



**BEAULIEU COLLEGE**  
**PRELIMINARY EXAMINATIONS 2016**  
**MATHEMATICS GRADE 12**  
**PAPER 2**

**Examiner:** Mr J Ruiz – Mesa

**Moderator:** Ms A Smith

**Total marks:** 150

**Time:** 3hrs

**Date:** 25 July 2016

Instructions:

- This question paper consists of TEN questions. Answer ALL the questions in the space provided on the question paper.
- Clearly show ALL the calculations, diagrams, graphs, et cetera you have used in determining the answers.
- An approved calculator (non-programmable and non-graphical) may be used, unless stated otherwise.
- If necessary, answers should be rounded off to ONE decimal place, unless stated otherwise.
- Diagrams are NOT necessarily drawn to scale. An information sheet is included.
- It is in your own interest to write legibly and to present the work neatly.
- Please ensure your calculator is in DEGREE mode.

**DO YOUR BEST!!**

SECTION A							Comment
1	2	3	4	5	Total		
Max Mark	20	15	18	7	15	<b>75</b>	
Actual Mark							

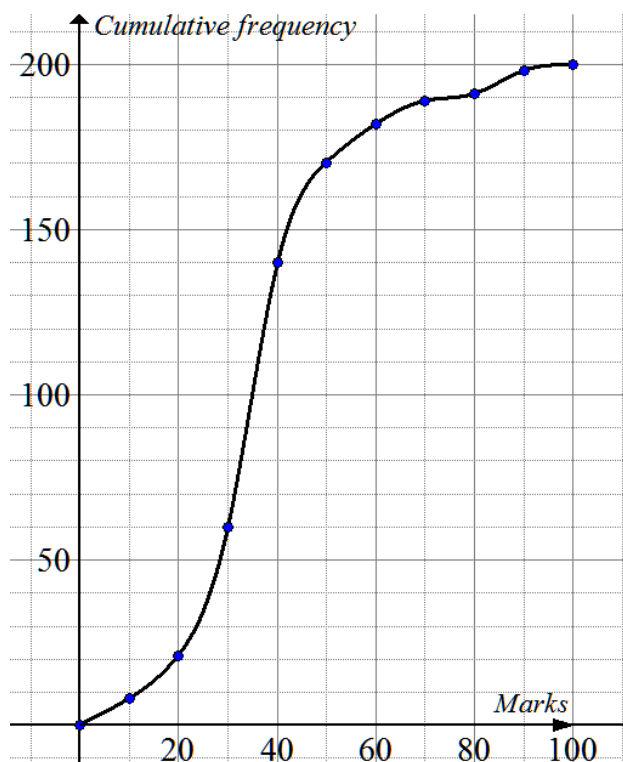
SECTION B						Comment	
6	7	8	9	10	Total		
Max Mark	23	14	16	18	4	<b>75</b>	
Actual Mark							
Stats. Q1	Analytical Geo. Q2+Q6		Trigonometry Q3+Q4+Q7		Euclidean Geo. Q5+Q8+Q9+Q10		



### SECTION A

#### Question 1

a) The cumulative frequency curve alongside shows the Mid-Year examination mark for a group of 200 pupils at a school. The passing mark for the exam was set at 30.



- 1) Determine the percentage of pupils who passed the examination. (2)

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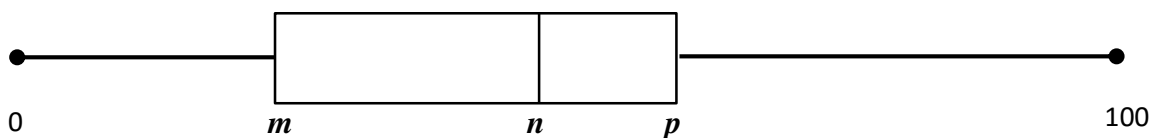
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- 2) A box and whisker plot of the data is given below. Using the diagram, or otherwise, determine the values of  $m$ ,  $n$  and  $p$ . (3)




