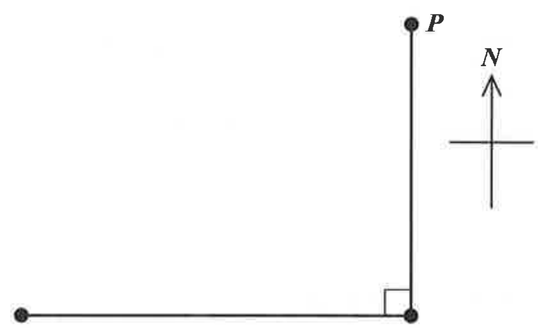


(2 marks)

(ii) a) Write an **expression** in x to represent the TOTAL number of students in the survey. **(1 mark)**

b) Write an **equation** in x to represent the total number of students in the survey and hence solve for x. **(2 marks)**

(b) The diagram below, **not drawn to scale**, shows the journey of a ship which started at port P, sailed 15 km due south to port Q, and then a further 20 km due west to port R.



(i) Copy the diagram and label it to show the points Q and R, and the distances 20 km and 15 km. **(2 marks)**

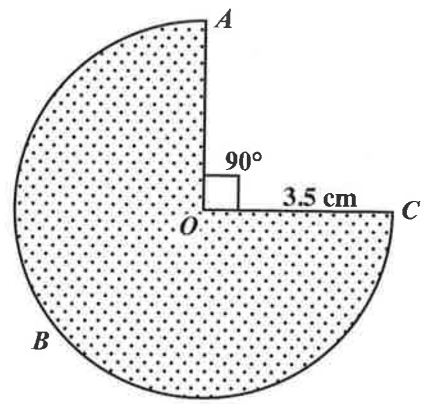
(ii) Calculate PR, the **shortest** distance of the ship from the port where the journey started. **(2 marks)**

(iii) Calculate the measure of angle QPR, giving your answer to the nearest degree. **(3 marks)**

Total 12 marks

4. The diagram below, **not drawn to scale**, shows the cross section of a prism in the shape of a sector of a circle, centre O, and radius 3.5 cm. The angle at the centre is 270°.

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



(a) Calculate

(i) the length of the arc ABC **(2 marks)**

(ii) the perimeter of the sector $OABC$ **(2 marks)**

(iii) the area of the sector $OABC$. **(2 marks)**

(b) The prism is 20 cm long and is a solid made of tin. Calculate

(i) the volume of the prism **(2 marks)**

(ii) the mass of the prism, **to the nearest kg**, given that 1 cm^3 of tin has a mass of 7.3 kg. **(2 marks)**

Total 10 marks

5. (a) (i) Using a ruler, a pencil and a pair of compasses, construct triangle PQR with $PQ = 8$ cm, $<PQR = 60°$ and $<QPR = 45°$. **(4 marks)**

(ii) Measure and state the length of RQ. **(1 mark)**

(b) The line ℓ passes through the points S (6, 6) and T (0, –2).

