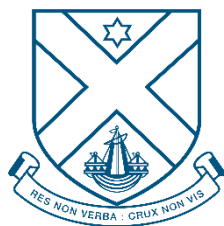




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ST ANNE'S DIOCESAN COLLEGE
TRIAL EXAMINATION - 2022
GRADE 12

MATHEMATICS - PAPER 2

Time: 3 hours

NAME:/exam no. _____

150 marks

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This question paper consists of 24 pages. Please check that your question paper is complete.
2. Read the questions carefully.
3. Answer all the questions.
4. You may use an approved non-programmable and non-graphical calculator unless otherwise stated.
5. Clearly show **ALL** calculations, diagrams, graphs, etc. that you have used in determining your answers. **Answers only will NOT be awarded full marks.**
6. Diagrams are not necessarily drawn to scale.
7. If necessary, round off answers to **ONE** decimal place, unless otherwise stated.
8. It is in your own interest to write legibly and to present your work neatly.
9. An information sheet with formulae is included.
10. Ensure that your calculator is in **DEGREE** mode.
11. Pages 23 and 24 are blank and can be used as extra working space. Label your questions clearly if you make use of this space.

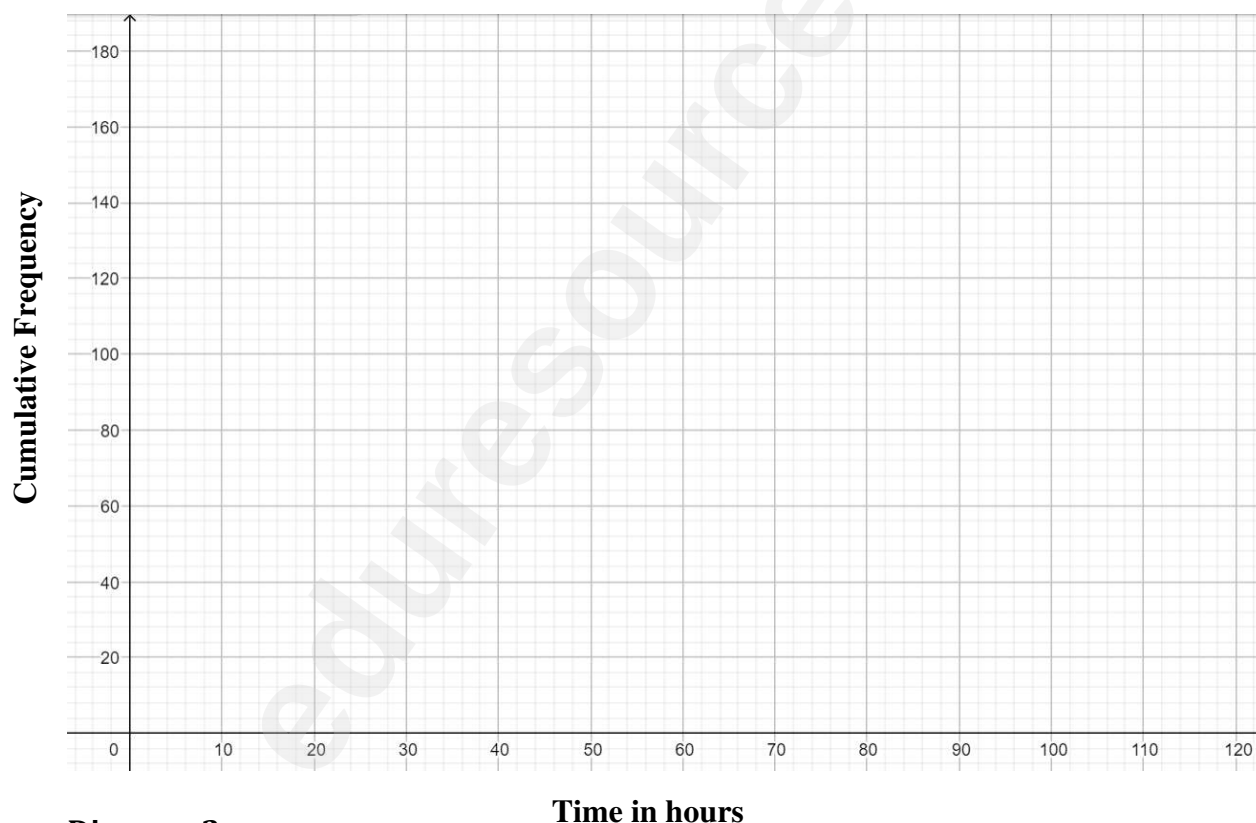
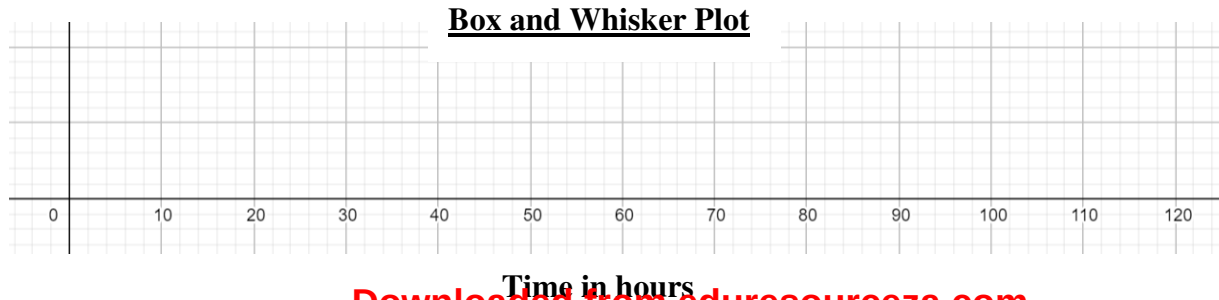
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	SECTION A					SECTION B						
Question	1	2	3	4	5	6	7	8	9	10	11	12
Mark												
Total	14	6	13	24	17	12	11	14	12	8	13	6
											Total	
												150
											Percentage	
												100

