



eduresourceza.com



Please paste the barcoded label here

TOTAL
MARKS

--

INTERNATIONAL SECONDARY CERTIFICATE EXAMINATION
NOVEMBER 2022

MATHEMATICS: PAPER II

EXAMINATION NUMBER

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Time: 3 hours

150 marks

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

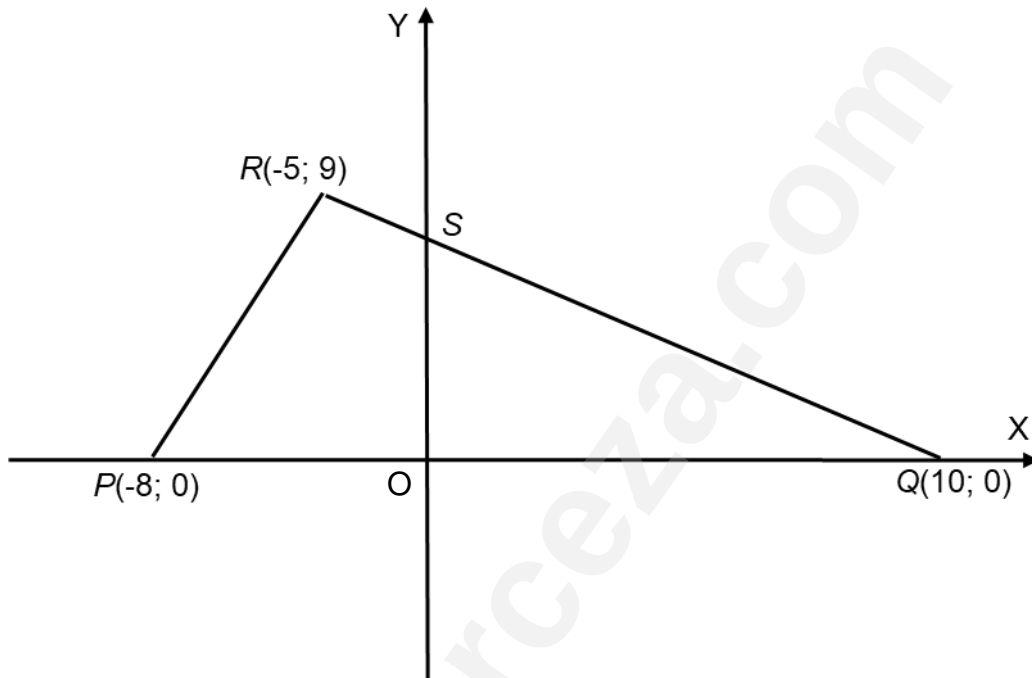
1. This question paper consists of 28 pages and an Information Sheet of 2 pages (i–ii). Please check that your question paper is complete.
2. Read the questions carefully.
3. **Answer ALL the questions on the question paper and hand it in at the end of the examination. Remember to write your examination number in the space provided.**
4. Diagrams are not necessarily drawn to scale.
5. You may use an approved non-programmable and non-graphical calculator, unless otherwise stated.
6. Ensure that your calculator is in **DEGREE** mode.
7. Clearly show **ALL** calculations, diagrams, graphs, etc. that you have used in determining your answers. **Answers only will NOT necessarily be awarded full marks.**
8. Round off to **ONE DECIMAL PLACE** unless otherwise stated.
9. It is in your own interest to write legibly and to present your work neatly.
10. Three blank pages (pages 26 to 28) are included at the end of the paper. If you run out of space for a question, use these pages. Clearly indicate the number of your answer should you use this extra space.

FOR OFFICE USE ONLY: MARKER TO ENTER MARKS

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	TOTAL
13	16	14	16	14	5	8	12	11	6	21	8	6	150

SECTION A**QUESTION 1**

The diagram shows $\triangle PQR$ with coordinates $P(-8; 0)$, $Q(10; 0)$ and $R(-5; 9)$. The line QR cuts the y -axis at point S .



Find ...

(a) the length of QR . (2)

(b) the equation of line QR . (3)

(c) the coordinates of S . (1)

(d) k if $M(-12; k)$ and P, S and M are collinear. (4)

(e) $\frac{\text{Area} \triangle PQR}{\text{Area} \triangle SOQ}$. (3)

[13]

QUESTION 2

- (a) The marks achieved by 12 students in a mathematics class in a test are given in the stem and leaf diagram alongside.