Determine

(i) the gradient of the line, ℓ **(2 marks)**

(ii) the equation of the line, ℓ **(2 marks)**

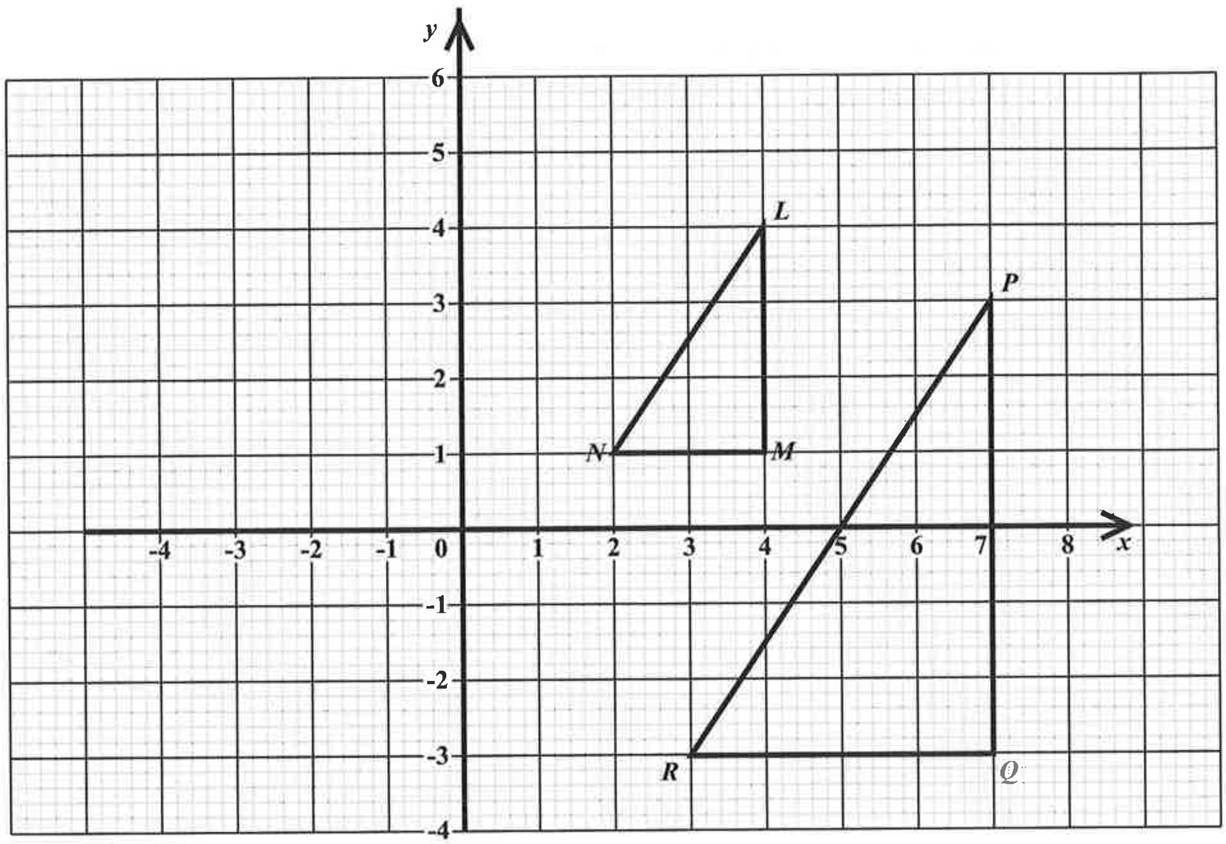
(iii) the midpoint of the line segment, TS **(1 mark)**

(iv) the length of the line segment, TS. **(2 marks)**

Total 12 marks

6. **An answer sheet is provided for this question.**

The graph below shows triangle *LMN* and its image *PQR* after an enlargement.



On the answer sheet provided

(a) Locate the centre of enlargement, showing your method clearly. **(2 marks)**

(b) State the scale factor and the coordinates of the centre of the enlargment. **(2 marks)**

(c) Determine the value of $\frac{\text{Area of } PQR}{\text{Area of } LMN}$. **(2 marks)**

(d) Draw and label triangle ABC with coordinates (–4, 4), (–1, 4) and (–1, 2) respectively. **(2 marks)**

(e) Describe fully the single transformation which maps triangle *LMN* on to triangle *ABC*. **(3 marks)**

Total 11 marks

GO ON TO THE NEXT PAGE

7. The table below shows the ages, to the nearest year, of the persons who visited the clinic during a particular week.

Age (yrs)	Number of persons	Cumulative Frequency
40 – 49	4	4
50 – 59	11	15
60 – 69	20	—
70 – 79	12	—
80 – 89	3	50

(a) Copy and complete the table to show the cumulative frequency. **(2 marks)**

(b) **Using a scale of 2 cm to represent 10 years on the x-axis and 1 cm to represent 5 persons on the y-axis**, draw the cumulative frequency curve for the data. **(5 marks)**