SECTION A**QUESTION 1**

The table below shows the amount of time (in hours) that learners aged between 13 and 18 years of age spent on social media during the July holiday.

Time (hours)	Cumulative Frequency		
$0 \leq t < 20$	25		
$20 \leq t < 40$	69		
$40 \leq t < 60$	129		
$60 \leq t < 80$	167		
$80 \leq t < 100$	177		
$100 \leq t < 120$	180		

Diagram 1:**Cumulative Frequency Graph****Diagram 2:****Box and Whisker Plot**

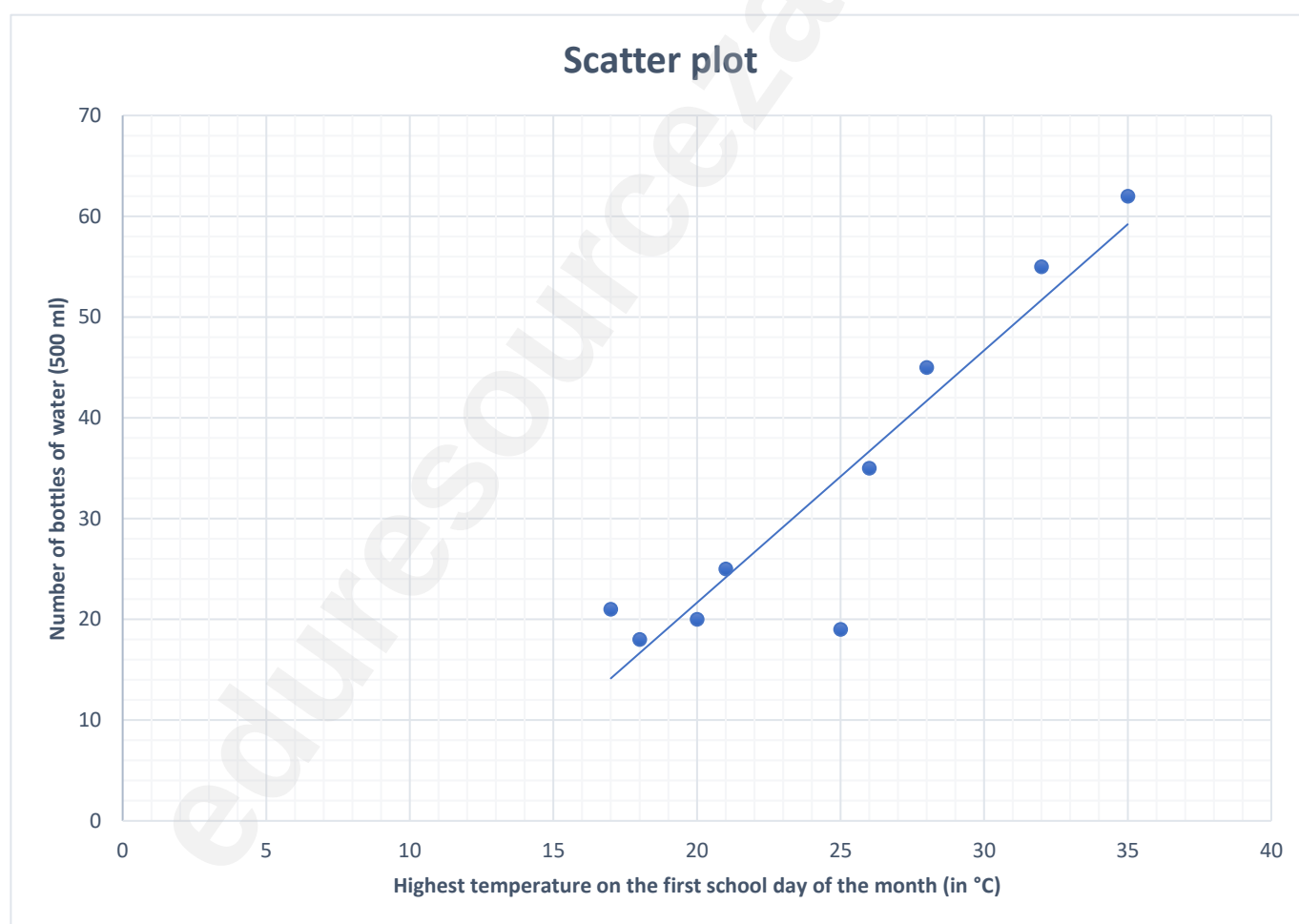
- (a) Draw a Cumulative Frequency Graph on **Diagram 1**.
Mark Q_1 , Q_2 and Q_3 where you read the values off your graph and write your answers in the space below. (5)
- (b) Draw a Box and Whisker plot on **Diagram 2**, if it is given that the minimum time spent on social media is 10 hours and the maximum is 118 hours.
Comment on the skewness of the data. (3)
- (c) Write down the modal class of the data. (1)
- (d) Estimate the mean time in hours that the teenagers spent on social media during this holiday. (3)
- (e) Use your graph to estimate the number of learners who used social media for more than 75% of the 120 hours recorded. (2)

