



NATIONAL SENIOR CERTIFICATE EXAMINATION  
SUPPLEMENTARY EXAMINATION 2015

**MATHEMATICS: PAPER II**

Time: 3 hours

150 marks

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**PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY**

1. This question paper consists of 24 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 this in at the end of the examination.**
4. Diagrams are not necessarily drawn to scale.
5. You may use an approved non-programmable and non-graphical calculator, unless otherwise stated.
6. All necessary working details must be clearly shown.
7. Round off your answers to one decimal digit where necessary, unless otherwise stated.
8. Ensure that your calculator is in **DEGREE** mode.
9. It is in your own interest to write legibly and to present your work neatly.
10. The last pages can be used for additional working, if necessary. If this space is used, make sure that you indicate clearly which question is being answered.

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**FOR OFFICE USE ONLY: MARKER TO ENTER MARKS**

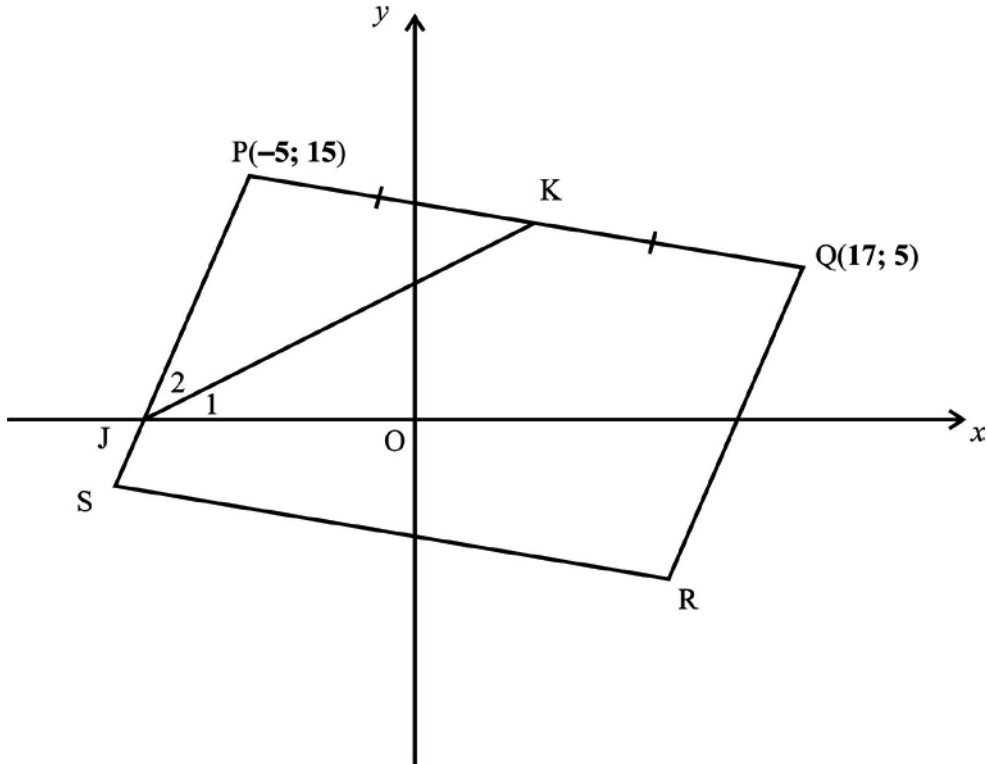
Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
<b>21</b>	<b>21</b>	<b>10</b>	<b>20</b>	<b>10</b>	<b>21</b>	<b>28</b>	<b>19</b>

<b>TOTAL</b>	<b>/150</b>
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**SECTION A**

**QUESTION 1**

- (a) In the diagram below, parallelogram PQRS is drawn.  
 The equation of QR is given by  $y = 5x - 80$ .  
 P has coordinates  $P(-5; 15)$  and Q has coordinates  $Q(17; 5)$ .  
 K is the midpoint of PQ.



- (1) Determine the coordinates of K.

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(2)

- (2) Determine the equation of PS in the form  $y = mx + c$ .

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(3)

(3) Hence, determine the gradient of JK.