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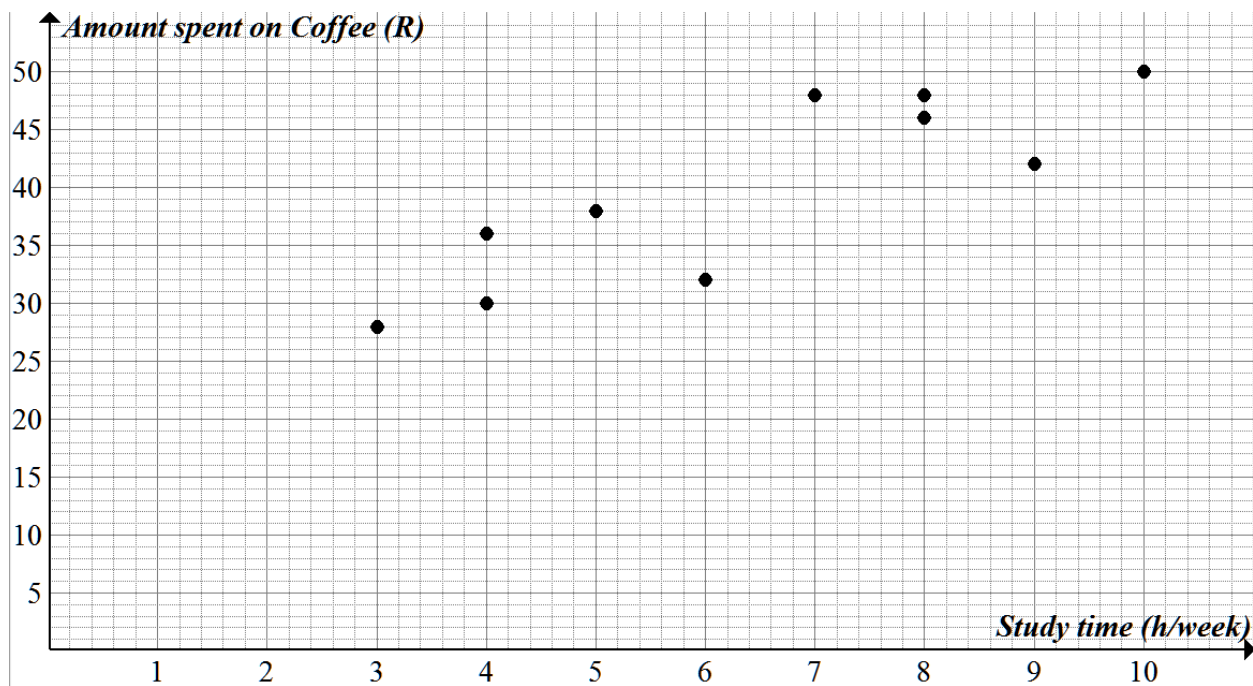
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b) The scatter diagram below displays the amount of money Tanner spends on coffee in relation to the number of hours he spends studying per week.



1) On the diagram, draw a line of best fit for the data. (1)

2) Using your line, estimate how much Tanner will spend on coffee if he studied for 6,5 hours in a week. (1)

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3) Could you estimate accurately the amount Tanner would have spent on coffee if he had studied for 1 hour in a week? Clearly explain the reasons for your answer. (2)

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c) The table alongside shows information about the year marks for Mathematics and Physical Sciences for a group of 50 grade 11 students at the end of 2015.

Subject	Mean	Median	Standard Deviation	Range
Mathematics	64,3	66,0	17,6	68
Physical Sciences	66,7	61,5	12,4	51

- 1) Joseph scored a Mathematics year mark of 65% and a Physical Sciences year mark of 63%. Assuming that the pupils were ranked from highest to lowest according to their marks, in which subject was Joseph better ranked? Substantiate your answer. (2)

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- 2) The Mathematics mark was adjusted and 4% added to each mark. Write down the new Mean, Median, Standard Deviation and Range for Mathematics. (4)

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- 3) Mr. Naidoo decided to adjust the Physical Sciences marks by subtracting 3% from each of the top 10% of the Science students. Determine the Mean, Median and Range for Physical Sciences after the adjustment. (5)