Stem	Leaf
2	7
3	2 8
4	6
5	4 6
6	4 8
7	2 6
8	5
9	2

Key: 3 | 7 means 37

The diagram below shows a box-and-whisker plot representing their results.



- (1) Find the values of x and y . (2)

- (2) Comment on the skewness of the data. (1)

(b) There are 40 marbles in bag P of which x are green, 20 are yellow and the rest are blue. There are 60 marbles in bag Q of which 15 are green, $2x$ are yellow and the rest are blue.

(1) If the probability of selecting a blue marble from bag P is $\frac{1}{8}$, show that the value of x is 15. (3)

(2) Find the probability of selecting a blue marble from bag Q . (2)

(3) If the marbles from bag P and Q are put together in another bag, find the probability of selecting a yellow marble from this new bag. (2)

- (c) A group of men in a fishing competition have the number of fish caught recorded in the table below.

Number of fish	0	1	2	3	4	5
Number of men	10	12	7	x	3	2

- (1) Find the minimum value of x if the mode is 3. (1)

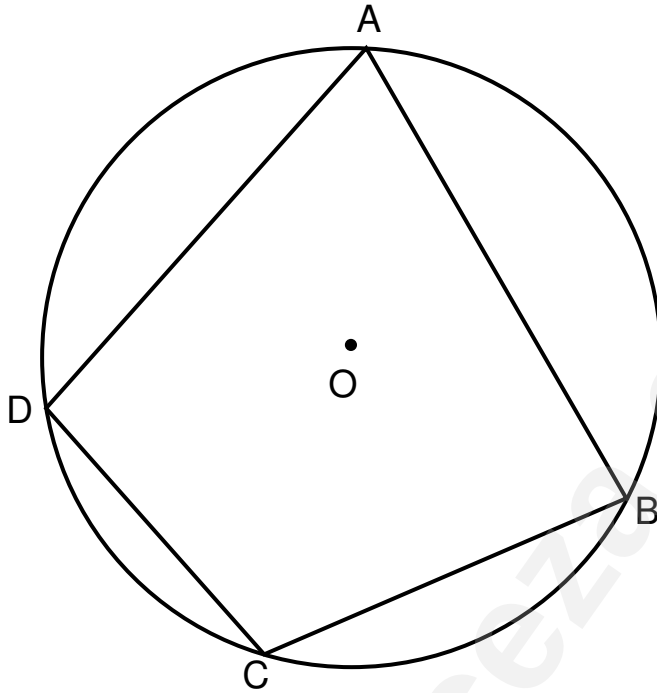
- (2) Find the median if the value of x is 20. (2)

- (3) If 44% of the men caught at most 1 fish, find the value of x . (3)

[16]

QUESTION 3

- (a) In the figure below A, B, C and D are points on the circumference of the circle centre O.

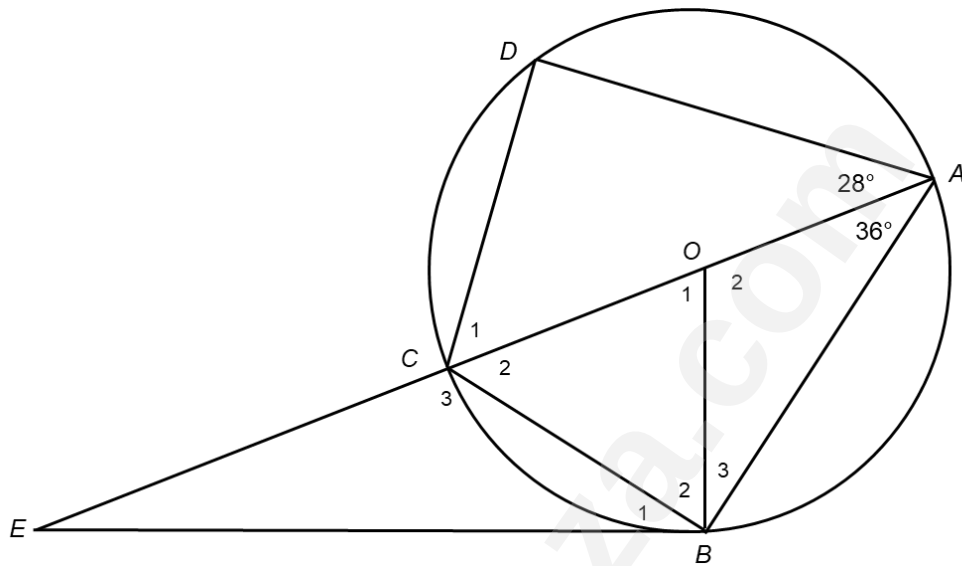


Using the above diagram, prove the theorem which states that ...