[14]

QUESTION 2

On the first school day of every month the highest temperature (in °C) is recorded together with the number of 500ml water bottles sold at the tuck shop during tea break. The data is shown in the table below and represented on the scatter plot. The least squares regression line for this data is drawn on the scatter plot.

Highest Temperature (in °C)	35	32	28	26	21	17	18	20	25
No of water bottles (500 ml)	62	55	45	35	25	21	18	20	19



- (a) Use your calculator to determine the equation of the line of best fit in the form $y = A + Bx$.
Give your answer correct to 3 decimal places. (2)

- (b) Hence, estimate the number of 500 ml bottles of water that will be sold if the temperature is 30°C? Round **up** to the nearest bottle. (2)

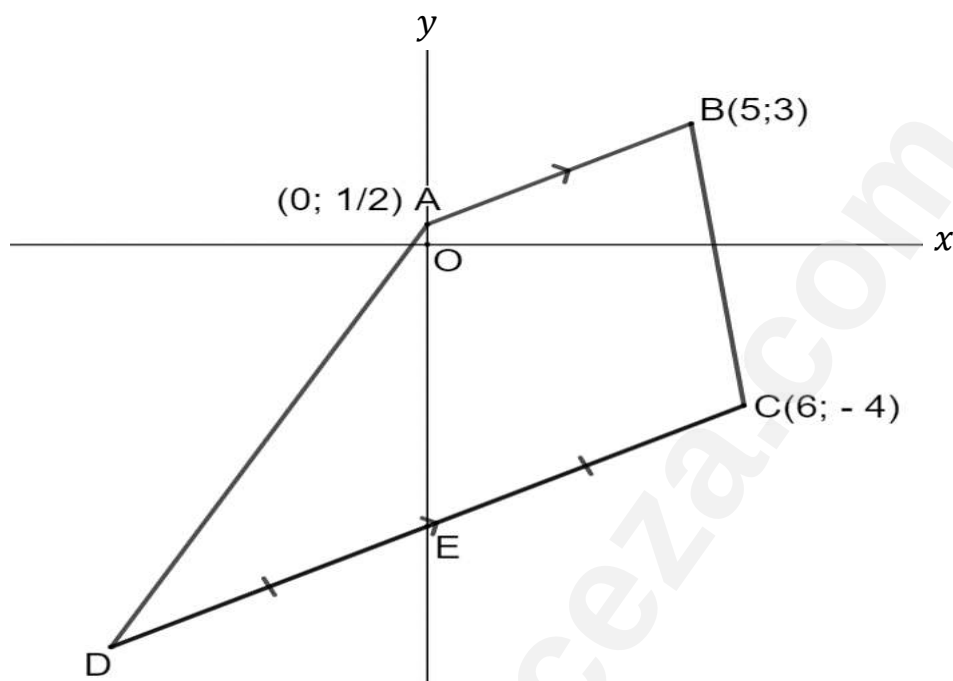
- (c) Identify an outlier in the data. (1)

- (d) If the outlier was removed would the gradient of the least squares regression line increase or decrease? (1)

[6]

QUESTION 3

- (a) In the diagram, $A\left(0; \frac{1}{2}\right)$, $B(5; 3)$ and $C(6; -4)$ are the vertices of a trapezium with $AB \parallel DC$ and $DE = EC$.



