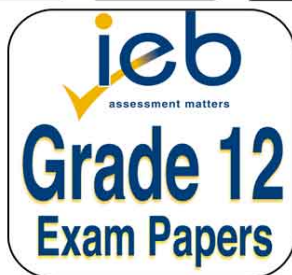




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NATIONAL SENIOR CERTIFICATE EXAMINATION
SUPPLEMENTARY EXAMINATION 2015

MATHEMATICS: PAPER II

Time: 3 hours

150 marks

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.

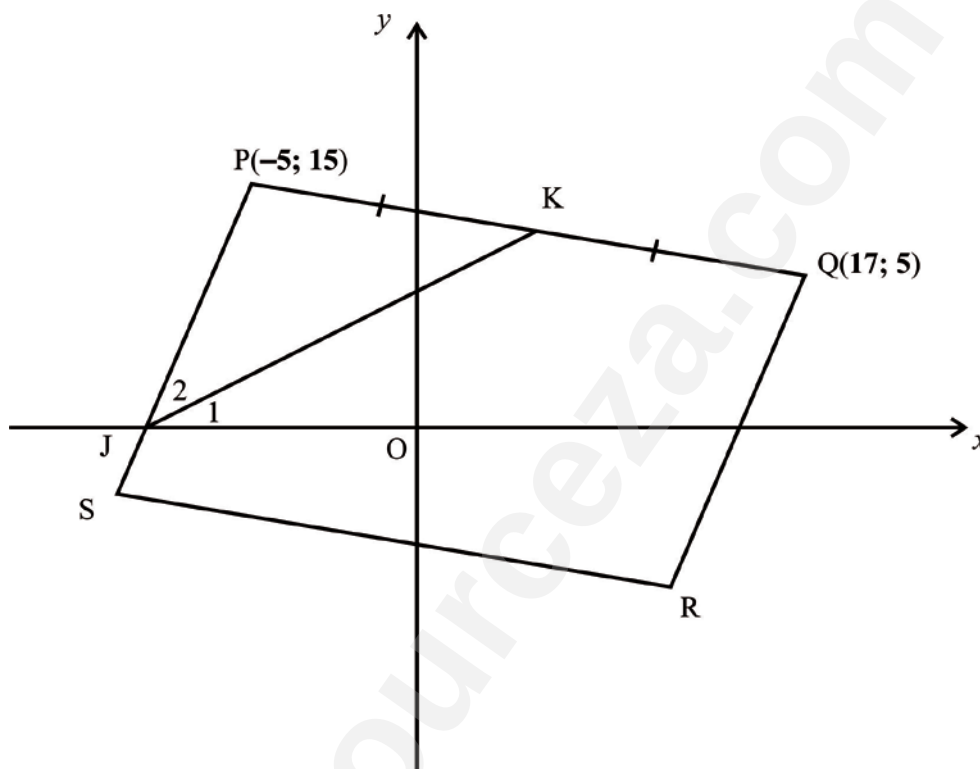
FOR OFFICE USE ONLY: MARKER TO ENTER MARKS

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
21	21	10	20	10	21	28	19

TOTAL	/150
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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.

(2)

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

(3)

- (3) Hence, determine the gradient of JK.

(3)

- (4) Determine, correct to one decimal digit:

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

(2)

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

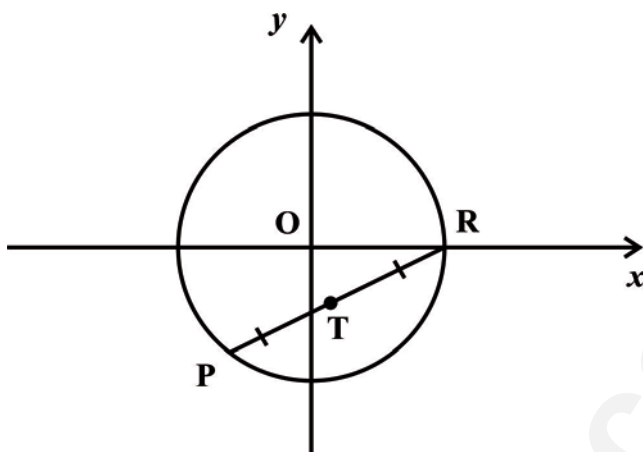
(2)

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

(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 $\hat{OTR}$, giving reasons.