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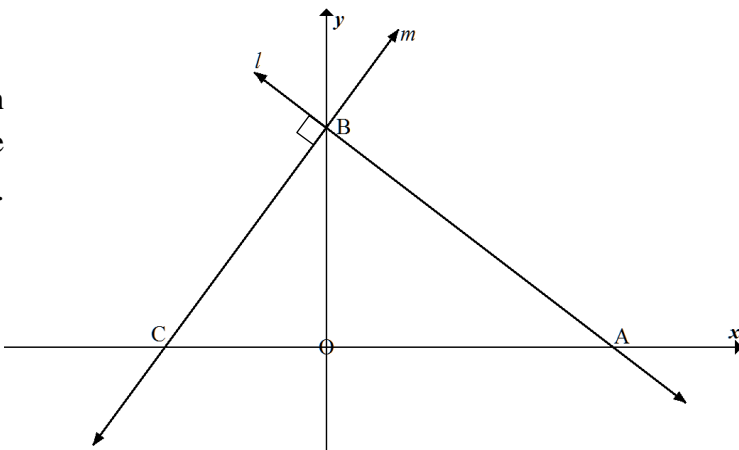
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[20]

**Question 2**

a) The diagram alongside shows line  $l$ , through points A and B, with equation  $3x + 4y = 24$ . The line intersects the  $x$ -axis at A and the  $y$ -axis at B.



1) Determine the coordinates of A and B. (2)

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2) Determine the gradient of line  $l$ . (2)

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3) Line  $m$ , through points B and C, is perpendicular to line  $l$ . Determine the equation of the line  $m$ . (2)

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4) Determine the angle of inclination of line  $m$ . (2)

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- 5) Point D lies on the line segment AC such that the area of  $\triangle ABD$  is 15 units<sup>2</sup>. Determine the coordinates of D. (3)

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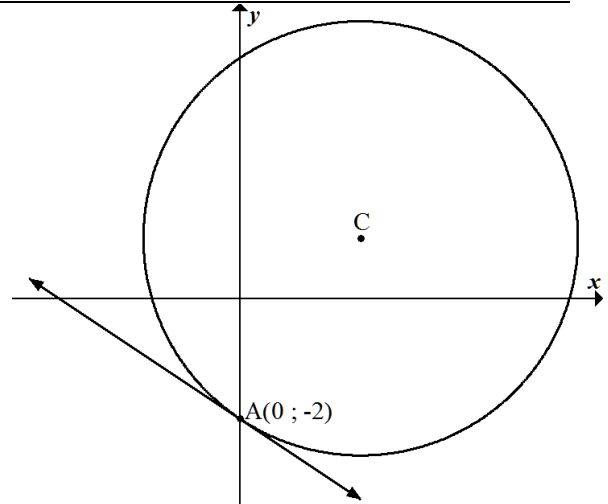
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- b) In the diagram alongside the equation of the circle with centre C is:  $(x-2)^2 + (y-1)^2 = r^2$ . The circle passes through the point A(0 ; -2). A tangent is drawn through A.



- 1) Determine the value of  $r$ . Leave your answer in surd form. (2)

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- 2) Determine the equation of the tangent through A. (2)

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[15]

**Question 3**

- a) It is given that  $\frac{2}{\sqrt{3}}\cos x = 1$  and  $0^\circ \leq x \leq 180^\circ$ . Determine, without the use of the calculator, the value of:
- $$\sin(45^\circ - x)\cos(x + 60^\circ) \qquad (4)$$

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b) Simplify, without using a calculator:

$$\frac{\cos^2 15^\circ - \sin 15^\circ \cos 75^\circ}{\cos^2 15^\circ + \sin 15^\circ \cdot \cos 15^\circ \cdot \tan 15^\circ} \quad (5)$$

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c) Given the identity  $\frac{1 - \cos 2A}{\sin 2A} = \tan A$

1) Prove the identity. (4)

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2) Hence, or otherwise, find the general solution to the equation

