Province of the
EASTERN CAPE
EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE 11

NOVEMBER 2024

MATHEMATICS P2

MARKS: **150**

TIME: **3 hours**

* I M A T 2 *

This question paper consists of 16 pages, including 1-page information sheet, and an answer book of 25 pages.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of 10 questions.
2. Answer ALL the questions in the SPECIAL ANSWER BOOK provided.
3. Clearly show ALL calculations, diagrams, graphs, etc. which you have used in determining the answers.
4. Answers only will NOT necessarily be awarded full marks.
5. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
6. If necessary, round off answers to TWO decimal places, unless stated otherwise.
7. Diagrams are NOT necessarily drawn to scale.
8. An information sheet with formulae is included at the end of the question paper.
9. Write neatly and legibly.

QUESTION 1

After utilising GeoGebra to teach geometry, the 14 participants marks out of 100 are displayed in the table below.

16	28	41	41	42	52	54
55	58	59	60	62	64	99

1.1 Write down the mode of the data. (1)

1.2 Identify any outlier. (1)

1.3 Determine the median of the data. (2)

1.4 Determine the interquartile range of the data. (3)

1.5 Draw a box and whisker diagram using the number line provided in the answer book. (2)

1.6 Comment on the skewness of the data by using the box and whisker diagram. (1)

[10]

QUESTION 2

The weight of the boxers who underwent fitness and health checks is shown in the frequency table below.

WEIGHT OF BOXERS	FREQUENCY	CUMULATIVE FREQUENCY
$35 \leq x < 55$	1	
$55 \leq x < 75$	3	
$75 \leq x < 95$	9	
$95 \leq x < 115$	6	
$115 \leq x < 135$	3	
$135 \leq x < 155$	1	

2.1 Complete the cumulative frequency column provided in the table in the ANSWER BOOK. (2)

2.2 Write down the total number of boxers. (1)

2.3 Estimate the mean for the data. (3)

2.4 Use the grid provided in the ANSWER BOOK to draw a cumulative frequency graph (ogive) for the data. (3)

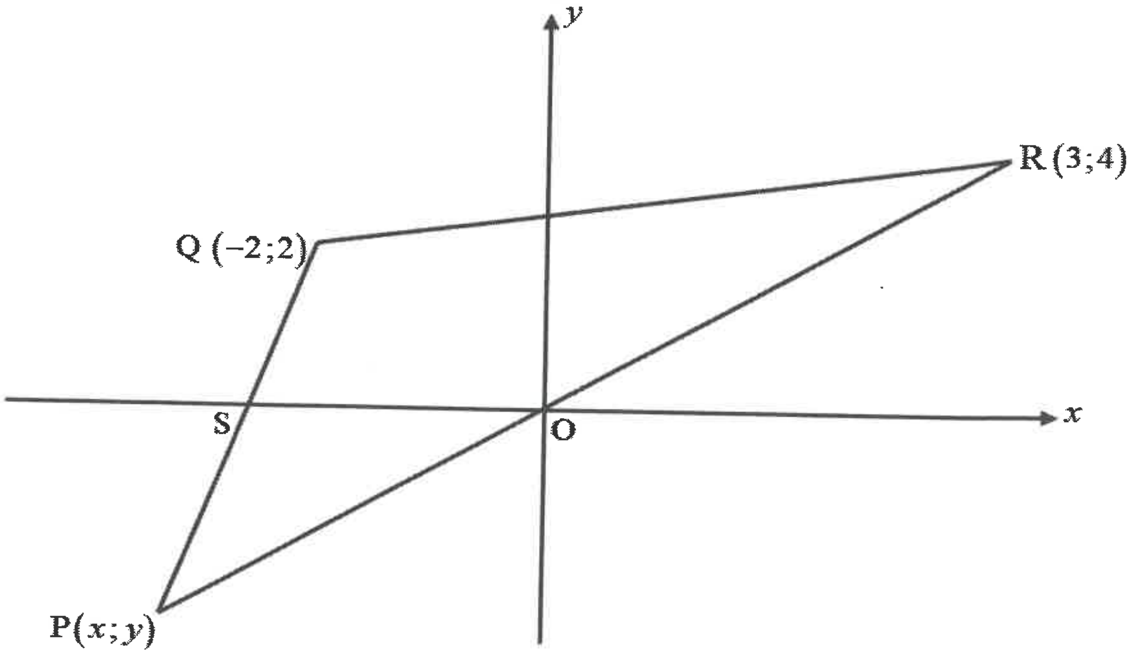
2.5 It is further given that, for a boxer to qualify for the next upcoming match, he must have a mass that is in the interval of $75 < x \leq 100$.