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(3)

(4) Determine, correct to one decimal digit:

(i) the size of  $\hat{J}_1$

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(2)

(ii) the size of  $\hat{J}_1 + \hat{J}_2$

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(2)

(iii) the size of  $\hat{J}_2$

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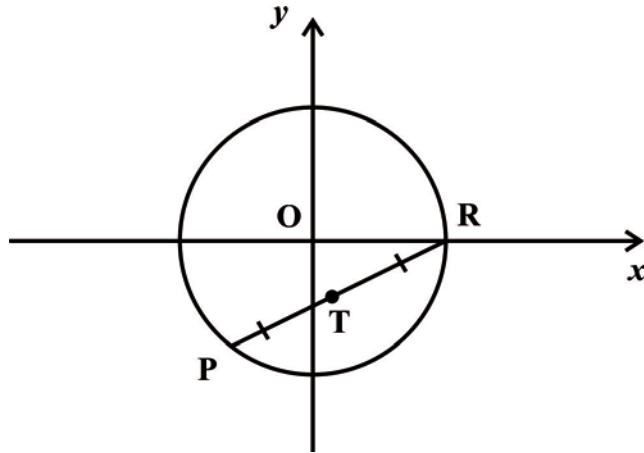


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(1)

(b) In the diagram below, a circle with equation  $x^2 + y^2 = r^2$  is drawn.

$T(4; -6)$  is the midpoint of  $PR$ .  $R$  is a point on the  $x$ -axis.



(1) Write down the size of  $\hat{O}TR$ , giving reasons.

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(2)

(2) Show that the equation of  $PR$  is  $3y = 2x - 26$ .

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(3)

(3) Determine the radius of the circle.

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(3)  
[21]

**QUESTION 2**

**PLEASE ENSURE THAT YOUR CALCULATOR IS IN DEGREE MODE**

- (a) If  $\hat{P} = 22^\circ$  and  $\hat{Q} = 111^\circ$ , show, using a calculator, that  $\cos(P + Q) \neq \cos P + \cos Q$ .

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(2)

- (b) Simplify as far as possible without using a calculator:

$$\frac{\cos(180^\circ + \theta) - \cos(90^\circ - \theta)}{\cos(-\theta) - \sin(-\theta)}$$

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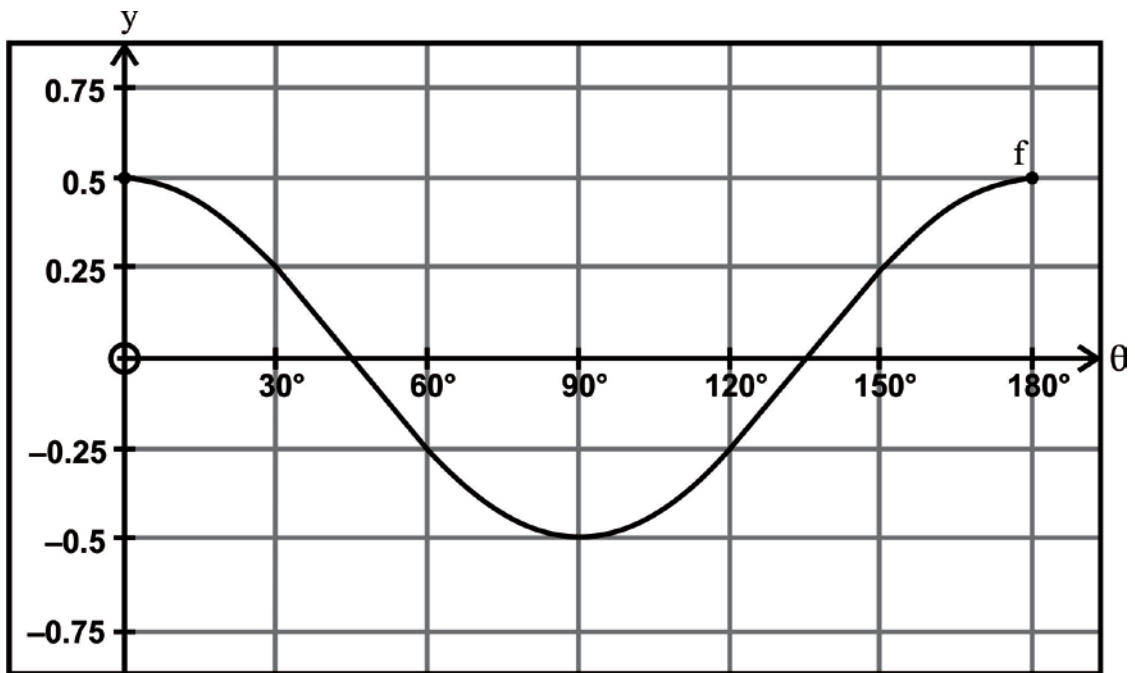
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(5)

(c) Study the graph drawn of  $f(\theta) = a \cos b\theta$  for  $0^\circ \leq \theta \leq 360^\circ$ .