$$\hat{A} + \hat{C} = 180^\circ$$

(5)

- (b) In the diagram, A , B , C and D lie on the circumference of the circle with centre O . The diameter AC produced meets the tangent at B at the point E . $\hat{OAB} = 36^\circ$ and $\hat{DAC} = 28^\circ$.



Find with reasons ...

$$(1) \quad B\hat{C}D \quad (2)$$

$$(2) \quad \hat{E} \quad (4)$$

(3) $\hat{D}BC$

(1)

(4) $\hat{C}_3$

(2)

[14]

QUESTION 4

(a) Simplify fully: $\frac{\cos(90^\circ + x) \tan^2(-x - 180^\circ) \cos(x + 720^\circ)}{\tan(-x) \sin(180^\circ - x) \sin(x - 360^\circ)}$ (6)

(b) Prove that $\cos^2 \theta (1 - \tan^2 \theta) = \cos 2\theta$ (3)

- (c) If $\cos 2\theta = -\frac{5}{6}$ and $2\theta \in [180^\circ; 270^\circ]$ calculate, without a calculator, in its simplest form:

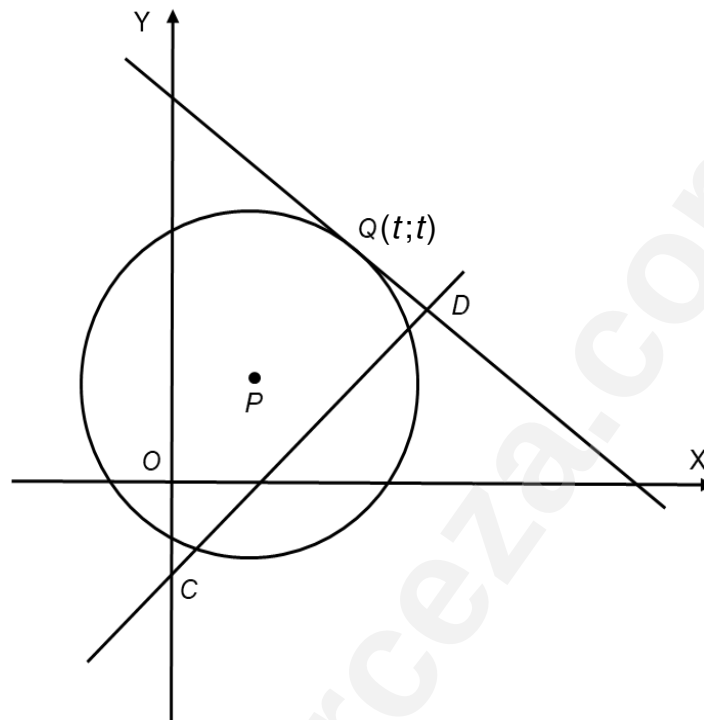
(1) $\sin 2\theta$ (3)

(2) $\sin^2 \theta$ (4)

[16]

QUESTION 5

$x^2 + y^2 = 4x + 6y + 12$ is the equation of the circle centre P . QD is a tangent to the circle at Q . Line CD has equation $y = x - 3$.



- (a) Find the co-ordinates of the centre of circle P and the radius of the circle. (3)

- (b) Determine whether $A(7; 4)$ lies inside or outside of circle centre P . (2)

- (c) $Q(t; t)$ is a point on the circumference of circle P and t is a positive integer. Show that $t = 6$. (4)

- (d) Determine the size of $\hat{QDC}$. (5)

[14]

QUESTION 6

A company manufactures boxes. We know that box A's sides are scaled using a factor of k to form box B. The area of box A's base is $1\,500\text{ cm}^2$ and the area of box B's base is $3\,375\text{ cm}^2$.



BOX A



BOX B

(a) Find the value of k .

(3)

(b) If the height of box B is 99 cm, calculate the original height of box A.

