C A R I B B E A N   E X A M I N A T I O N S   C O U N C I L

CARIBBEAN SECONDARY EDUCATION CERTIFICATE® EXAMINATION

MATHEMATICS

Paper 02 – General Proficiency

2 hours 40 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of TWO sections: I and II.
2. Section I has EIGHT questions and Section II has THREE questions.
3. Answer ALL questions in Section I and any TWO questions from Section II.
4. Write your answers in the booklet provided.
5. Do NOT write in the margins.
6. All working MUST be clearly shown.
7. **A list of formulae is provided on page 4 of this booklet.**
8. If you need to rewrite any answer and there is not enough space to do so on the original page, you must use the extra page(s) provided at the back of this booklet. **Remember to draw a line through your original answer.**
9. **If you use the extra page(s) you MUST write the question number clearly in the box provided at the top of the extra page(s) and, where relevant, include the question part beside the answer.**

Required Examination Materials

Electronic calculator
Geometry set

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

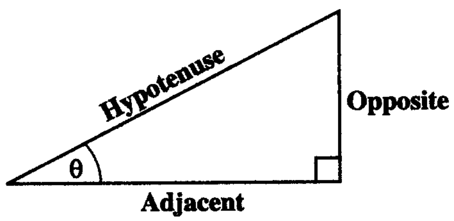
then $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Trigonometric ratios

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

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

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



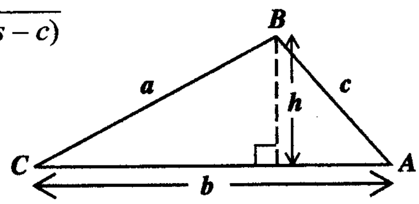
Area of a triangle

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 questions in this section.

All working must be clearly shown.

1. (a) Using a calculator, or otherwise, calculate

(i) $5\frac{1}{2} \div 3\frac{2}{3} + 1\frac{4}{5}$, giving your answer as a fraction in its lowest terms

....

(2 marks)

(ii) 165×0.38^2, giving your answer as an EXACT value.

....

(1 mark)

GO ON TO THE NEXT PAGE

(b) Write your answer in (a) (ii) correct to

(i) two decimal places

....

(1 mark)

(ii) three significant figures

....

(1 mark)

(iii) the nearest whole number.

....

(1 mark)

GO ON TO THE NEXT PAGE

(c) Mr Adams invested \$5 000 at the credit union and received \$5 810, inclusive of simple interest, after 3 years.

Determine

(i) the simple interest earned

....

(1 mark)

(ii) the annual interest rate paid by the credit union

....

(2 marks)

(iii) the length of time it will take for Mr Adams' investment to be **doubled**, at the same rate of interest.

....

(2 marks)

Total 11 marks

2. (a) Given that a * b means $\sqrt{a + 4b}$, where the positive root is taken, determine

(i) the value of 1 * 2

....

(2 marks)

(ii) whether the operation denoted by * is commutative. Justify your answer.

....

(3 marks)

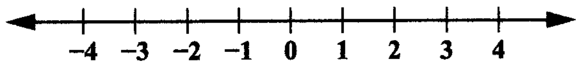
GO ON TO THE NEXT PAGE

(b) (i) Solve the inequality $3 - 2x > 5$.

....

(2 marks)

(ii) Represent your answer in (b) (i) on the number line shown below.



(1 mark)

(c) **Statement one:** Two adult tickets and three children tickets cost \$43.00.
Statement two: One adult ticket and one ticket for a child cost \$18.50.

(i) Let x represent the cost of an adult ticket and y the cost of a ticket for a child. Write TWO equations in x and y to represent the information above.

....

(2 marks)

(ii) Solve the equations to determine the cost of an adult ticket.

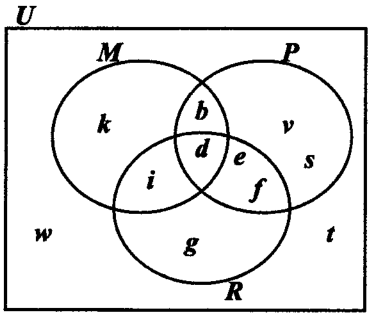
....

(2 marks)

Total 12 marks

GO ON TO THE NEXT PAGE

3. (a) The universal set $U = \{b, d, e, f, g, i, k, s, t, v, w\}$. The Venn diagram below shows U and three sets, M, P and R, which are subsets of U.



(i) State the value of $n(P \cup R)$.

....

(1 mark)

(ii) List the members of

a) $M \cap P$

....

(2 marks)

b) $M \cup R'$.

....