1. Calculate the gradient of AB. (2)

2. Hence, determine the equation of DC. (3)

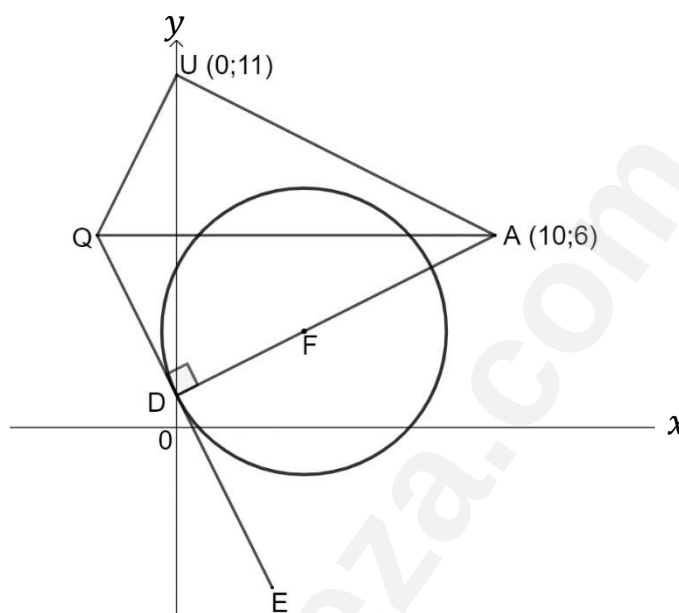
3. Show that the coordinates of E, the y -intercept, is $(0; -7)$. (1)
4. Calculate the coordinates of D. (3)
5. If F is the reflection of C about the y -axis, write down the coordinates of F. (1)
6. Calculate the area of $\triangle CDF$. (3)

QUESTION 4

Given circle, centre F, with the equation $x^2 + y^2 - 8x - 6y = -5$.

QDE is a tangent to the circle at D. DFA is a straight line that cuts the y-axis at D.

QA is parallel to the x-axis.



- (a) Determine the coordinates of F, the centre of the circle, as well as the radius of the circle (in surd form). Show all working. (5)
- (b) Calculate the coordinates of D. (2)
- (c) Give a reason why $QE \perp AD$. (1)
- (d) Determine the equation of the tangent, QDE. (3)

- (e) Calculate the coordinates of Q. (3)
- (f) Prove that QUAD is a cyclic quadrilateral. (4)
- (g) Write down the equation of circle, centre B, where B is the reflection of F about the x -axis, and the x -axis is also a tangent to this circle, centre B. (3)
- (h) If a cylinder with a height (H) of 12 cm has a base identical to the circle centre F in the given diagram, determine the volume of this cylinder. (3)

[24]

QUESTION 5

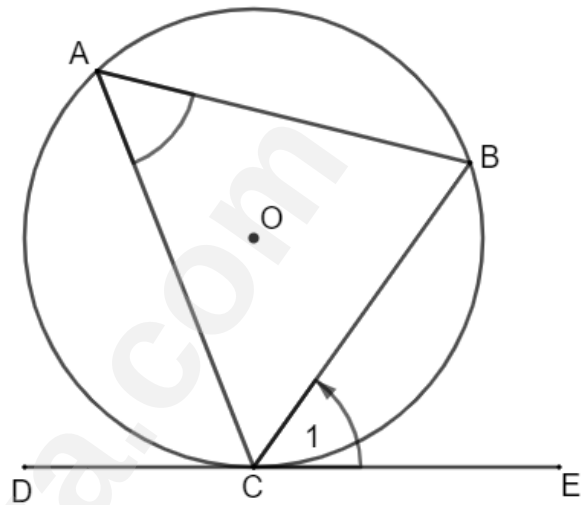
- (a) Prove the theorem which states that the angle between the tangent to a circle and the chord drawn from the point of contact is equal to the angle in the alternate segment. (4)

Given: circle centre O, with chords AB, AC and CB and DCE a tangent.