$$1 - \cos 2\theta = \sin 2\theta \quad (5)$$

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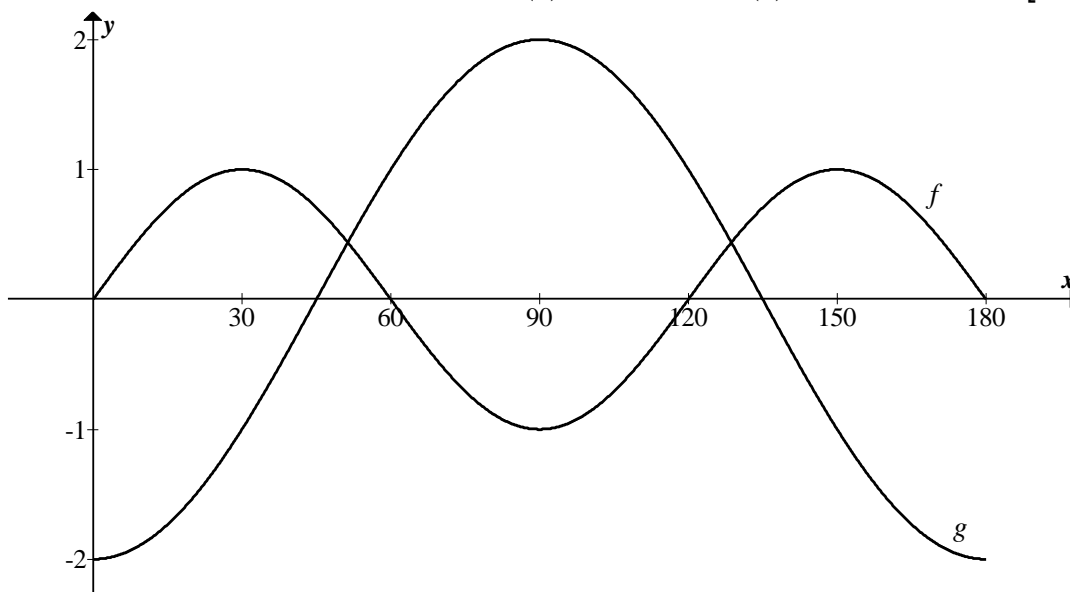
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[18]

**Question 4**

a) The graph below shows the graphs of  $f(x) = \sin bx$  and  $g(x) = a \cos 2x$  for  $x \in [0^\circ; 180^\circ]$



1) Write down the values of  $a$  and  $b$ . (2)

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2) Write down the period of  $g$ . (1)

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3) For what value(s) of  $x$  is  $g(x) - f(x) = 3$ ? (2)

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4) In your diagram, mark the segment(s) on the  $x$ -axis that will satisfy the inequality:

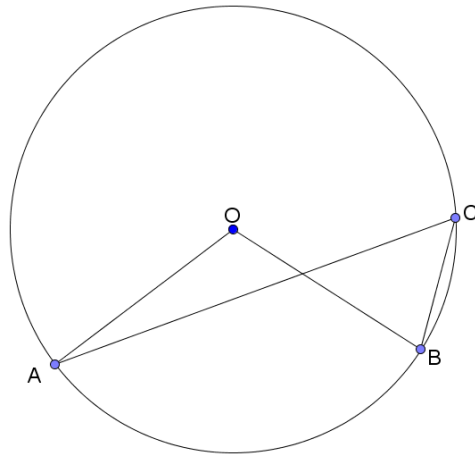
$$\frac{g(x)}{f(x)} \geq 0 \quad (2)$$

[7]

**Question 5**

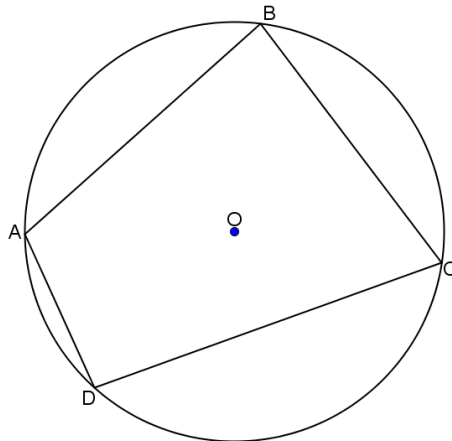
a) In each of the following cases mark the statement which is true about the given diagram. (1)

- 1) O is the centre of the circle. A, B and C are points on the circumference. (1)