Using the cumulative frequency graph (ogive) and estimate the number of boxers that will qualify for the upcoming match. (2)

[11]

QUESTION 3

In the diagram, P$(x\,;\,y)$, $Q(-2\,;\,2)$ and ~~R(2 ; 3)~~ R(3;4) are the vertices of triangle PQR. Line PR passes through the point of origin at O. The equation of line PQ is given as $y=6x+14$. S is the x-intercept of line QP.



3.1 Calculate the gradient of PR. (2)

3.2 Determine the equation of PR. (3)

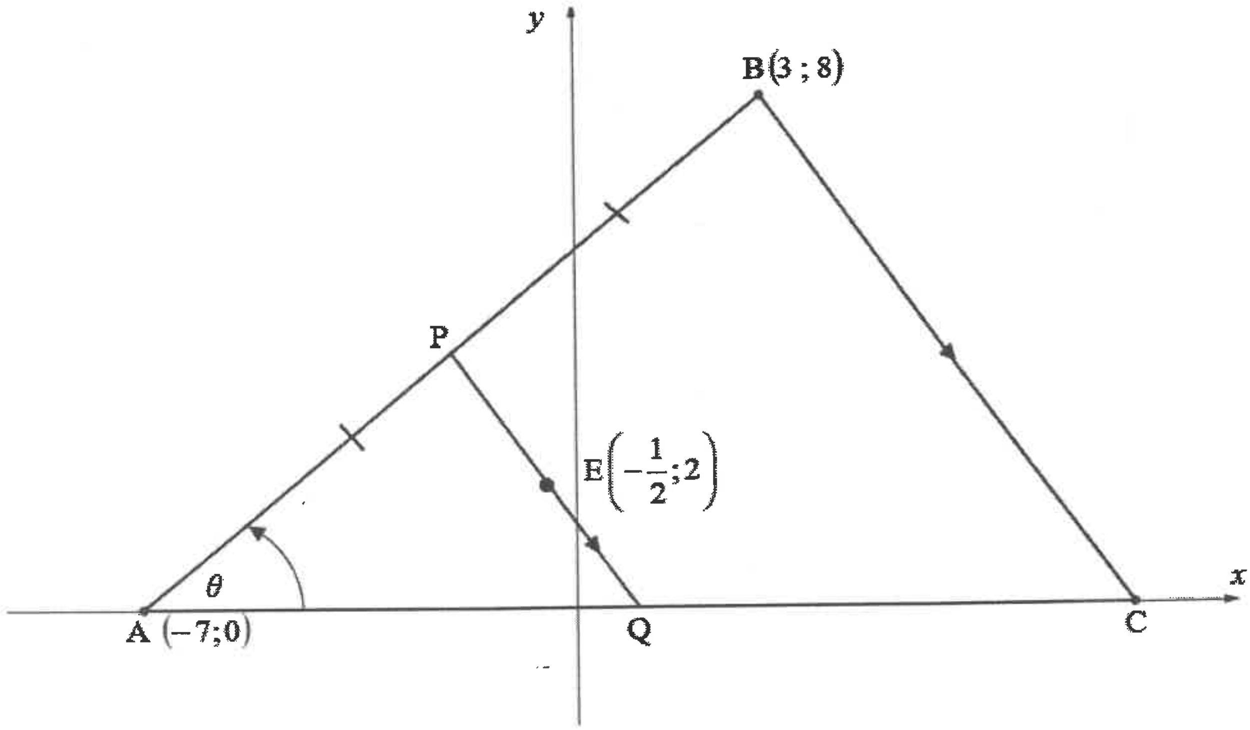
3.3 Determine the coordinates of P. (4)

3.4 Determine the coordinates of S. (1)

[10]