(2)

[5]

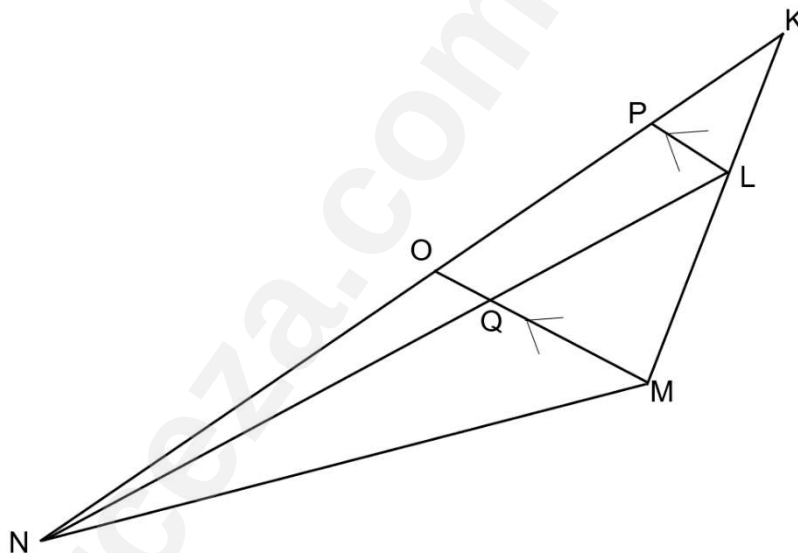
78 marks

SECTION B

QUESTION 7

- (a) Complete the following theorem statement.
 "The line drawn parallel to one side of a triangle divides _____"
 _____" (1)

- (b) In the diagram $OM \parallel LP$,
 $KN:KO = 8:3$ and
 $LM = 3KL$



- (1) Calculate $\frac{LQ}{QN}$ (4)

- (2) Calculate $\frac{\text{Area of } \triangle KMO}{\text{Area of } \triangle NMO}$ (3)

[8]

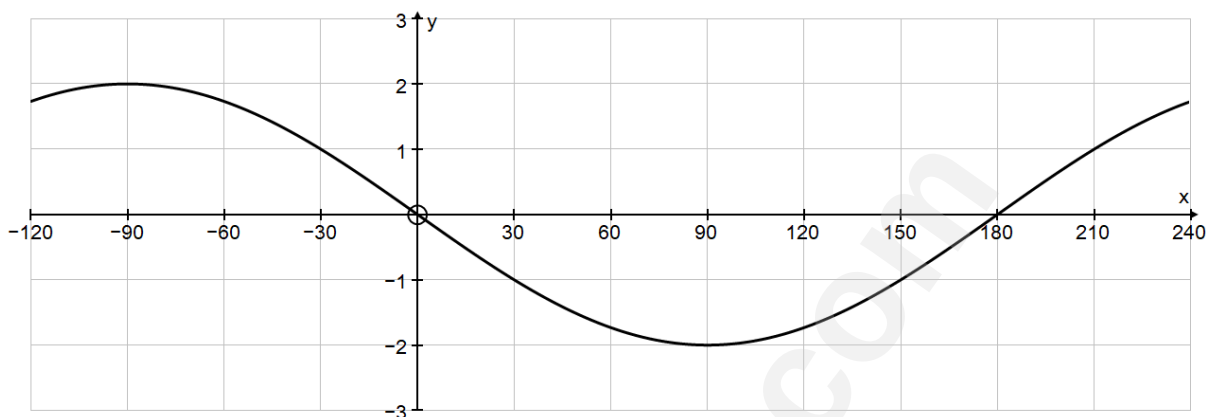
QUESTION 8

- (a) Show that equation $\cos(x + 60^\circ) + 2\sin x = 0$ can be written as $\tan x = \frac{1}{\sqrt{3} - 4}$. (4)

- (b) Hence determine the solutions of the equation $\cos(x + 60^\circ) + 2\sin x = 0$ in the interval $-180^\circ \leq x \leq 180^\circ$. (3)

- (c) In the diagram below, the graph of $f(x) = -2\sin x$ is drawn for the interval $-120^\circ \leq x \leq 240^\circ$. Sketch the graph of $g(x) = \cos(x + 60^\circ)$ on the same axis.