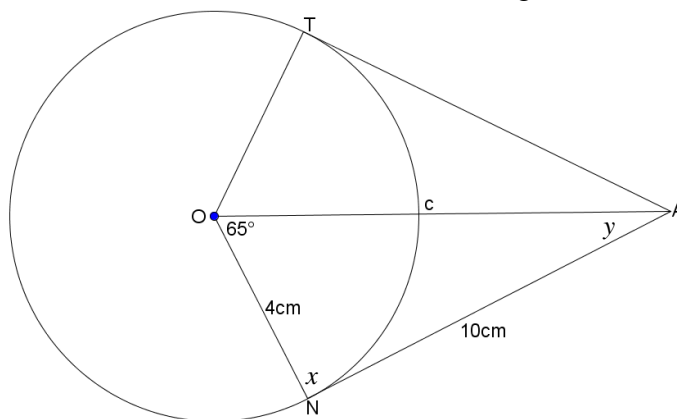
- $\hat{ACB} = 2\hat{AOB}$
- $\hat{ACB} = \hat{AOB}$
- $\hat{AOB} = 2\hat{ACB}$
- $\hat{AOB} = \frac{1}{2}\hat{ACB}$

- 2) O is the centre of the circle. A, B, C and D are points on the circumference. (1)



- $\angle ADB + \angle ABC = 360^\circ$
- $\angle DAB + \angle DCB = 180^\circ$
- $\angle DAB = \angle DCB$
- $\angle ABC = \angle BCD$

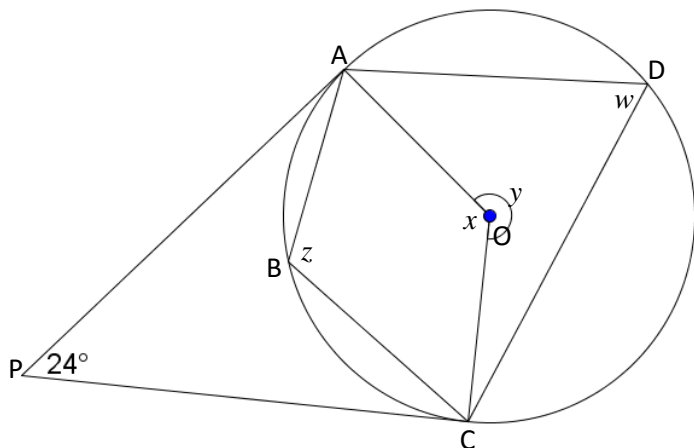
- 3) O is the centre of the circle. AT and AN are tangents to the circle. (1)



- $y = 65^\circ$
- $x = 90^\circ$
- $c = 14\text{cm}$
- $x + y = 65^\circ$

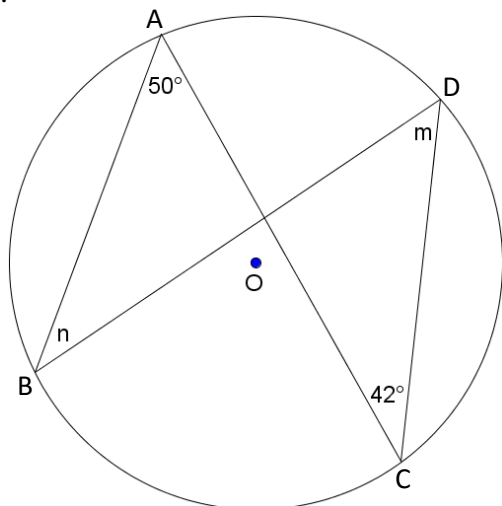
**Question 5 (Cont.)**

- 4) O is the centre of the circle. A, B, C and D are points on the circumference. PA and PC are tangents to the circle. (1)



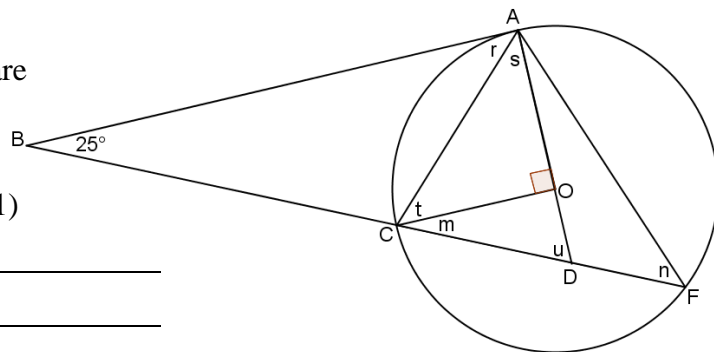
- $z = 24^\circ$
- $w = 24^\circ$
- $x = 2z$
- $x = 2w$

- 5) O is the centre of the circle. A, B, C and D are points on the circumference. (1)



- $n = 50^\circ$
- $m = n$
- $m = 50^\circ$
- $m = 42^\circ$

b) In the diagram alongside AB is a tangent to the circle. O is the centre of the circle, OA and OC are radii and  $OA \perp OC$ . Use the diagram to write a reason for each of the statements given below.