QUESTION 4

In the diagram, ΔABC is drawn with vertices $A(-7\,;0)$, B $(3\,;8)$ and C. P is the midpoint of line AB. Q is a point on line AC. AQC is a line on the x-axis. E $\left(-\frac{1}{2}\,;\,2\right)$ is a point on line PQ. $PQ \parallel BC$



4.1 Calculate the:

4.1.1 Coordinates of P (2)

4.1.2 Gradient of AB (2)

4.1.3 Size of θ (2)

4.2 Determine the equation of BC in the form $y = mx + c$. (5)

4.3 Calculate the:

4.3.1 Length of AC (3)

4.3.2 Area of trapezium PBCQ (6)

[20]

QUESTION 5

5.1 If $-3\tan\beta-\sqrt{5}=0$ and $\sin\beta<0$. Determine the value of $\sin^2\beta-\cos^2\beta$ with the aid of a diagram. (5)

5.2 If $\cos 49° = k$, determine the values of the following in terms of k.

5.2.1 $\sin 131°$ (2)

5.2.2 $1-\cos^2 41°$ (2)

5.3 Simplify the expression to a single trigonometric ratio of x

$$\frac{\tan(180°-x).\cos(-x)+\sin^2(360°-x)\cos(90°-x)}{\sin(180°-x)}$$ (7)

5.4 Simplify, **without the use of a calculator**:

$\sin(-15°).\cos 75° + \tan 75°.\cos 75°.\cos 165°$ (5)

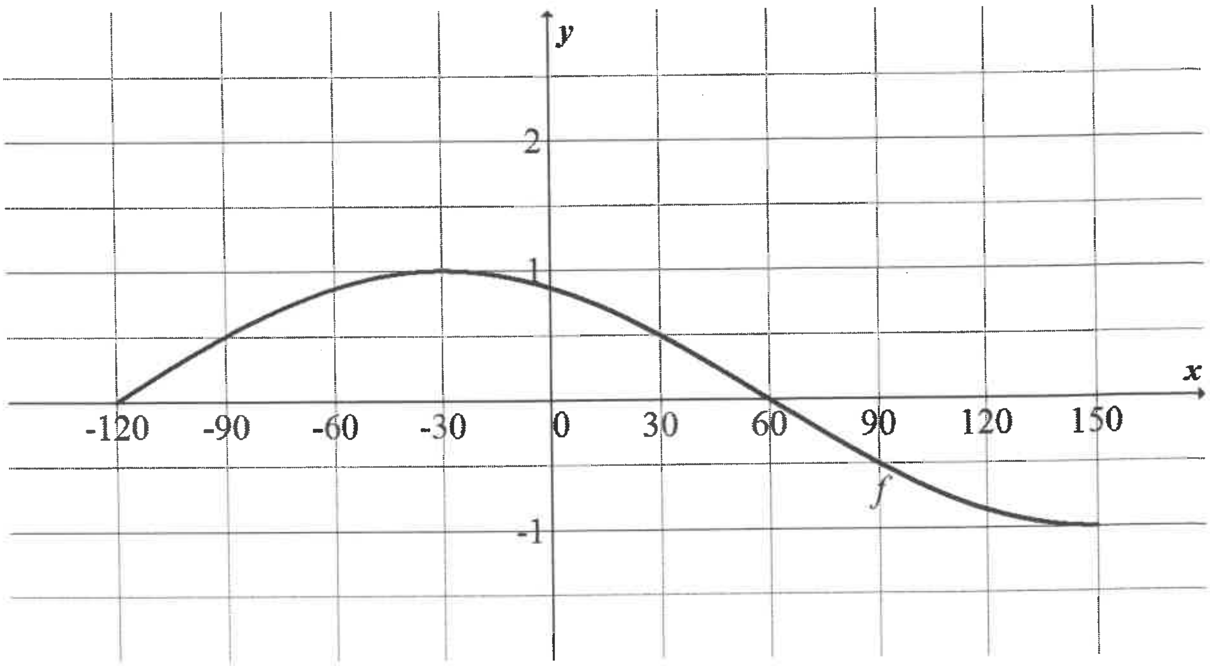
5.5 Prove the identity: $\frac{3\cos x}{1+\sin x}+3\tan x=\frac{3}{\cos x}$ (4)

5.6 Determine the general solution of: $\sin^2 x-3\cos^2 x=0$ (5)

[30]

QUESTION 6

The graph of $f(x) = \cos(x + 30°)$ in the interval of $x \in [-120^0; 150^0]$ has been drawn in the diagram below.