(2)

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

(3)

- (3) Determine the radius of the circle.

(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 $\cos(P + Q) \neq \cos P + \cos Q$.

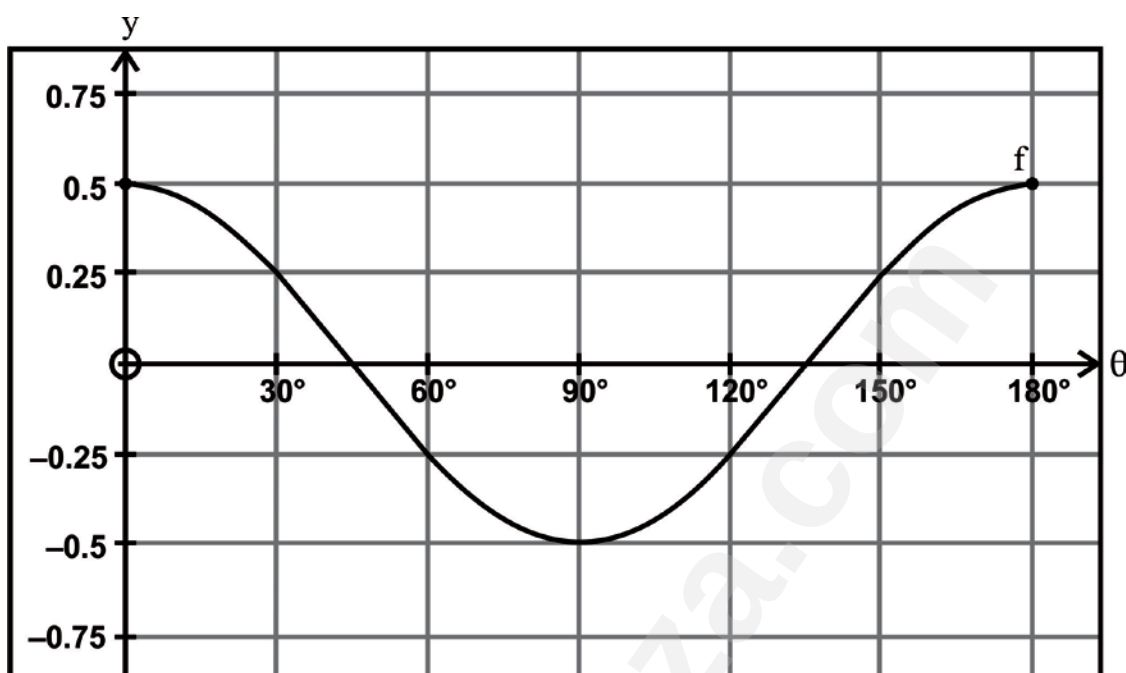
(2)

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

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

(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 .

(2)

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

(1)

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

(2)

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

(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.

(4)

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

(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
Amount raised	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 $Q_1 - 1,5 \times \text{IQR}$ or it is greater than