1)  $s = t = 45^\circ$  (1)

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2)  $r = 45^\circ$  (1)

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3)  $u = 65^\circ$  (1)

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4)  $m = 25^\circ$  (1)

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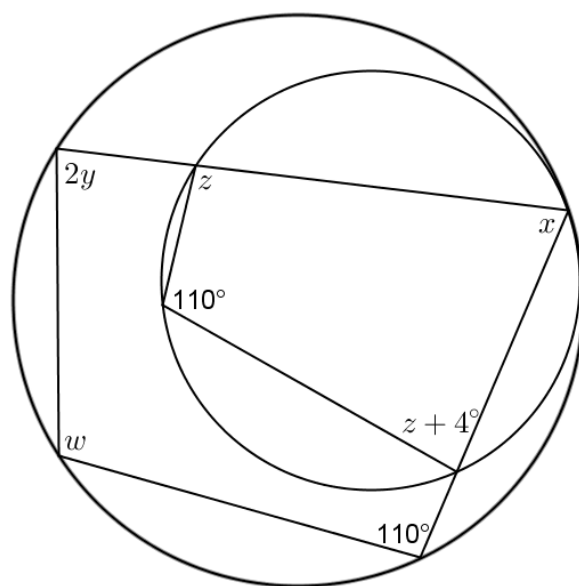
5)  $n = 45^\circ$  (1)

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c) Use the diagram alongside to determine the values of  $x$ ,  $y$ ,  $z$  and  $w$ . No reasons are required.



1)  $x =$  \_\_\_\_\_ (1)

2)  $y =$  \_\_\_\_\_ (1)

3)  $z =$  \_\_\_\_\_ (2)

4)  $w =$  \_\_\_\_\_ (1)

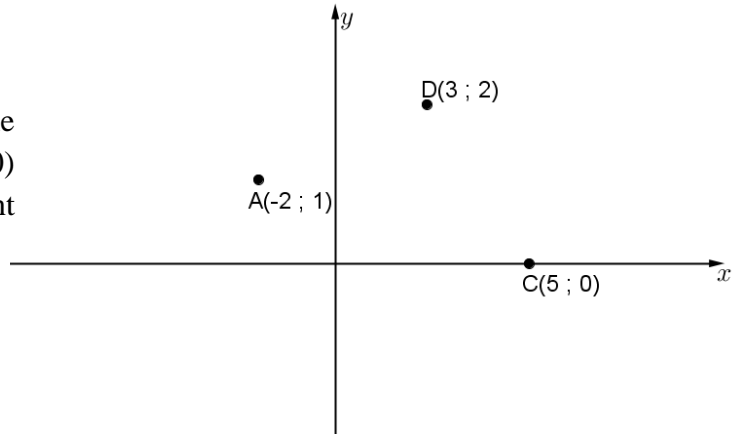
[15]

SECTION A: [75]

**SECTION B**

**Question 6**

a) The diagram alongside shows three of the vertices of trapezium ABCD.  $A(-2 ; 1)$ ,  $C(5 ; 0)$  and  $D(3 ; 2)$  where  $AB \parallel CD$ . The fourth point  $B(p ; -4)$ .



1) Show that  $p = 3$  (4)

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2) If  $N(x ; y)$  is a point on AB and NBCD is a parallelogram, determine the coordinates of N. (4)