(3)



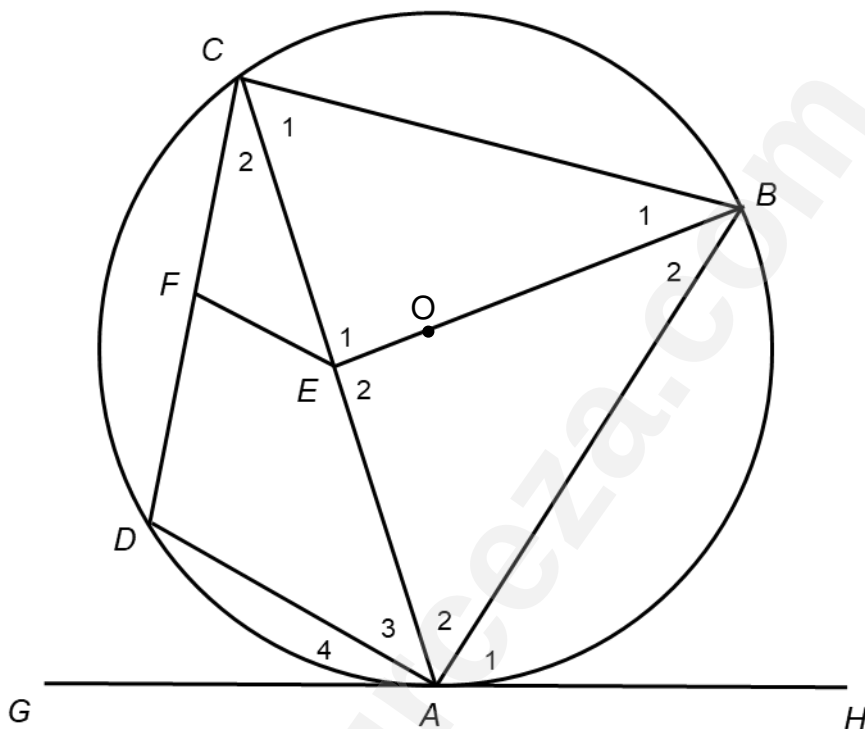
- (d) Hence, using your answers from parts (b) and (c), determine the values of x in the interval $-120^\circ \leq x \leq 240^\circ$, for which $\cos(x + 60^\circ) + 2\sin x \geq 0$.

(2)

[12]

QUESTION 9

The diagram shows a circle with centre O , passing through points A , B , C and D . GAH is a tangent to the circle at point A . It is given that $BA = BC$ and $FC = FD$. It is also given that E is a point on AC such that BE is perpendicular to AC and BE passes through O .



(a) Show that AB bisects $\hat{CAH}$. (3)

(b) Show that FE is parallel to DA . (4)

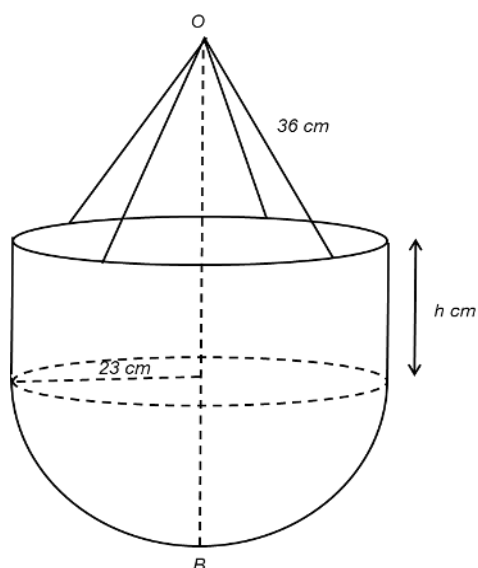
- (c) If $CA = 20$ units, $OE = 3$ units and $CB = 26$ units. Find the length of the radius of the circle.

(4)

[11]

QUESTION 10

The diagram below shows a container which is made by attaching an open hemisphere of internal radius 23 cm to the rim of a hollow cylinder with the same radius and a height of h cm.



Sphere

$$\text{Surface Area} = 4\pi r^2$$

$$\text{Volume} = \frac{4}{3}\pi r^3$$

Cylinder

$$\text{Surface Area} = 2\pi rh + 2\pi r^2$$

$$\text{Volume} = \pi r^2 h$$

The container is suspended from O by four wires, each of length 36 cm, fastened symmetrically to the rim of the cylinder.