$Q_3 + 1,5 \times \text{IQR}$ where Q_1 = Lower Quartile

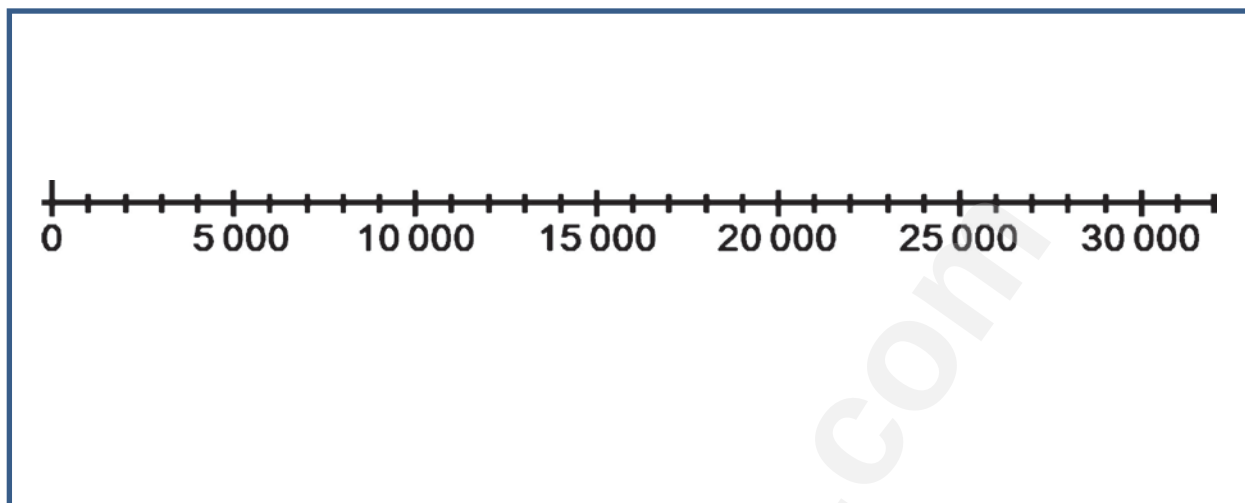
Q_3 = Upper Quartile

IQR = Inter-Quartile range.

(a) Determine outliers, if any.

(5)

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



(4)

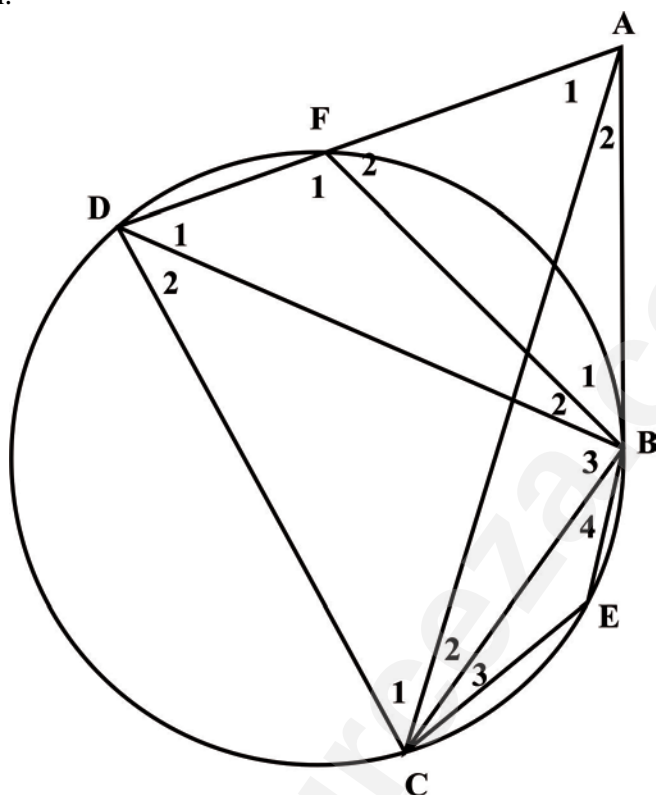
- (c) Describe the skewness of the amount of money raised.

(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)

-
- The diagram illustrates two intersecting circles. The larger circle, centered at point M , has points T , A , and B on its circumference. The smaller circle intersects the larger one at points A and B . Solid lines connect T to A and B , and A to B . Dashed lines connect the center M to points A and B .