(2 marks)

GO ON TO THE NEXT PAGE

(b) (i) Using a ruler, a pencil and a pair of compasses, construct triangle PQR with $PQ = 8$ cm, angle $PQR = 120°$ and $QR = 5$ cm.

(4 marks)

(ii) Measure and state the length of the side PR.

....

(1 mark)

(iii) On your diagram in (b) (i), construct the point S, such that $PQRS$ forms a parallelogram. **(2 marks)**

Total 12 marks

4. (a) The equation of a straight line, l, is given as $3x - 4y = 5$.

(i) Write the equation of the line, l, in the form $y = mx + c$.

....

(2 marks)

(ii) Hence, determine the gradient of the line, l.

....

(1 mark)

(iii) The point P with coordinates $(r, 2)$ lies on the line l. Determine the value of r.

....

(2 marks)

(iv) Find the equation of the straight line passing through the point $(6, 0)$ which is perpendicular to l.

....

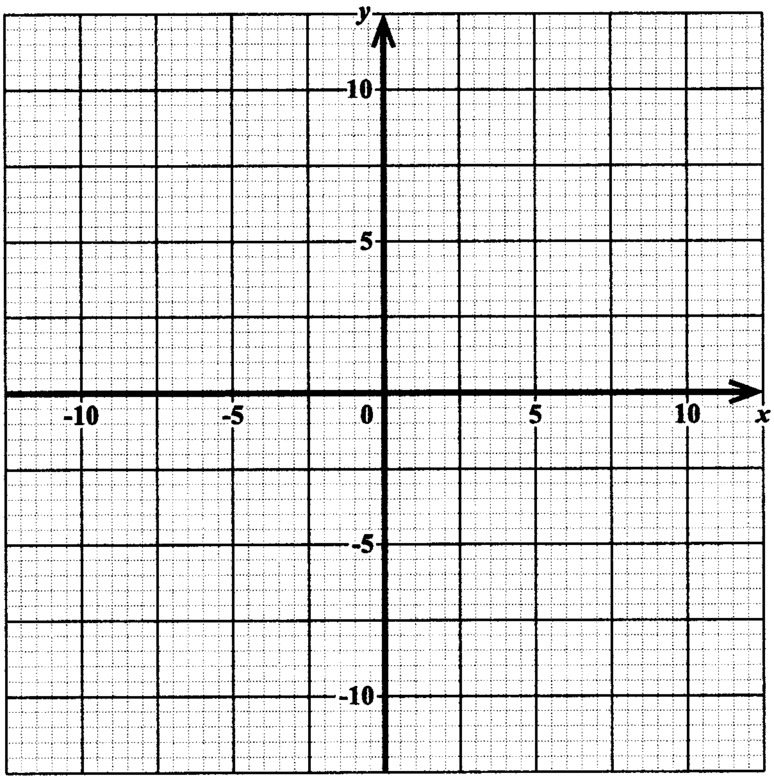
(2 marks)

GO ON TO THE NEXT PAGE

(b) (i) Draw the straight lines $x + y = 10$ and $y = x$ on the grid below. **(2 marks)**

(ii) On the same grid, shade the region which satisfies the FOUR inequalities

$x \geq 0$
$y \geq 0$
$x + y \leq 10$ and
$x \geq y$.



(2 marks)

Total 11 marks

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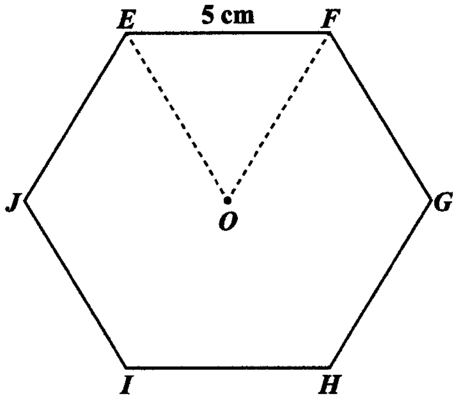
5. (a) The regular polygon *EFGHIJ*, shown below, has centre *O*. Triangle *OEF* is equilateral and *EF* = 5 cm.



(i) What is the name of the polygon shown above?

....

(1 mark)

(ii) Calculate the perimeter of the polygon *EFGHIJ*.

....

(1 mark)

(iii) Determine the size of each interior angle of the polygon.

....