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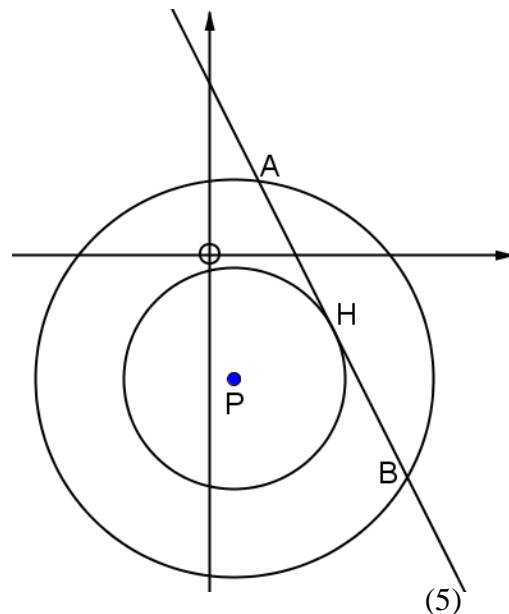
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b) In the diagram alongside, two concentric circles are given with centre P. Line  $y = 7 - 2x$  intersect the larger circle,  $x^2 + y^2 - 2x + 10y = 39$ , at A and B. The line is also a tangent to the smaller circle at H.



1) Determine the centre and radius of the larger circle. (5)

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2) Determine the coordinates of H. (7)

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3) If the point H is H(5; -3), determine the equation of the inner circle. (3)

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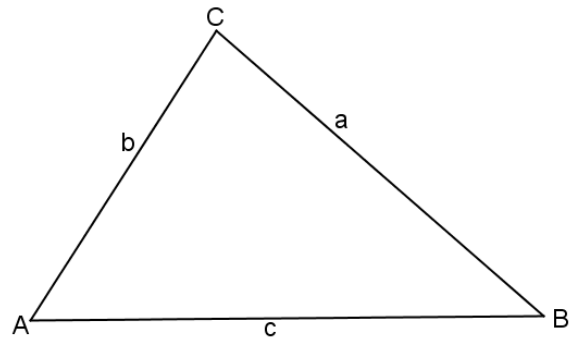
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[23]

**QUESTION 7**

a) Use the diagram alongside and complete the statement below. (2)

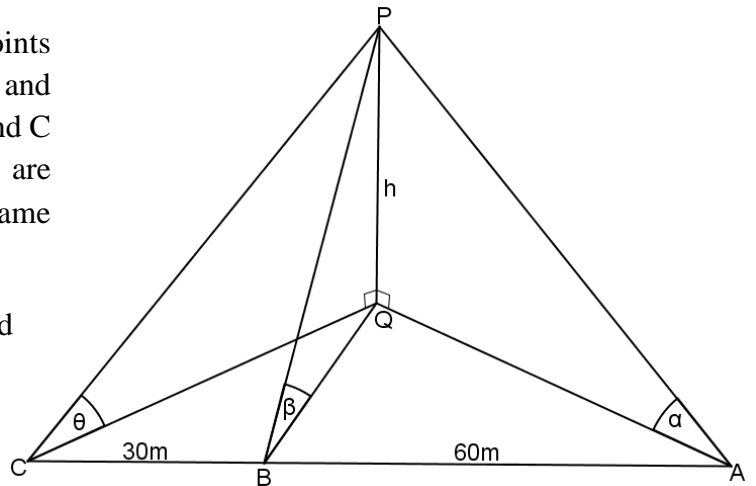
$\cos A =$



b) In the diagram alongside A, B and C are three points on a horizontal straight line such that  $AB = 60\text{m}$  and  $BC = 30\text{m}$ . The angles of elevation from A, B and C respectively, to the top of the tower, P, are  $\alpha, \beta$  and  $\theta$ . The foot of the tower Q is on the same horizontal plane as A, B and C.  $PQ = h$ .

Given that  $\tan \alpha = \frac{1}{13}$ ,  $\tan \beta = \frac{1}{15}$  and

$\tan \theta = \frac{1}{20}$



1) Write down the length of QA, QB and QC in terms of h. (3)

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2) Show that  $\cos \hat{QCB} = \frac{900 + 175h^2}{1200h}$  using  $\triangle QBC$ . (2)

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3) Using  $\Delta QAC$  write down the value of  $\cos \hat{QCA}$ . (3)

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4) Hence, or otherwise, determine the height of the clock tower (h). (4)