It is given that 43,7 litres of water is needed to completely fill the container.

Show that $h = 10,96$ cm.

[6]

QUESTION 11

- (a) A and B are two events in a sample space.

$$p(A) = 0,4 \text{ and } p(A \text{ or } B) = 0,9.$$

Find x in each case if $p(B) = x$.

- (1) A and B are mutually exclusive. (2)

- (2) A and B are independent. (4)

- (b) A group of 5 people are standing in a row to be photographed. There are 6 pupils, 4 parents and 3 teachers. Find the number of different row arrangements that can be formed if ...

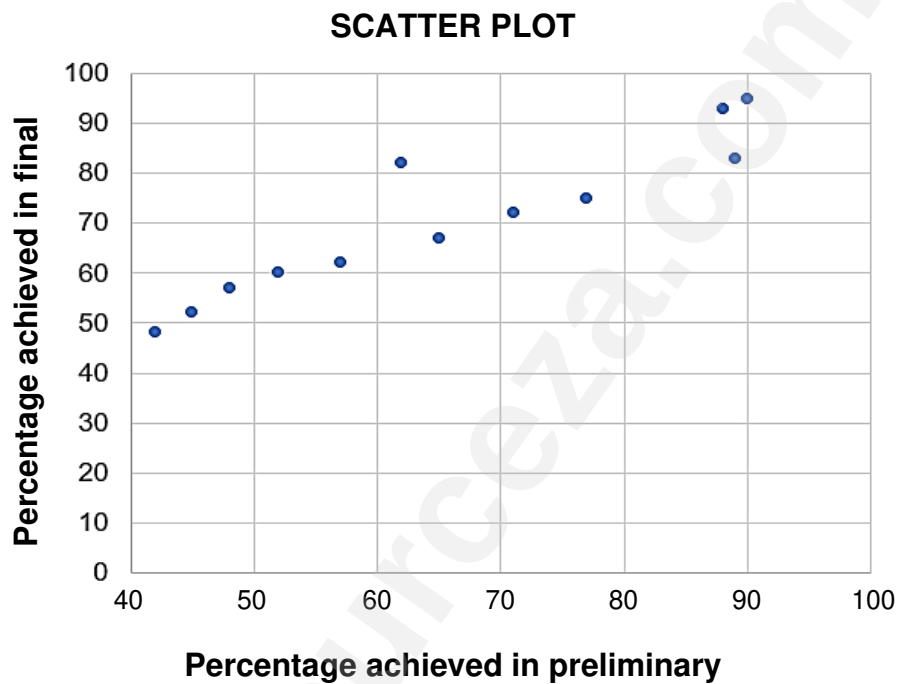
- (1) there are no restrictions. (1)

- (2) the row must contain at least one pupil. (2)

- (3) the row must contain all the teachers. (1)

- (c) A teacher at a small school had 12 pupils writing core mathematics in 2021. He is interested to see how the pupils performed in finals as opposed to the preliminary examination. The table below shows the performance of the 12 pupils.

Prelims	52	62	88	90	71	65	77	42	89	48	45	57
Finals	60	82	93	95	72	67	75	48	83	57	52	62



- (1) Calculate the mean percentage and standard deviation for the final paper. (3)
- (2) Determine the number of pupils whose percentage in the final mathematics paper lie within one standard deviation of the mean. (2)

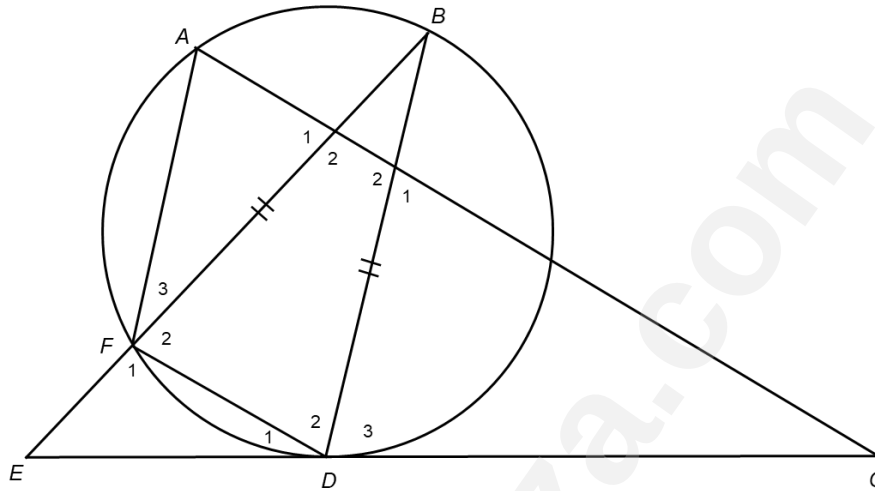
- (3) Calculate an equation for the least squares regression line (line of best fit) and correlation coefficient.
- (3)