6.1 Write down the period of f. (1)

6.2 Write down the range of $h(x) = f(x + 60°) + 1$. (2)

6.3 Write down the equation of h in its simplest form. (2)

6.4 Draw the graph of $h(x)$ on the grid provided in your ANSWER BOOK. (3)

6.5 Use the graph to answer the following questions in the interval $x \in [-120^0; 150^0]$.

For which values of x is:

6.5.1 f having a minimum value? (1)

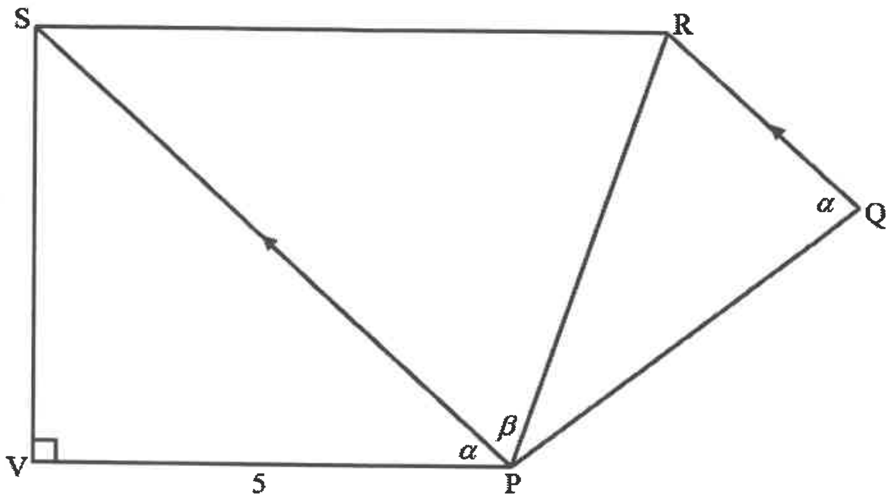
6.5.2 $h(x) \times f(x) \leq 0$? (2)

6.5.3 $f(x) = h(x)$? (1)

[12]

QUESTION 7

In the diagram, $VP = PQ = 5$ units, $R\hat{Q}P = S\hat{P}V = \alpha$, $S\hat{P}R = \beta$ and $PS \parallel QR$. SV is perpendicular to VP.



7.1 Express PS in terms of α. (1)

7.2 Determine RP in terms of α and β. (3)

7.3 Hence show that the area of $\Delta RPS = \dfrac{25.\tan\alpha}{2}$ (3)

[7]

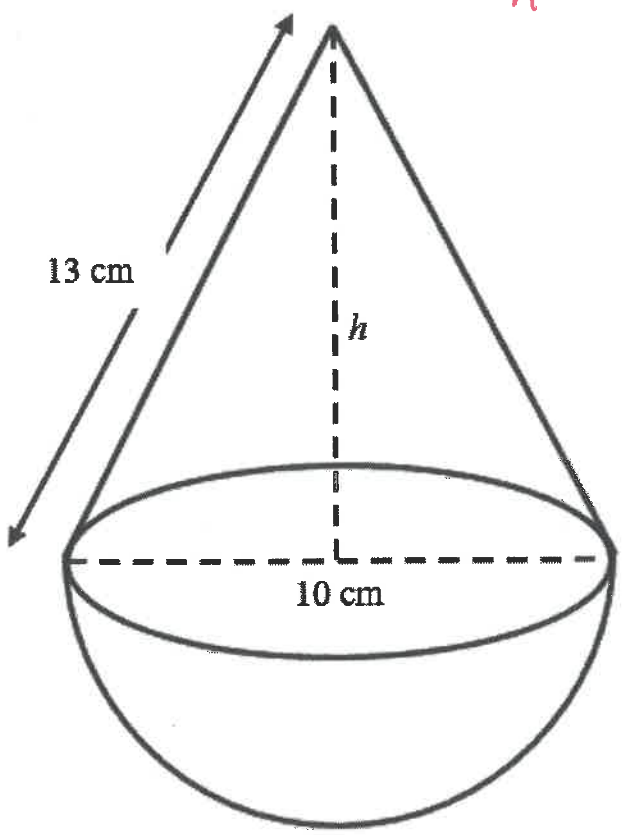
QUESTION 8

In the diagram, a lid with a hemispherical form seals an open cone. The slanted height of the cone is 13 cm, the diameter of the cone and hemisphere is 10 cm, the height of the cone h cm.