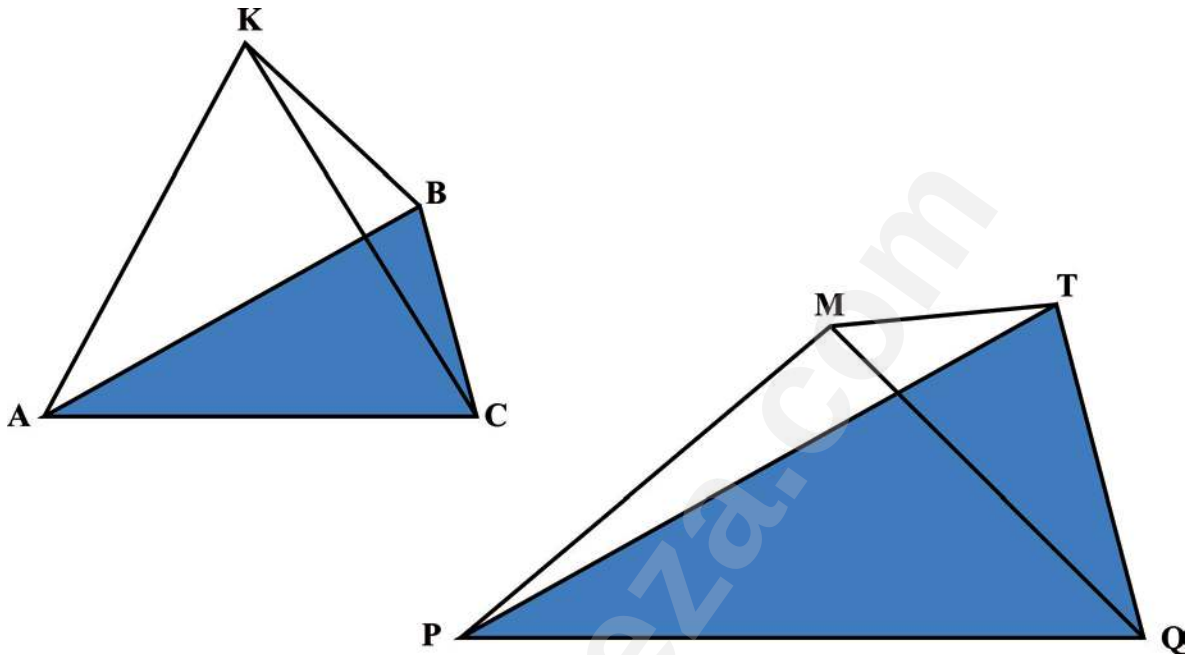
This image shows a blank sheet of white paper with horizontal ruling lines. A large, light gray watermark with the word "eduresource" is oriented diagonally from the bottom left towards the top right. The watermark is semi-transparent, allowing the underlying lines to be seen through it. There are approximately 18 horizontal lines visible across the page.

(6)

-

(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 $\triangle ABC \parallel \triangle PTQ$.

(4)

(2) Determine

Volume of Pyramid PQTM

Volume of Pyramid ABCK

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

(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 .

(2)

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

(5)

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

(2)

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

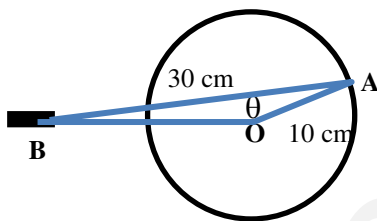
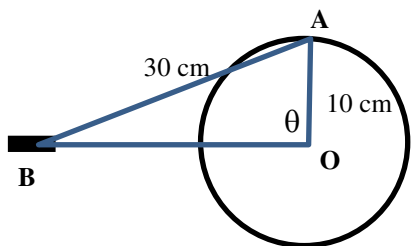
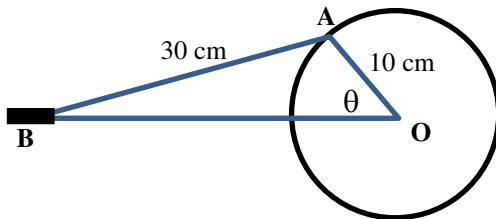
(1)

[10]

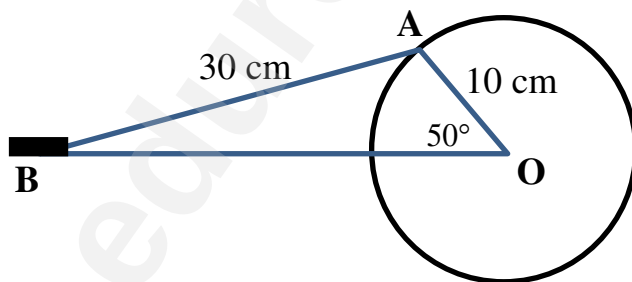
QUESTION 6

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, $\angle AOB = 50^\circ$, $\angle BAO$ is obtuse and the length of $OB = 35,4$ cm.



- (1) How far does B move when angle $\hat{A}OB$ changes from 50° to 120° ?