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

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\_\_\_\_\_ (2)

(2) Show on the graph, using the letter A, where you would read off the value of  $a \cos 150^\circ$ .

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\_\_\_\_\_ (1)

(3) Show on your graph, using the letters B and C, where you would read off a solution to  $a \cos b\theta = \frac{1}{4}$ .

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\_\_\_\_\_ (2)

(d) If  $\sin 18^\circ = t$ , express  $\cos 72^\circ \cdot \sin 198^\circ$  in terms of  $t$ .

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(3)

(e) If  $\sin \hat{K} = \frac{5}{13}$  and  $\cos \hat{K} = \frac{a}{39}$ , determine, without a calculator, the value of  $a$  if

(1)  $\hat{K}$  is acute.

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(4)

(2)  $\hat{K}$  is obtuse.

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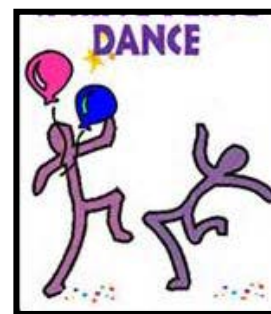
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(2)  
[21]

**QUESTION 3**

A school dance committee recorded the amount of money raised each month over a long period of time.

The data collected is summarised in the table below.



	Lowest value	Second lowest value	Lower quartile	Median	Upper quartile	Second highest value	Highest value
<b>Amount raised</b>	R3 000	R4 000	R7 000	R9 000	R14 000	R20 000	R25 000

A data value is an outlier if it is less than  $Q_1 - 1,5 \times IQR$  or it is greater than  $Q_3 + 1,5 \times IQR$  where  $Q_1$  = Lower Quartile  
 $Q_3$  = Upper Quartile  
IQR = Inter-Quartile range.

(a) Determine outliers, if any.

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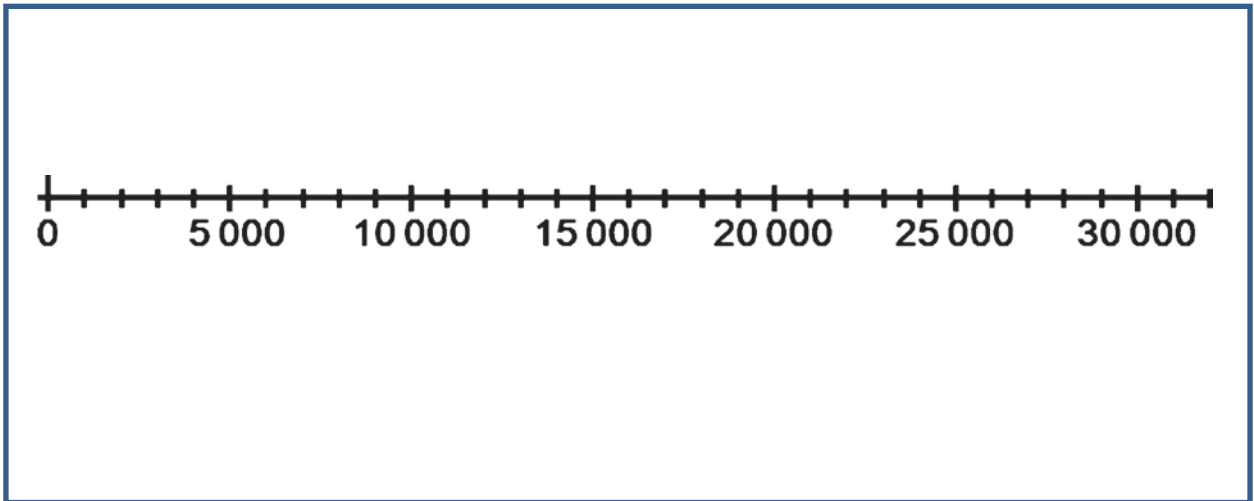
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(5)



- (b) Using the axes below, draw the box and whiskers plot for the data presented, indicating clearly any outliers.