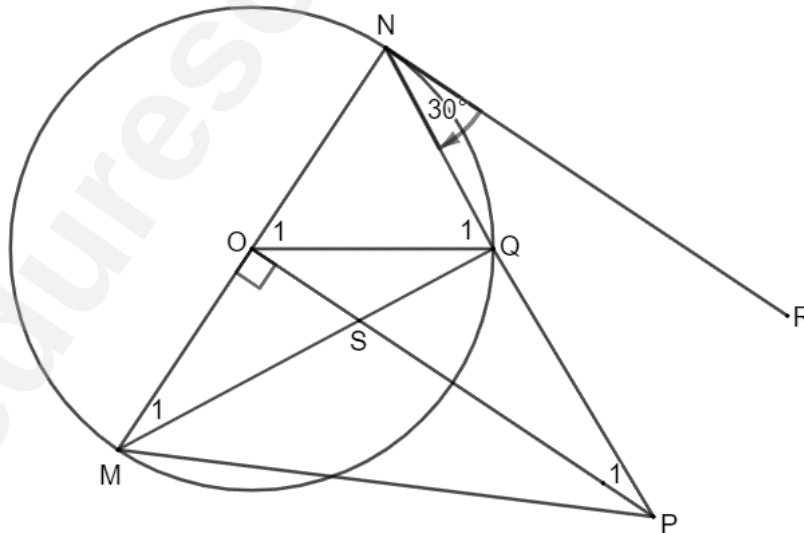
R.T.P.: $\hat{C}_1 = \hat{A}$

Construction:

Proof:



- (b) Given circle centre O, with diameter MN and Q a point on the circumference. NR is a tangent to the circle and $\angle QNR = 30^\circ$. $MN \perp OP$ and MSQ and OSP are straight lines. NQ is extended to P.



1. Show that $NR \parallel OP$. (3)

2. Calculate, with reasons, the size of:

i. $\hat{M}_1$ (1)

ii. $\hat{Q}_1$ (2)

iii. $\hat{O}_1$ (1)

iv. $\hat{P}_1$ (1)

3. Hence, or otherwise, prove that:

i. MOQP is cyclic. (2)

ii. OQ is a tangent to the circle passing through QPS. (3)

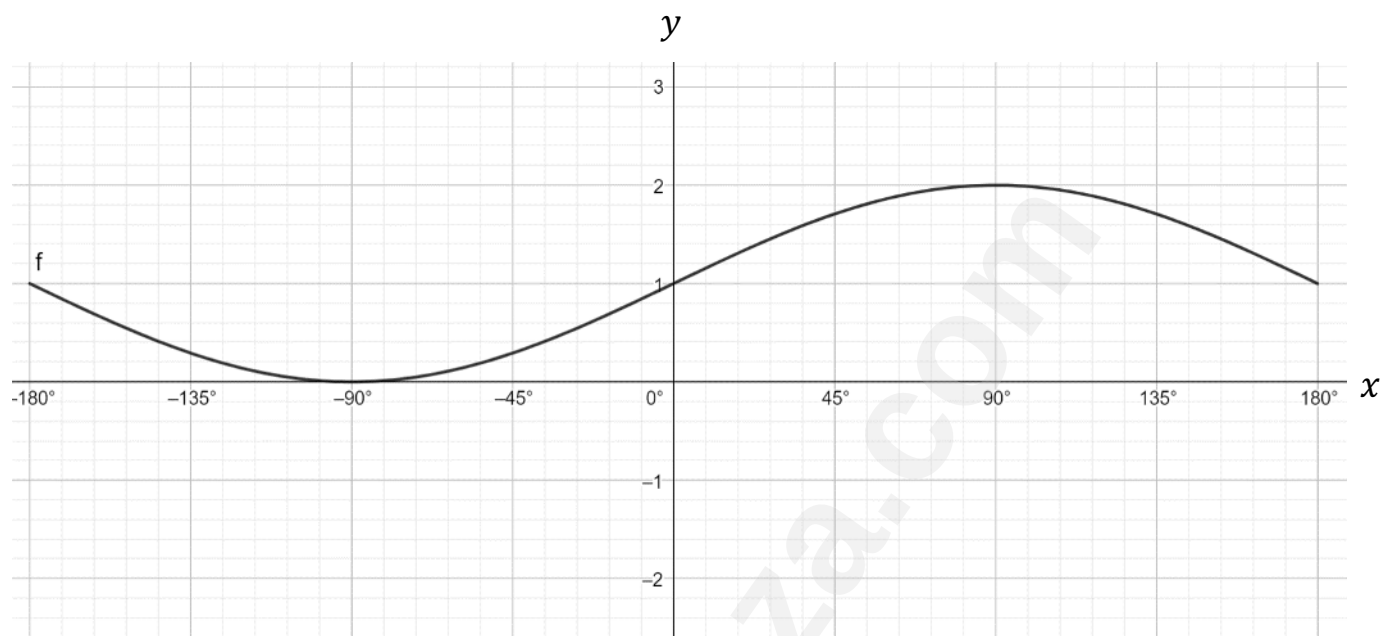
[17]

SECTION B**QUESTION 6**

- (a) Solve for x if $\sin x = \cos 2x - 1$ and $-180^\circ \leq x \leq 180^\circ$. (6)

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(b) In the diagram below the graph of $f(x) = \sin x + 1$ is drawn for the interval $x \in [-180^\circ; 180^\circ]$.