Formulae:

~~$V = \frac{2}{3}\pi r^3$~~ $\quad V = \frac{1}{3}\pi r^2 h \quad$ Surface Area $= \pi r^2 + \pi r s \quad$ ~~Surface Area $= 2\pi r^2$~~

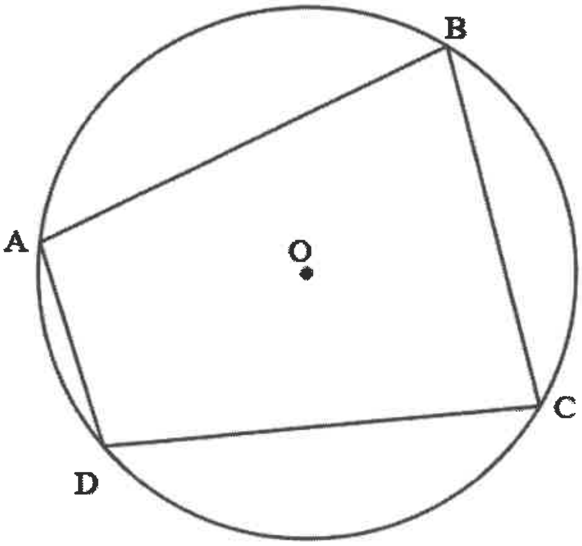
$V = \frac{4}{3}\pi r^3$ $\quad$ $A = 4\pi r^2$



8.1	Determine the height of the cone.	(3)
8.2	Write down the height of the container (height of the whole shape).	(1)
8.3	Calculate the volume of this container.	(3)
8.4	Determine the total surface area of the container.	(3)
		[10]

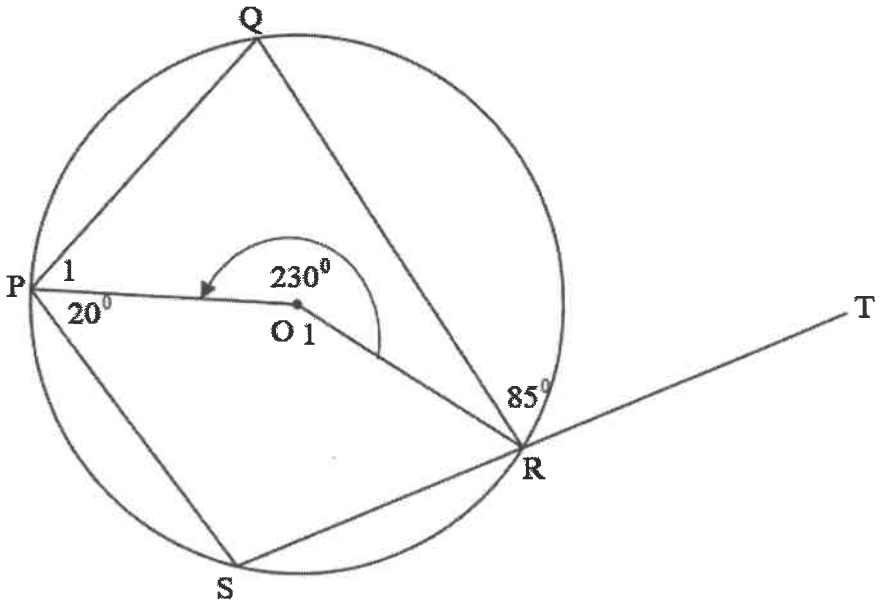
QUESTION 9

9.1 In the diagram, ABCD is a cyclic quadrilateral. O is the centre of the circle.



Use the diagram above to prove the THEOREM which states that, the opposite angles of a cyclic quadrilateral add up to 180°, then prove that, $\hat{B}+\hat{D}=180°$. (5)

9.2 In the diagram, O is the centre of the circle with a reflex angle of 230°. P, Q, R and S are points on the circumference of the circle with chord SR extended to point T. $Q\hat{R}T = 85°$ and $O\hat{P}S = 20°$.