(4)

- (c) Describe the skewness of the amount of money raised.

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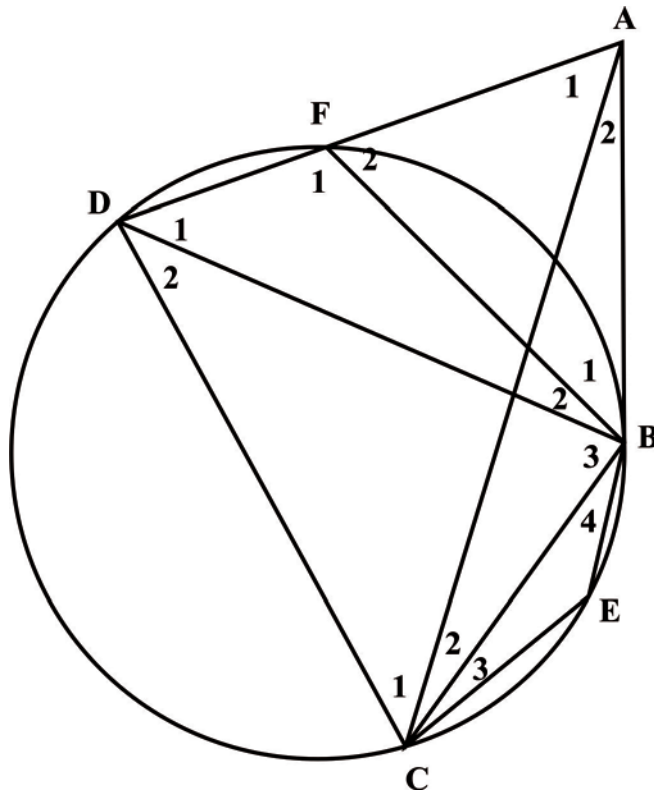


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(1)  
**[10]**

**QUESTION 4**

- (a) In the diagram below, AB is a tangent to the circle passing through B, E, C and D.  
 AD cuts the circle at F.  
 AC is drawn.



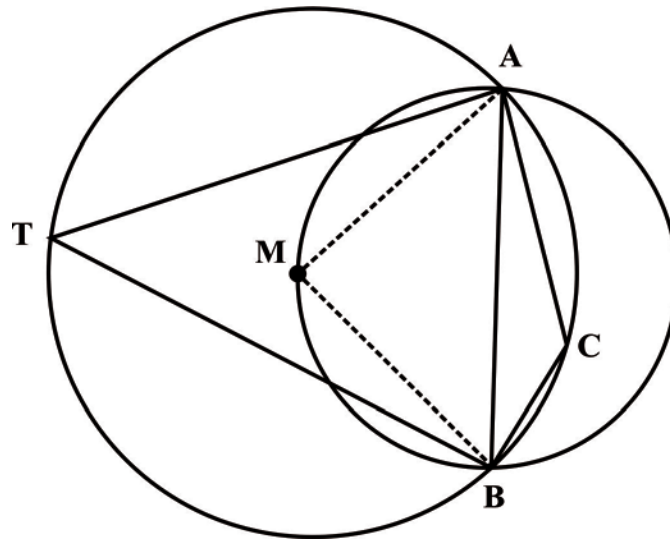
A list of statements is given.

Give reasons for the statements that are correct. If a statement is not necessarily correct, write '**not correct**' in the space provided for the reason.

STATEMENT	REASON
$\hat{C}_1 + \hat{C}_2 = \hat{F}_2$	
$\hat{D}_2 + \hat{E} = 180^\circ$	
$\hat{B}_1 = \hat{D}_1$	
$\hat{B}_1 + \hat{B}_2 = \hat{D}_1 + \hat{D}_2$	
$\hat{D}_2 = \hat{A}_2$	

(5)

- (b) (1) In the diagram below, circle centre M intersects a second smaller circle at A and B.  
 A, B, C and T are points on circle centre M.  
 AB is the diameter of the smaller circle.