Your answer(s) from (a) may be helpful with the following questions.

1. Draw the graph of $g(x) = \cos 2x$ for the interval $x \in [-180^\circ; 180^\circ]$ on the grid above. Label the turning points, and highlight any points of intersection. (2)

2. For the interval $x \in [-180^\circ; 0^\circ]$, write down the x -values such that:

- i. $f(x) \leq g(x)$ (2)

- ii. $g(x + 45^\circ) > 0$ (2)

[12]

QUESTION 7

(a) Determine the value of x , to two decimal places, if $\theta = 100,5^\circ$ and $3x \tan 2\theta = \sin \frac{\theta}{2}$. (2)

(b) Given $5 \cos \theta = 4$ and $180^\circ \leq \theta \leq 360^\circ$.

1. what quadrant does θ lie in? (1)

2. determine the value of $5 \sin 2\theta$ without using a calculator. (4)

(c) Determine the value of $\tan \theta$, if the distance between $(\cos \theta; 2)$ and $(1; -\sin \theta)$ is $\sqrt{6}$. (4)

QUESTION 8

(a) Simplify to a single term:

$$\sin(540^\circ - x) \cdot \cos(-2x) - \sin(180^\circ - 2x) \cdot \sin(90^\circ + x) \quad (6)$$

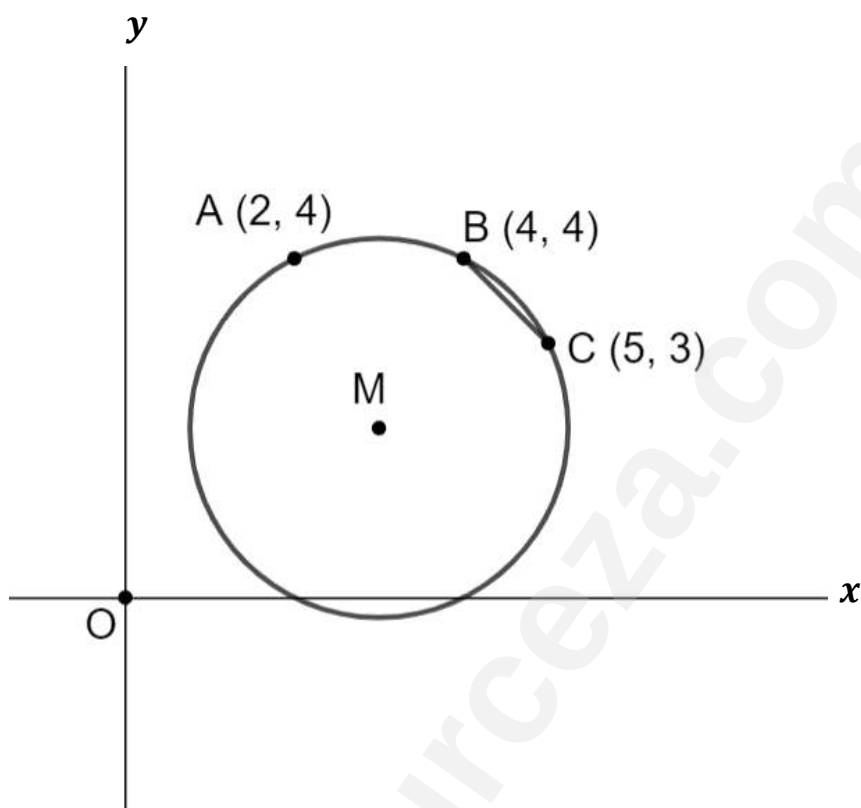
(b) 1. Prove: $\tan\theta + \frac{1+\cos 2\theta}{\sin 2\theta} = \frac{1}{\sin\theta \cdot \cos\theta}$ (5)

2. Determine the general solution for θ for which the identity is not valid. (3)

[14]