(6)

- (2) How far does B move when angle $\hat{A}OB$ changes from 0° to 180° ?

(2)

- (b) If $\tan \theta = p$, express $\frac{1 - \sin 2\theta}{1 - \sin 2\theta + \cos 2\theta}$ in terms of p.

(6)

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

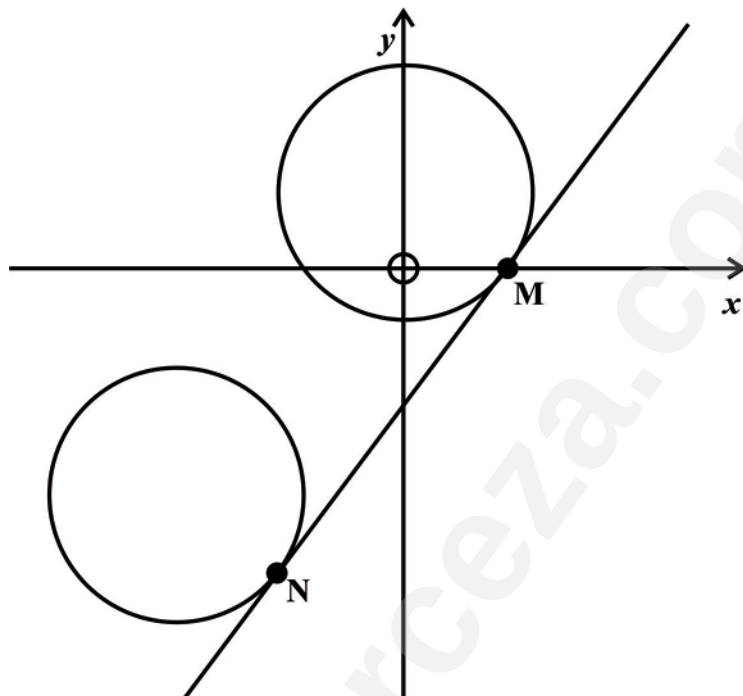
(4)

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

(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.



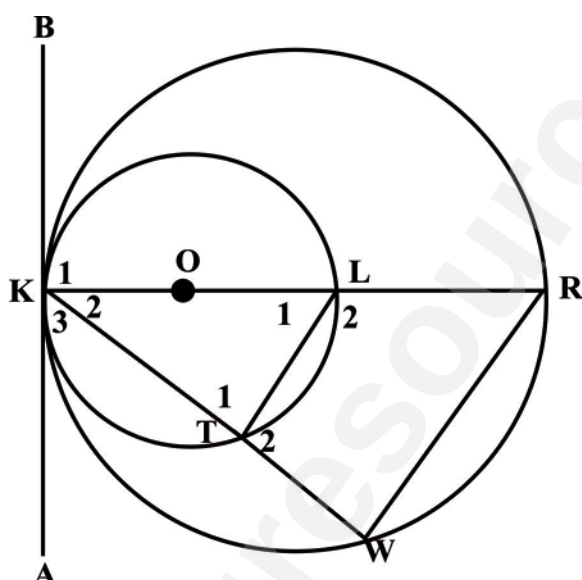
- (1) Determine the equation of the common tangent.

(7)

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

(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.

(5)

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(6)

-

(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)

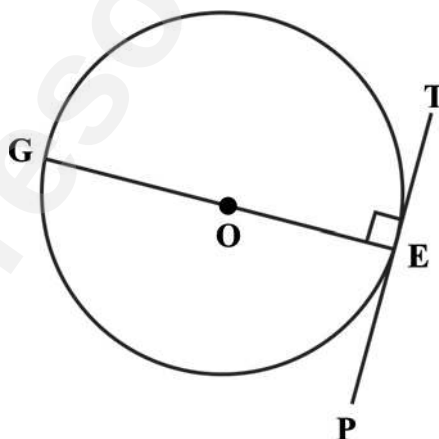
Statement	$\hat{C} = \hat{A} + \hat{B}$
Statement	
Deduction	$\therefore \hat{A} = \hat{D}$

(3)

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

(3)