Determine the size of  $\hat{C}$ .

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(6)

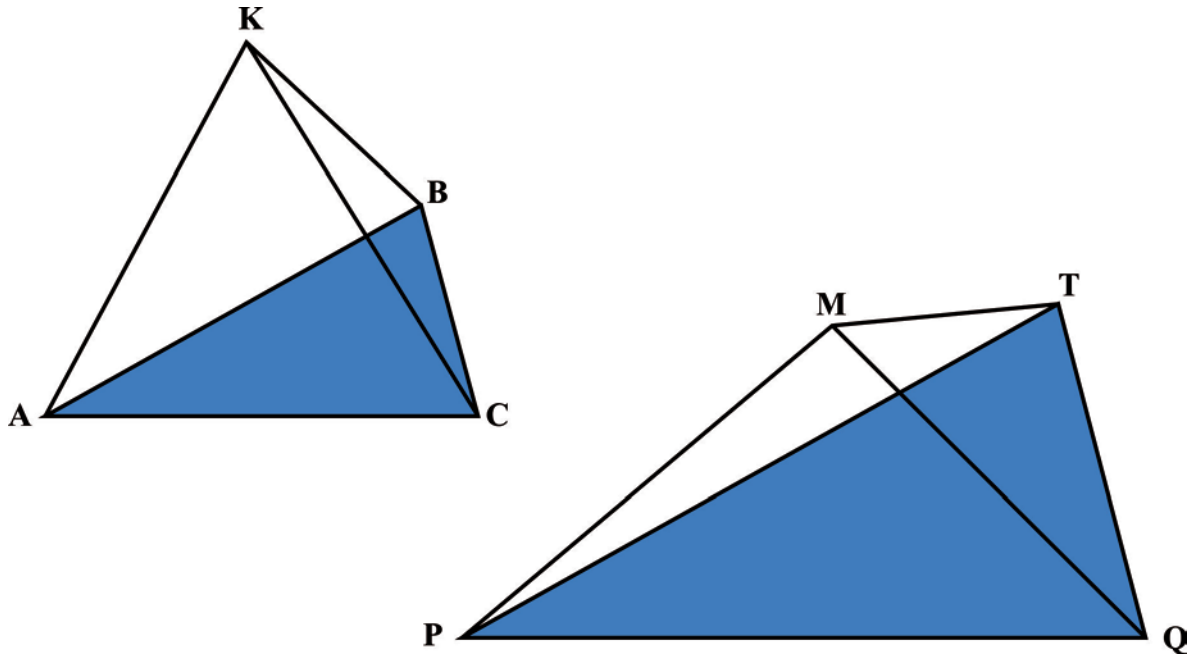
- (2) Explain why AMBC is not a cyclic quadrilateral.

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(1)

- (c) In the diagram below, two different triangular pyramids are drawn.  
 The pyramids have the same height from vertices K and M.  
 $AB = 4$ ,  $AC = 5$ ,  $BC = 2$ ,  $TQ = 3$ ,  $PQ = 7,5$  and  $PT = 6$



- (1) Prove that  $\triangle ABC \parallel \triangle PQT$ .

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(4)

(2) Determine

$\frac{\text{Volume of Pyramid PQTM}}{\text{Volume of Pyramid ABCK}}$

(Hint:  $V = \frac{1}{3} \times \text{Area of Base} \times \perp \text{ height}$ )

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(4)  
[20]

**72 marks**

**SECTION B**

**QUESTION 5**



Year	2009	2010	2011	2012	2013
Number of Visitors	7,0 million	8,0 million	8,3 million	9,2 million	9,5 million

- (a) The table above shows the approximate number of visitors to South Africa from 2009 to 2013.

Suppose the following variables are defined:

( $x$ ): year

( $y$ ): number of tourists to South Africa in millions

- (1) The correlation co-efficient between  $x$  and  $y$  is 0,98, correct to two decimal places.

Comment on the correlation between  $x$  and  $y$ .

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(2)

- (2) (i) Use a calculator to determine the equation of the least squares regression line.

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(5)

- (ii) Use your answer in (2)(i) to predict the number of tourists in 2018.

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(2)

- (iii) Comment on the reliability of your answer in (2)(ii).