QUESTION 9

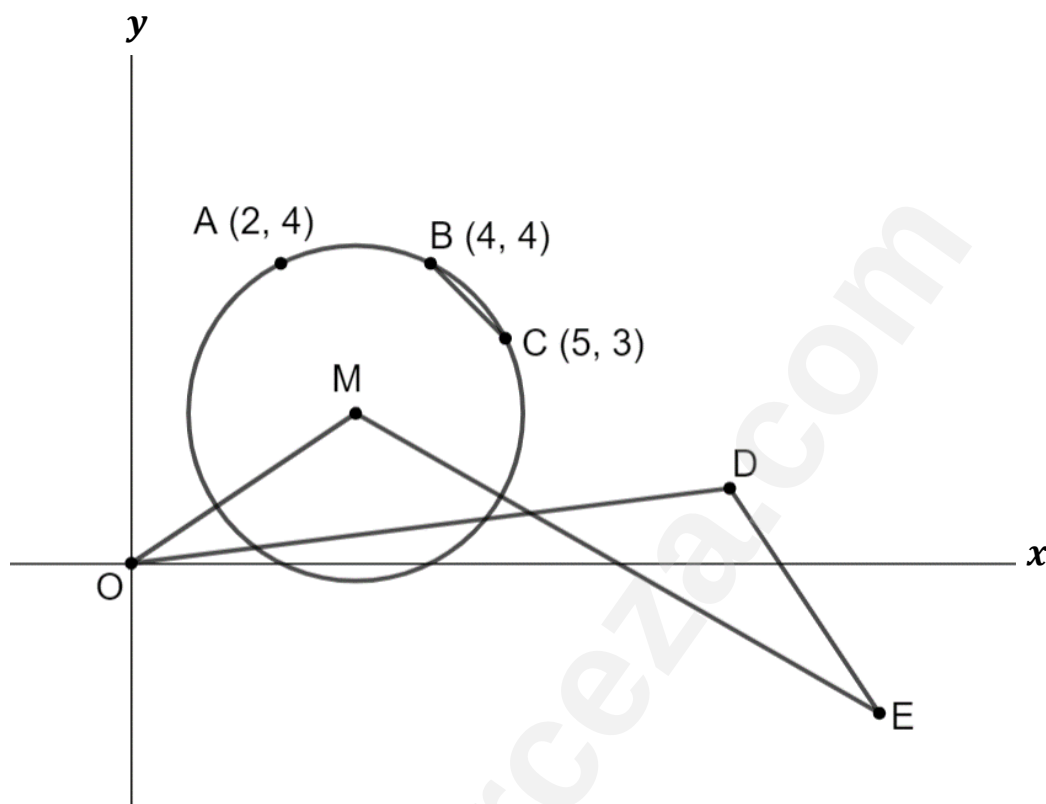
The diagram shows circle, centre M, with point A (2; 4) on the circle. The line from B (4; 4) and C (5; 3) is a chord of the circle. O is the origin.



- (a) Determine the coordinates of M, the centre of the circle. Show all necessary working.

(7)

- (b) Two extra points D (8; 1) and E (10; -2) are added to the diagram above.
It is further given that M is the point (3; 2) and $\widehat{MED} = 26,6^\circ$.



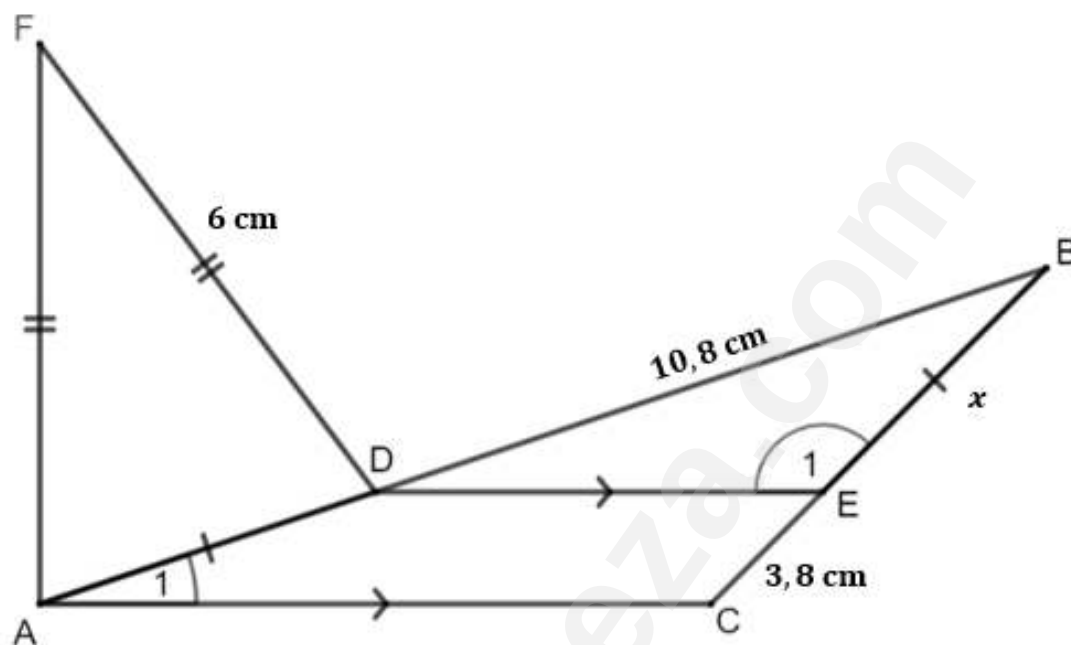
Prove that OMDE is a cyclic quadrilateral.