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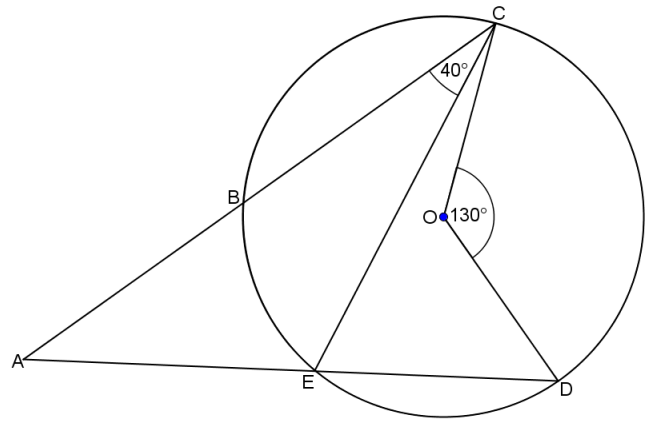
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[14]

**QUESTION 8**

- a) In the diagram alongside, O is the centre of the circle.  $\widehat{C\hat{O}D} = 130^\circ$  and  $\widehat{A\hat{C}E} = 40^\circ$ .



Determine the size of angle A. No reasons are required. (3)

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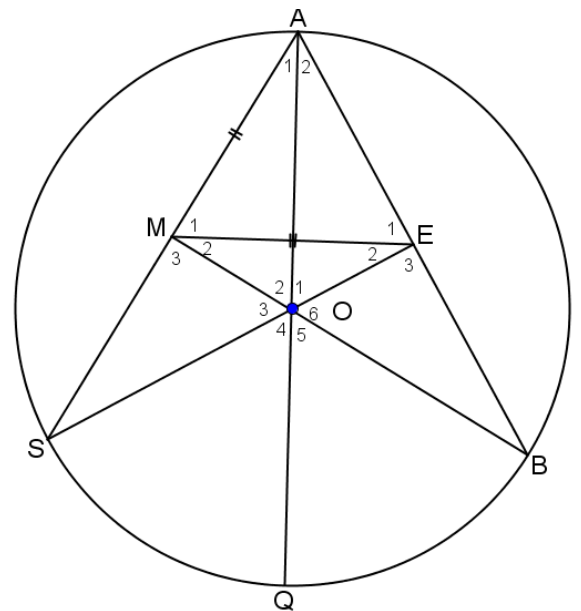


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- b) In the diagram alongside, O is the centre of the circle. AQ is a diameter, SA and AB are chords such that AQ bisects  $\widehat{S\hat{O}B}$ . M and E are points on SA and AB such that BM and SE intersect at O.  $AM = ME$ .



Given that  $\widehat{Q\hat{O}B} = x$

- 1) Show, giving reasons for your answers, that  $\widehat{E_1} = x$ . (3)

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- 2) Show that AMOE is a cyclic quadrilateral. (4)

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3) Show that OM is the perpendicular bisector of AS.

(6)

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[16]



2) Prove, giving reasons, that PK bisects  $\widehat{TKQ}$ .

(6)

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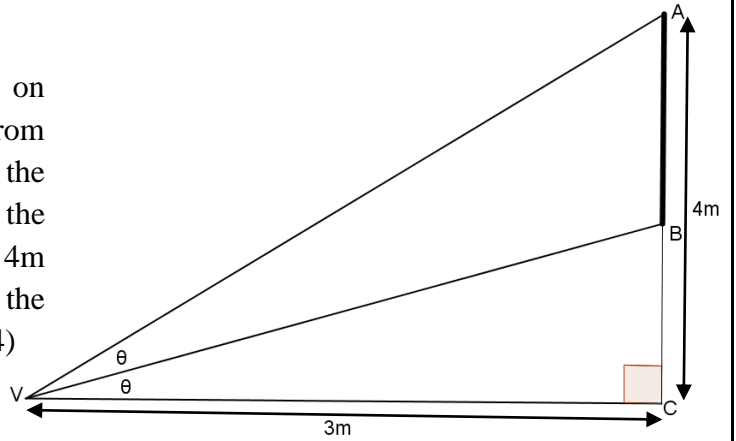
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[18]

**Question 10**

The diagram alongside represents a painting (AB) on display at a gallery. From a viewpoint (V) 3m away from the wall the angle between the top and the bottom of the painting is the same as the angle of elevation to the bottom of the painting. If the top of the painting is 4m from the floor, determine how far the bottom of the painting is from the floor (BC).

(4)




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