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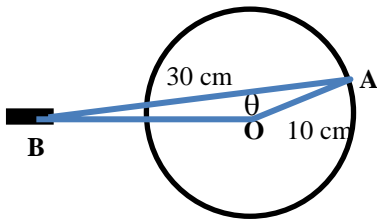
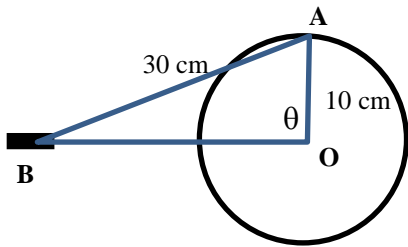
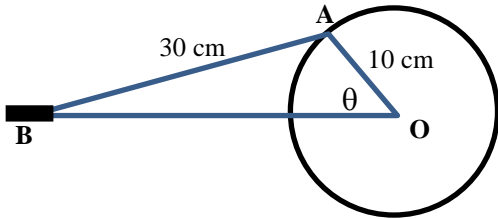
(1)

**[10]**

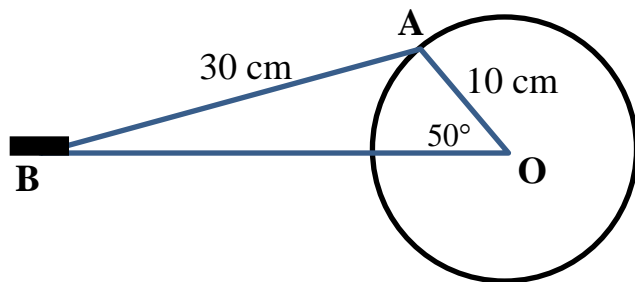
**QUESTION 6**

**PLEASE ENSURE THAT YOUR CALCULATOR IS IN DEGREE MODE**

- (a) In the diagrams below, arm OA is 10 cm long and rotates clockwise about O.  
The connecting rod AB is 30 cm long and point B moves on a fixed line through O.



In the diagram below,  $\hat{A}OB = 50^\circ$ ,  $\hat{B}AO$  is obtuse and the length of  $OB = 35,4$  cm .







(c) (1) If  $\cos\beta - \sqrt{3}\sin\beta = 2\sqrt{3}\cos(\beta - 30^\circ)$ , show that  $\tan\beta = -\frac{1}{\sqrt{3}}$ .

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(4)

(2) Hence, or otherwise, determine the general solution to  $\cos\beta - \sqrt{3}\sin\beta = 2\sqrt{3}\cos(\beta - 30^\circ)$ .

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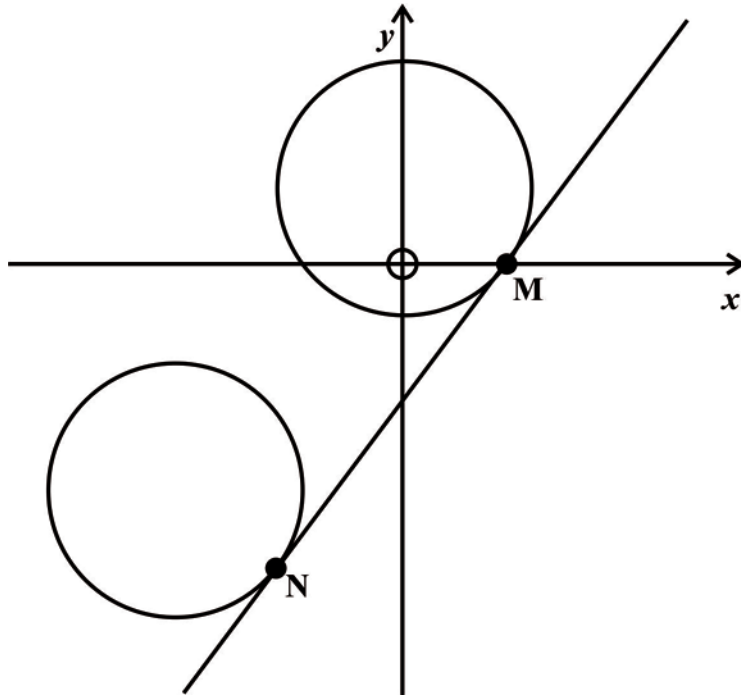
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(3)  
[21]

**QUESTION 7**

- (a) In the diagram below, the common tangent to the circles  $x^2 + y^2 - 6y = 16$  and  $(x+9)^2 + (y+9)^2 = 25$  at M and N respectively is drawn. M is the x –intercept of the one circle.