(5)

[12]

QUESTION 10

Given $\triangle ABC$ with D and E points on AB and BC respectively. $DE \parallel AC$ and $BE = AD = x$.
 $BD = 10,8 \text{ cm}$, $EC = 3,8 \text{ cm}$ and $AF = FD = 6 \text{ cm}$.



(a) Prove that $x = 6,4 \text{ cm}$. (2)

(b) Hence, or otherwise, calculate the size of $\hat{AFD}$. (3)

(c) If $\hat{A}_1 = 15^\circ$, determine the size of $\hat{E}_1$ if it is given that $\hat{E}_1 > 90^\circ$. (3)

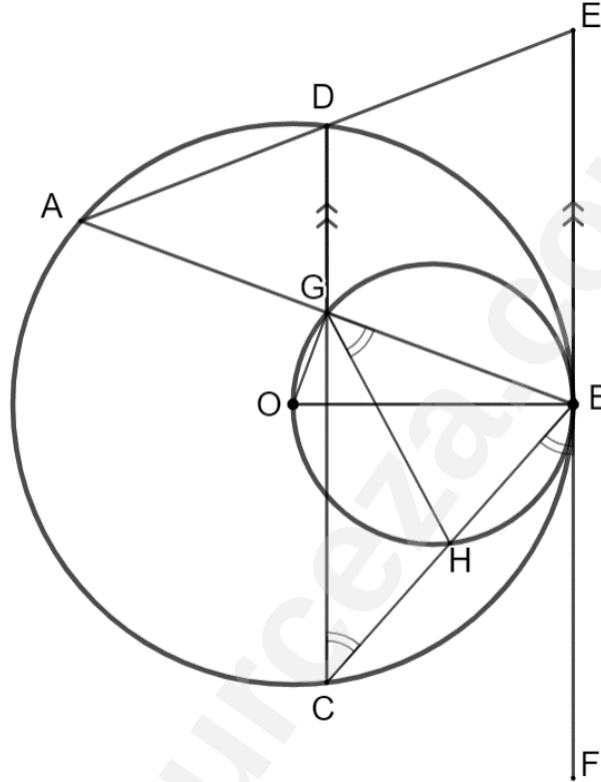
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QUESTION 11

Two circles touch each other internally at B.

O is the centre of the big circle and OB is the diameter of the small circle.

EBF is a common tangent. AB and BC are chords of the bigger circle and intersect the smaller circle at G and H respectively. ADE is a straight line. Chords OG, GH and GB of the smaller circle are drawn. $DC \parallel EF$.



(a) Give a reason why:

1. $\widehat{CBF} = \widehat{GCB}$ (1)
2. $\widehat{CBF} = \widehat{HGB}$ (1)
3. $\widehat{OGB} = 90^\circ$ (1)
4. G is the midpoint of AB. (1)

(b) Prove that:

1. $\triangle GBH \parallel \triangle CBG$. (3)

2. $\frac{AB^2}{4} = BC \cdot BH$ (3)

3. $CH:CB = 5:9$ if $GB = 3$ units and $BH = 2$ units. (3)

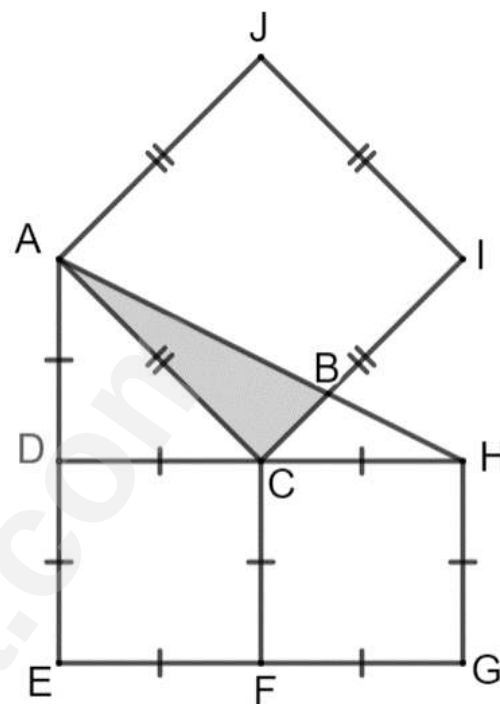
QUESTION 12

Given squares DCFE, CHGF and AJIC, with the area of DCFE = 45 units².

ABH, ADE, DCH and EFG are straight lines.

Determine the area of the shaded triangle ABC.

Only round off final answer.



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