(2 marks)

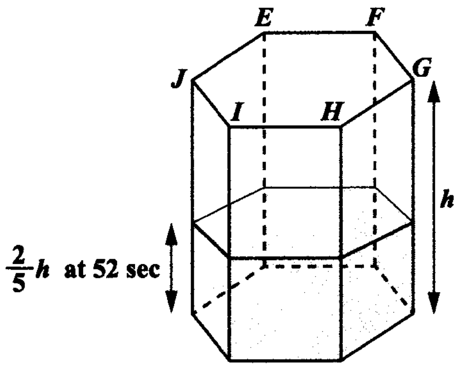
GO ON TO THE NEXT PAGE

(iv) Show, by calculation, that the area of the polygon, to the nearest whole number, is 65 cm^2.

....

(3 marks)

(b) A tank has a cross section with dimensions **identical** to the polygon *EFGHIJ* in 5 (a). Water is poured into the tank at a rate of 75 cm³ per second. After 52 seconds the tank is $\frac{2}{5}$ full.



(i) Determine the capacity of the tank, in litres.

....

(3 marks)

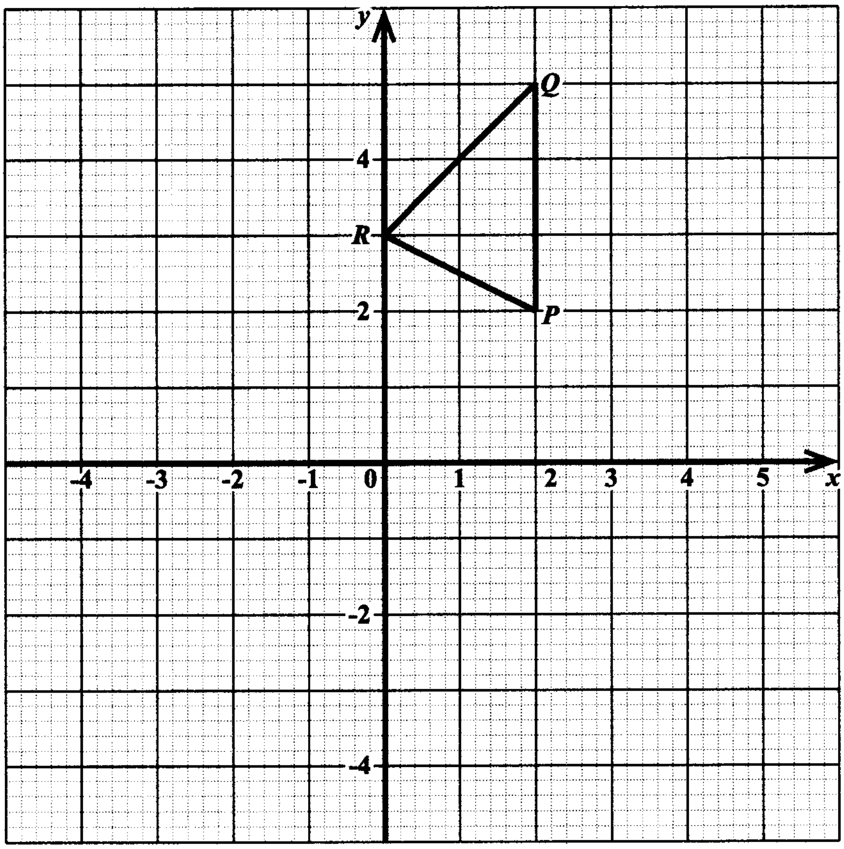
(ii) Calculate the height, h, in metres, of the tank.

....

(2 marks)

Total 12 marks

6. The diagram below shows triangle *PQR*.



(a) State the coordinates of *R*.

....

(1 mark)

(b) On the diagram above, draw

(i) $\Delta\, P'Q'R'$, a reflection of $\Delta\, PQR$ in the line $y = 1$ **(2 marks)**

(ii) $\Delta\, P''Q''R''$, a reflection of $\Delta\, P'Q'R'$ in the line $x = 0$. **(2 marks)**

GO ON TO THE NEXT PAGE

(c) Describe, fully, the single transformation that maps $\Delta P''Q''R''$ onto ΔPQR.

....

....

....

(3 marks)

(d) Triangle PQR undergoes an enlargement of scale factor 2. Calculate the area of its image.

....

(2 marks)

Total 10 marks

7. (a) The marks obtained by 10 students in a test, scored out of 60, are shown below.

29	38	26	42	38
45	35	37	38	31

For the data above, determine

(i) the range

....

(1 mark)

(ii) the median

....

(1 mark)

(iii) the interquartile range

....

(2 marks)

(iv) the probability that a student chosen at random scores less than half the total marks in the test.

....

(2 marks)

GO ON TO THE NEXT PAGE

(b) The frequency distribution below shows the masses, in kg, of 50 adults prior to the start of a fitness programme.