- (1) Determine the equation of the common tangent.

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(7)

(2) Determine the length of MN, the common tangent.

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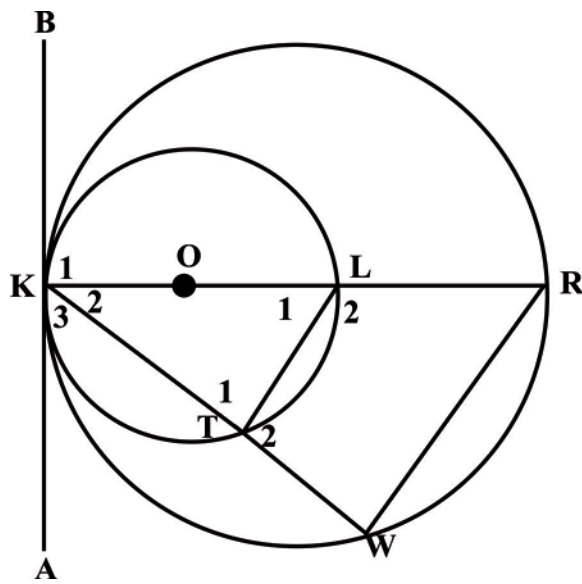
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(5)

(b) In the diagram below, two circles touch at K. AKB is the common tangent and O is the centre of the smaller circle. KO is produced to meet the circles at L and R. KTW is a straight line. LT and RW are drawn.



(1) Prove that KR is a diameter of the larger circle.

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(5)

(2) Prove that  $\frac{KL}{LR} = \frac{KT}{TW}$ .

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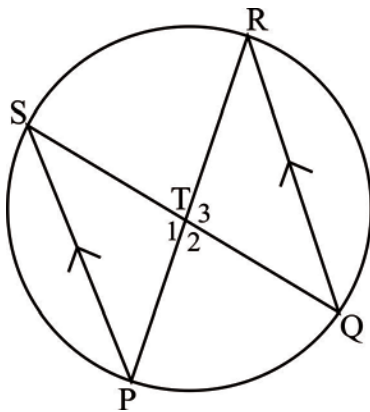
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(6)

(c) In the diagram, P, Q, R and S are points on a circle.  
 PS // QR.  
 PR and SQ meet at T.



Show that  $\hat{PTQ} = 2\hat{S}$ .

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(5)  
 [28]

**QUESTION 8**

(a) In each case, fill in the missing statement which would lead to the given deduction.

(1)

Statement	$\hat{C} = \hat{A} + \hat{B}$
Statement	
Deduction	$\therefore \hat{C} = 2\hat{B}$

(2)

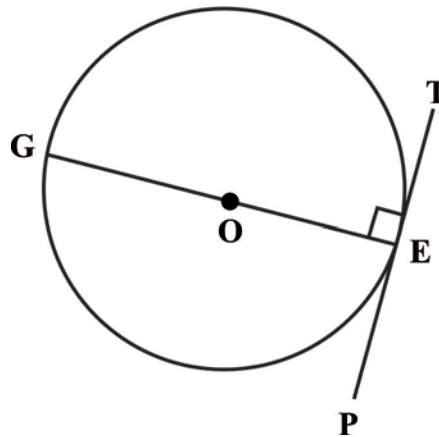
Statement	$\hat{C} = \hat{A} + \hat{B}$
Statement	
Deduction	$\therefore \hat{A} = \hat{D}$

(3)

Statement	$\hat{C} = \hat{A} + \hat{B}$
Statement	
Deduction	$\therefore \hat{C} = \hat{P} + \hat{B}$

(3)

(b) Given TEP is a tangent to the circle at E and  $\hat{OET} = 90^\circ$ . EO produced meets the circle at G.



Is O the centre of the circle? Justify your answer.