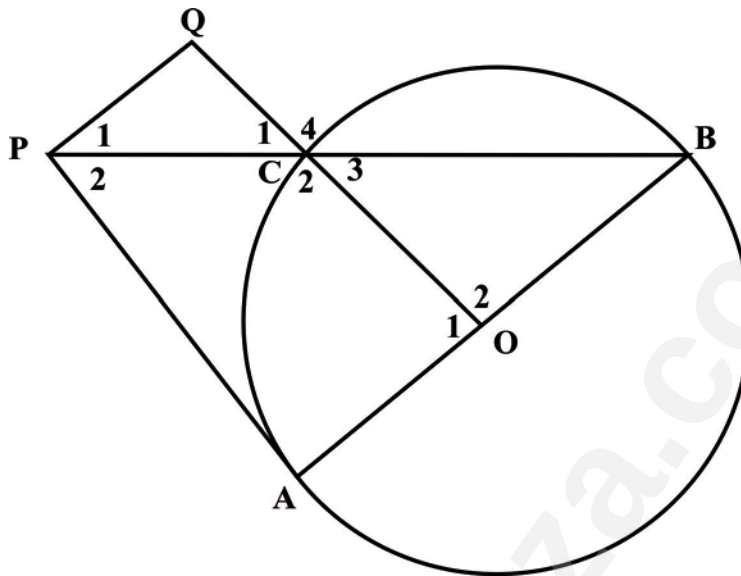
(b) Given TEP is a tangent to the circle at E and $\text{O}\hat{\text{E}}\text{T} = 90^\circ$. EO produced meets the circle at G.



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

(2)

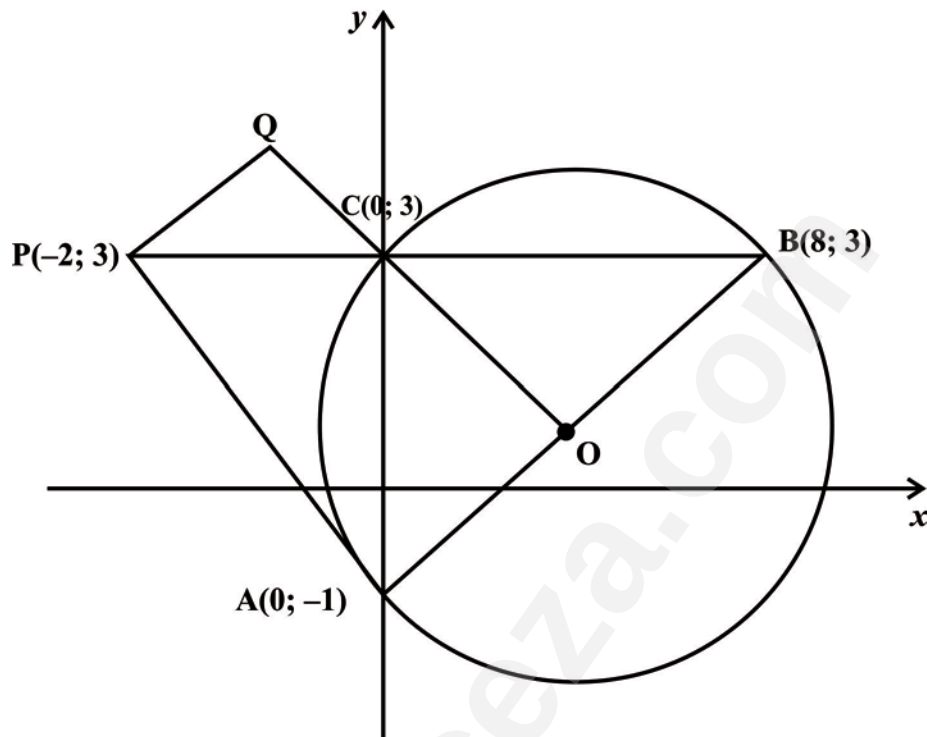
- (c) (1) In the diagram below, C is a point on the circle with AB as diameter and O as the centre.
The tangent to the circle at A meets BC produced at P.
PQ is parallel to AB and OC produced meets PQ at Q.



Prove that $PQ = QC$.

(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.

(4)

- (ii) Determine the coordinates of Q.

(4)
[19]

78 marks

Total: 150 marks