(c) Use your graph drawn at (b) above to estimate

(i) the median age for the data **(2 marks)**

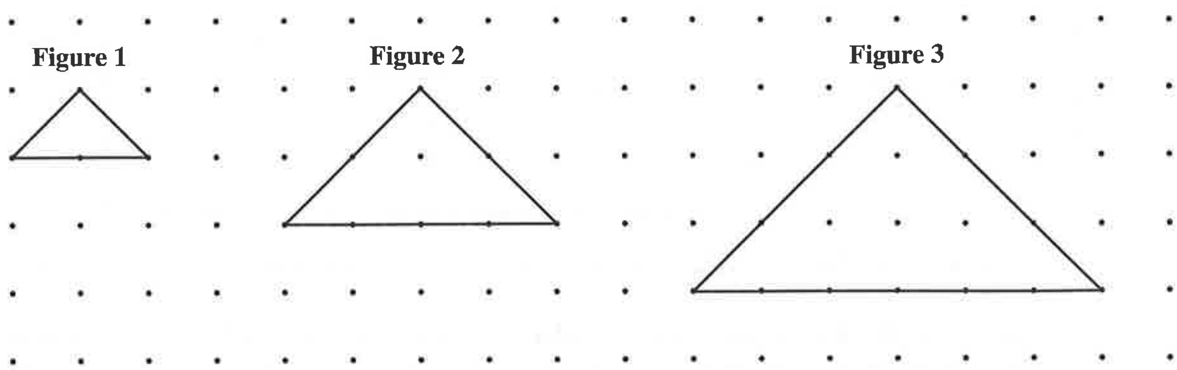
(ii) the probability that a person who visited the clinic was 75 years or younger. **(2 marks)**

Draw lines on your graph to show how these estimates were obtained.

Total 11 marks

8. **An answer sheet is provided for this question.**

The diagram below shows the first three figures in a sequence of figures. Each figure is an isosceles triangle made of a rubber band stretched around pins on a geo-board. The pins are arranged in rows and columns, one unit apart.



(a) **On the answer sheet provided**, draw the fourth figure (Figure 4) in the sequence. **(2 marks)**

(b) Study the patterns in the table below, and on your answer sheet, complete the rows numbered (i), (ii), (iii) and (iv). The breaks in the columns are to indicate that the rows do not follow one after the other.

	Figure	Area of Triangle	No. of Pins on Base	
	1	1	$2 \times 1 + 1 = 3$	
	2	4	$2 \times 2 + 1 = 5$	
	3	9	$2 \times 3 + 1 = 7$	
(i)	4	_____	_____	**(2 marks)**
(ii)	___	100	_____	**(2 marks)**
(iii)	20	_____	_____	**(2 marks)**
(iv)	n	_____	_____	**(2 marks)**

Total 10 marks

SECTION II

There are THREE questions in this section.

Answer TWO questions in this section

ALGEBRA AND RELATIONS, FUNCTIONS AND GRAPHS

9. (a) (i) Solve the pair of simultaneous equations:

$y = 8 - x$
$2x^2 + xy = -16$ **(5 marks)**

(ii) State, giving the reason for your answer, whether the line $y = 8 - x$ is a tangent to the curve $2x^2 + xy = -16$. **(2 marks)**

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

A florist makes bouquets of flowers, each consisting of x roses and y orchids. For each bouquet, she applies the following constraints:

- the number of orchids must be at least half the number of roses
- there must be at least 2 roses
- there must be no more than 12 flowers

(i) Write THREE inequalities for the constraints given. **(3 marks)**

(ii) **On the answer sheet provided**, shade the region of the graph which represents the solution set for the inequalities in (b) (i). **(1 mark)**

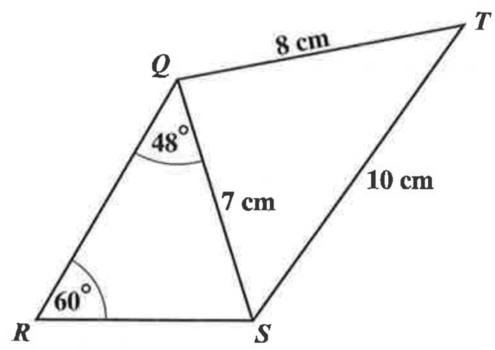
(iii) State the coordinates of the points which represent the vertices of the region showing the solution set. **(1 mark)**

(iv) The florist sells a bouquet of flowers to make a profit of \$3 on each rose and \$4 on each orchid. Determine the MAXIMUM possible profit on the sale of a bouquet. **(3 marks)**

Total 15 marks

MEASUREMENT, GEOMETRY AND TRIGONOMETRY

10. (a) The diagram below, **not drawn to scale**, shows a quadrilateral $QRST$ in which $QS = 7$ cm, $ST = 10$ cm, $QT = 8$ cm, $<SRQ = 60°$ and $<RQS = 48°$.