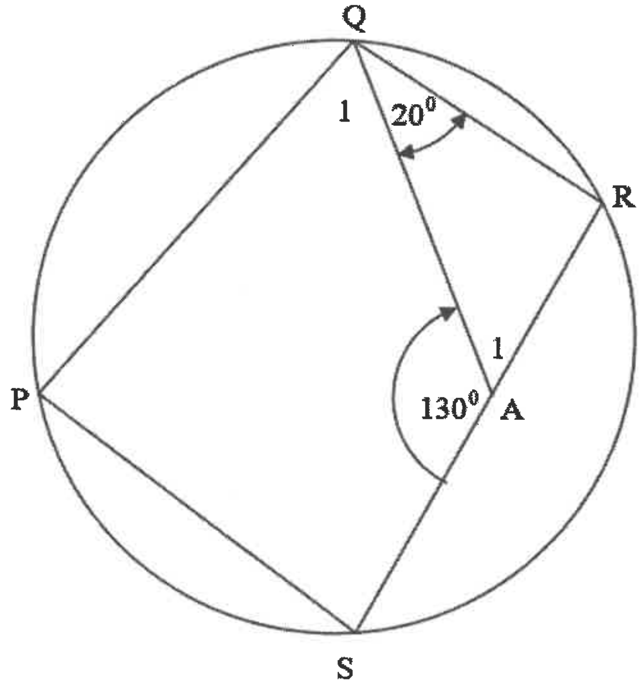
Calculate the magnitude of the following angles:

9.2.1 $\hat{S}$ (2)

9.2.2 $\hat{Q}$ (2)

9.2.3 $\hat{P}_1$ (2)

9.3 In the diagram, PQRS is a cyclic quadrilateral. QA intersects SR at point A. $S\hat{A}Q = 130°$ and $A\hat{Q}R = 20°$.

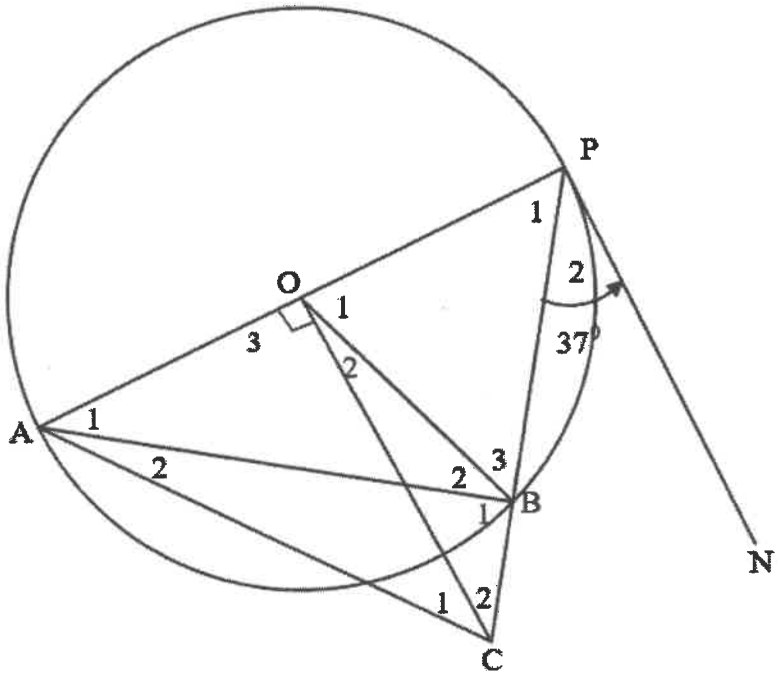


Calculate, giving reasons, the size of $\hat{P}$. (4)

[15]

QUESTION 10

10.1 In the diagram, O is the centre of circle ABP. PB is extended to C. AC is drawn. PN is a tangent to the circle at P. OC intersects AP perpendicularly at point O. $\hat{P}_2 = 37°$