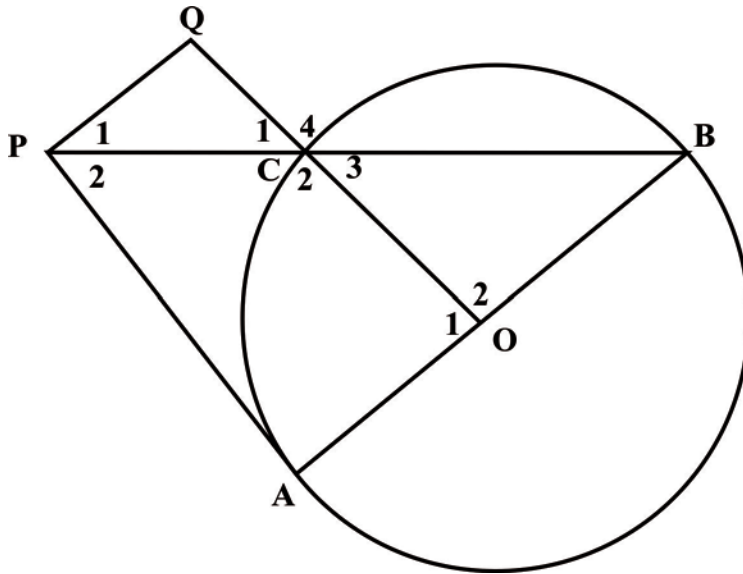
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(2)

- (c) (1) In the diagram below, C is a point on the circle with AB as diameter and O as the centre.  
 The tangent to the circle at A meets BC produced at P.  
 PQ is parallel to AB and OC produced meets PQ at Q.



Prove that  $PQ = QC$ .

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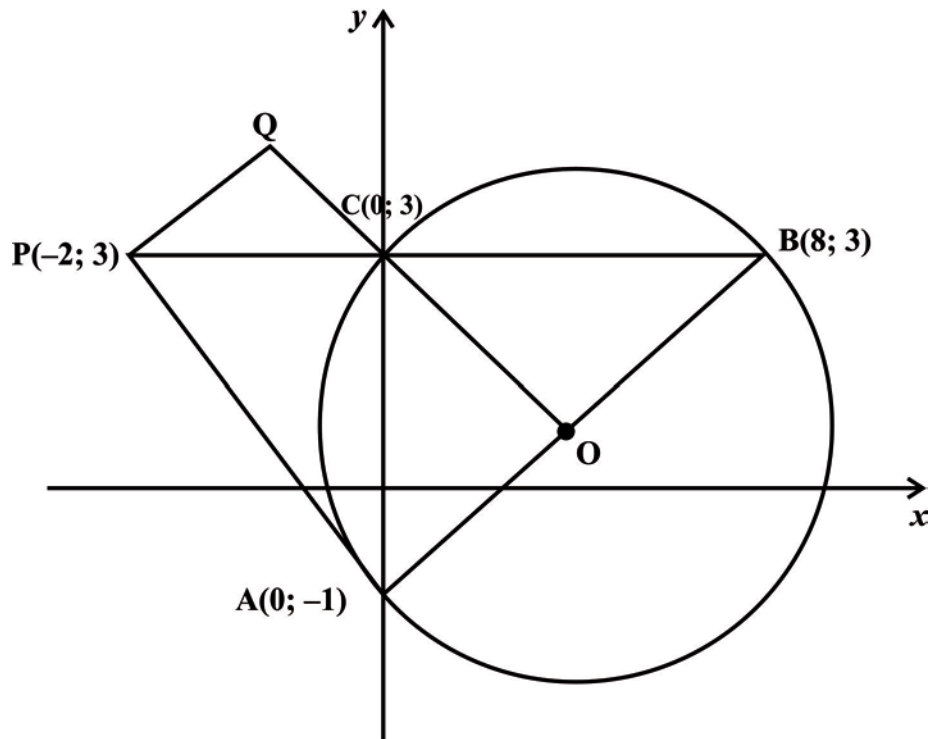
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(6)

- (2) The Cartesian plane is introduced in the diagram above so that  $A(0; -1)$ ,  $B(8; 3)$ ,  $C(0; 3)$  and  $P(-2; 3)$ .



- (i) Determine the equation of line QC.

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(4)

(ii) Determine the coordinates of Q.

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(4)  
[19]

**78 marks**

**Total: 150 marks**