Mass (kg)	Midpoint	Frequency
60–64	62	8
65–69	67	11
70–74	72	15
75–79	77	9
80–84	82	5
85–89	87	2

On the grid **on page 23**, using a scale of 2 cm to represent 5 units on the x-axis and 1 cm to represent 1 unit on the y-axis, draw a frequency polygon to represent the information in the table. **(6 marks)**

Total 12 marks

8. A sequence of figures is made from toothpicks of unit length. The first three figures in the sequence are shown below.

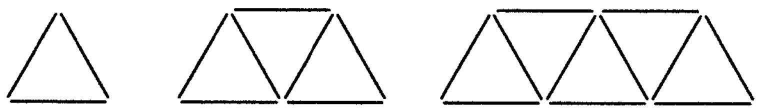


Figure 1 **Figure 2** **Figure 3**

(a) Draw Figure 4 of the sequence.

(2 marks)

(b) Study the patterns of numbers in each row of the table below. Each row relates to one of the figures in the sequence of figures above. Some rows have not been included in the table.

Complete the rows numbered (i), (ii), (iii) and (iv).

	Figure	Number of Toothpicks in Pattern	Perimeter of Figure	
	1	3	$0 + 1 + 2 = 3$	
	2	7	$1 + 2 + 2 = 5$	
	3	11	$2 + 3 + 2 = 7$	
(i)	4			**(2 marks)**
	⋮			
(ii)			$19 + 20 + 2 = 41$	**(2 marks)**
	⋮			
(iii)		127		**(2 marks)**
	⋮			
(iv)	n			**(2 marks)**

Total 10 marks

GO ON TO THE NEXT PAGE

SECTION II

Answer TWO questions in this section.

ALGEBRA AND RELATIONS, FUNCTIONS AND GRAPHS

9. (a) (i) Show, by calculation, that the EXACT roots of the quadratic equation

$x^2 + 2x - 5 = 0$ are $-1 \pm \sqrt{6}$.

....

(3 marks)

(ii) Hence, or otherwise, solve the simultaneous equations

$$2 + x = y$$
$$xy = 5.$$

....

(4 marks)

(b) The incomplete table below shows values of x and y for the function $y = 2^x$ for integer values of x from -1 to 4.

x	-1	0	1	2	3	4
y		1			8	

(i) Complete the table for the function $y = 2^x$. **(2 marks)**

(ii) On the grid provided **on page 27**, draw the graph of $y = 2^x$, using a scale of 2 cm to represent 1 unit on the x-axis and 1 cm to represent 1 unit on the y-axis.

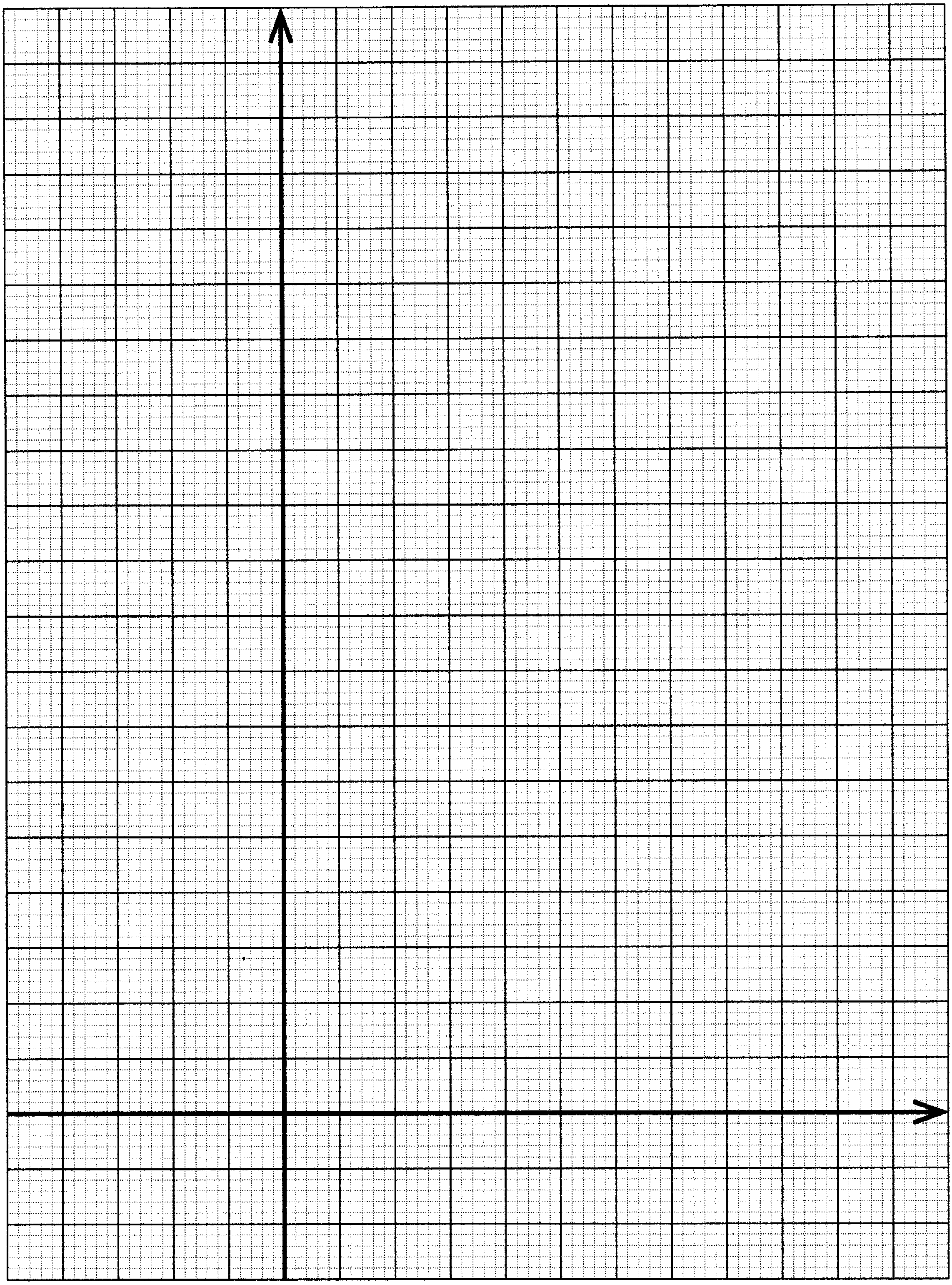
(4 marks)