- (4) If a candidate from this group scored 55% in the mathematics preliminary examination and unfortunately was unable to write the final examination, what would the teacher expect him to have got in the final examination? (Round your answer to the nearest integer.) Comment as to why this would probably be quite accurate.
- (3)

[21]

QUESTION 12

In the diagram a circle with points A, B, D and F on its circumference where $BF = BD$. The tangent to the circle at D meets BF extended at E and AC a straight line meets the tangent at C .



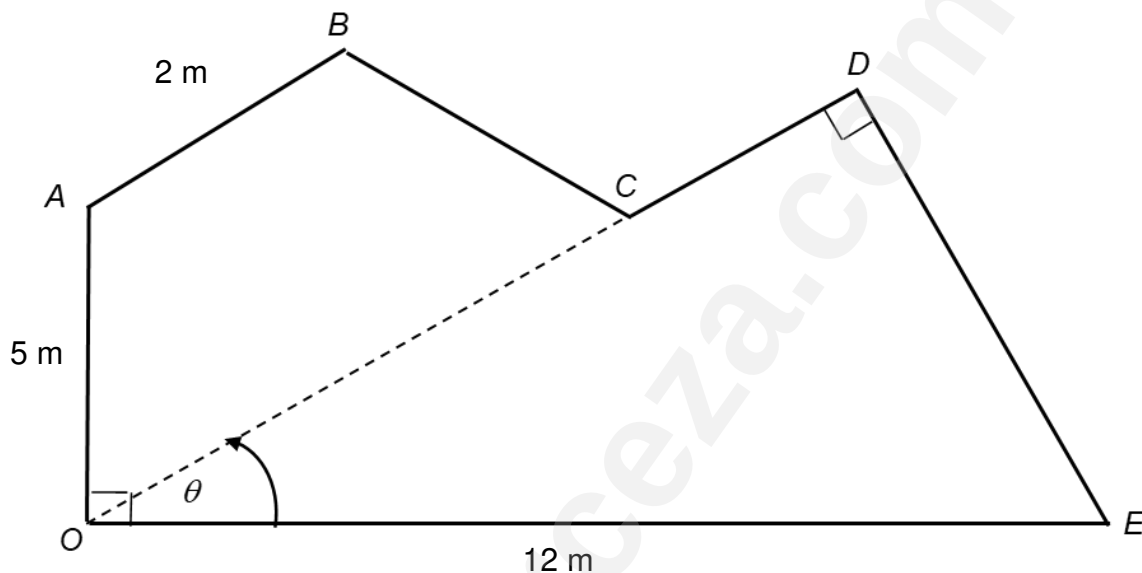
Prove that ...

(a) $\triangle EFD \parallel \triangle EDB$ (4)

(b) $ED^2 - EF^2 = EF \times DB$ (4)

QUESTION 13

A panel is constructed to separate workers in an office. It is constructed by joining an isosceles trapezium ($AO = BC$) and a right-angled triangle together as shown in the diagram. We know that $OA = 5$ m, $OE = 12$ m and $OA \perp OE$. OC is perpendicular to DE and makes an angle θ with the base OE . AB and OC are the parallel sides of the trapezium $OABC$ and $AB = 2$ m. The total length of the edges of the panel (perimeter) $OABCDE$ is represented by S .



(a) Show that $OC = 10 \sin \theta + 2$. (3)

(b) Show that $S = 12 \cos \theta + 2 \sin \theta + 22$. (3)

[6]

72 marks

ADDITIONAL SPACE (ALL QUESTIONS)

REMEMBER TO CLEARLY INDICATE AT THE QUESTION THAT YOU USED THE ADDITIONAL SPACE TO ENSURE THAT ALL ANSWERS ARE MARKED.

eduresourceza.com

eduresourceza.com

eduresourceza.com