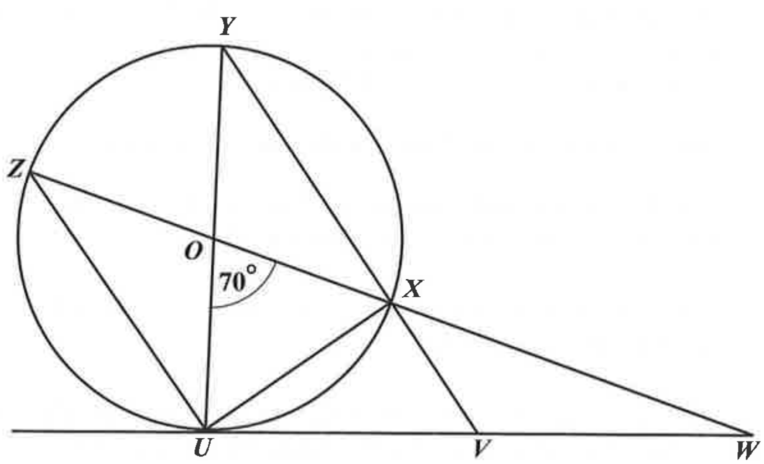


Calculate

(i) the length of RS **(3 marks)**

(ii) the measure of $<QTS$. **(3 marks)**

(b) The diagram below, **not drawn to scale**, shows a circle, centre O. The line UVW is a tangent to the circle, $ZOXW$ is a straight line and angle $UOX = 70°$.



(i) Calculate, showing working where necessary, the measure of angle

a) OUZ **(2 marks)**

b) UVY **(3 marks)**

c) UWO. **(2 marks)**

(ii) Name the triangle in the diagram which is congruent to triangle

a) ZOU **(1 mark)**

b) YXU. **(1 mark)**

Total 15 marks

GO ON TO THE NEXT PAGE

VECTORS AND MATRICES

11. (a) The points A, B and C have position vectors $\overrightarrow{OA} = \begin{pmatrix} 6 \\ 2 \end{pmatrix}$, $\overrightarrow{OB} = \begin{pmatrix} 3 \\ 4 \end{pmatrix}$ and $\overrightarrow{OC} = \begin{pmatrix} 12 \\ -2 \end{pmatrix}$ respectively.

(i) Express in the form $\begin{pmatrix} x \\ y \end{pmatrix}$ the vector

a) $\overrightarrow{BA}$ **(2 marks)**

b) $\overrightarrow{BC}$. **(2 marks)**

(ii) State ONE geometrical relationship between BA and BC. **(1 mark)**

(iii) Draw a sketch to show the relative positions of A, B and C. **(2 marks)**

(b) (i) Calculate the values of a and b such that $\begin{pmatrix} a & -4 \\ 1 & b \end{pmatrix}\begin{pmatrix} 2 & -4 \\ 1 & -3 \end{pmatrix} = \begin{pmatrix} 2 & 0 \\ 0 & 2 \end{pmatrix}$.

(3 marks)

(ii) Hence, or otherwise, write down the inverse of $\begin{pmatrix} 2 & -4 \\ 1 & -3 \end{pmatrix}$. **(2 marks)**

(iii) Use the inverse of $\begin{pmatrix} 2 & -4 \\ 1 & -3 \end{pmatrix}$ to solve for x and y in the matrix equation

$\begin{pmatrix} 2 & -4 \\ 1 & -3 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 12 \\ 7 \end{pmatrix}$. **(3 marks)**

Total 15 marks

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECKYOURWORK ON THIS TEST.