(iii) Drawing appropriate lines on your graph, determine the value of x for which $2^x = 11$.

....

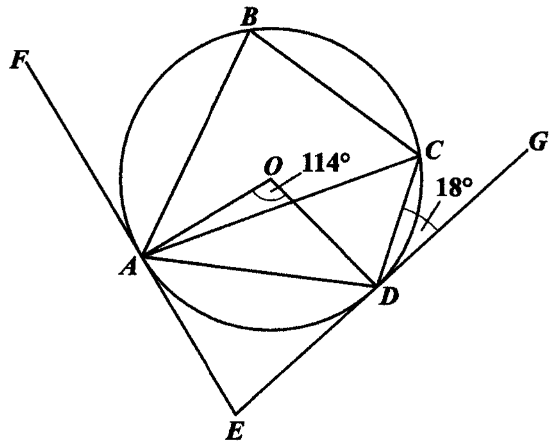
(2 marks)

Total 15 marks



MEASUREMENT, GEOMETRY AND TRIGONOMETRY

10. (a) The diagram below, **not drawn to scale**, shows a circle with centre O. The points A, B, C and D are on the circumference of the circle. EAF and EDG are tangents to the circle at A and D respectively. $A\hat{O}D = 114°$ and $C\hat{D}G = 18°$.



Calculate, giving reasons for EACH step of your answer, the measure of

(i) $A\hat{C}D$

....

(2 marks)

(ii) $A\hat{E}D$

....

(2 marks)

(iii) $O\hat{A}C$

....

(2 marks)

(iv) $A\hat{B}C$.

....

(2 marks)

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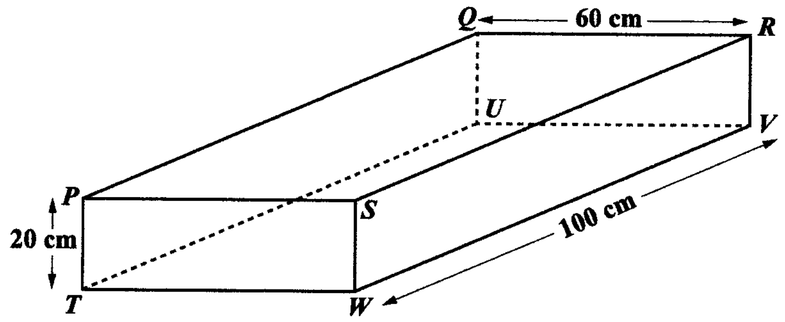
(b) The diagram below shows a cuboid.



Give your answer correct to one decimal place.

(i) A straight adjustable wire connects R to P along the top of the cuboid. Calculate the length of the wire RP.

....

(1 mark)

(ii) The connection at P is now adjusted and moved to T.

Calculate the length of the wire RT.

....

(2 marks)