10.1.1 Determine, giving reasons, the size of $\hat{O}_1$. (4)

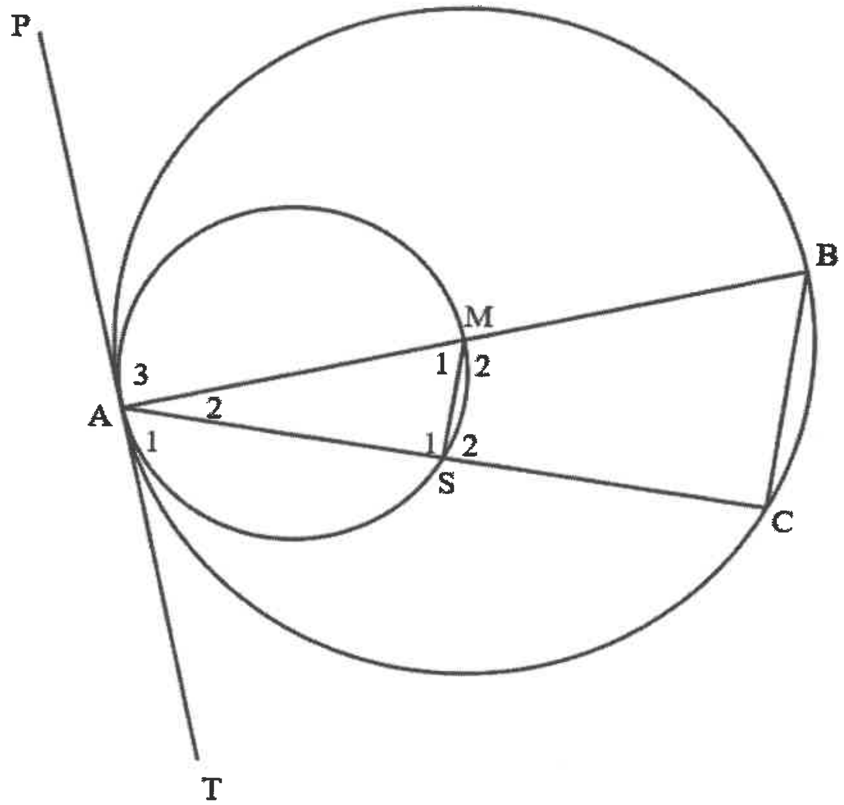
10.1.2 Prove that:

(a) OACB is a cyclic quadrilateral (4)

(b) $OC \parallel PN$ (3)

10.2 In the diagram, PAT is the common tangent of the smaller and larger circles at A. AMB is the diameter of the larger circle with M on the circumference of the smaller circle. ASC and BC are chords of the larger circle and MS chord of the smaller circle. M is the centre of the larger circle.

It is also given that, the length of AM = p units, AS = $(p - 1)$ units and BC = 6 units.



10.2.1 Name, giving reasons, 3 angles equal to 90^0. (6)

10.2.2 Give a reason why MS || BC. (1)

10.2.3 Write down the ratio of AS : SC with a reason. (2)

10.2.4 Write down the length of MS with a reason. (2)

10.2.5 Calculate the value of p. (3)

[25]

TOTAL: 150

INFORMATION SHEET: MATHEMATICS

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$A = P(1 + ni)$ $A = P(1 - ni)$ $A = P(1 - i)^n$ $A = P(1 + i)^n$

$F = \frac{x\left[(1+i)^n - 1\right]}{i}$ $P = \frac{x\left[1 - (1+i)^{-n}\right]}{i}$

$T_n = a + (n-1)d$ $S_n = \frac{n}{2}(2a + (n-1)d)$

$T_n = ar^{n-1}$ $S_n = \frac{a(r^n - 1)}{r - 1}$; $r \neq 1$ $S_\infty = \frac{a}{1-r}$; $-1 < r < 1$

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ $M\left(\frac{x_1 + x_2}{2}; \frac{y_1 + y_2}{2}\right)$

$y = mx + c$ $y - y_1 = m(x - x_1)$ $m = \frac{y_2 - y_1}{x_2 - x_1}$ $m = \tan\theta$

$(x-a)^2 + (y-b)^2 = r^2$

In ΔABC: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$ $a^2 = b^2 + c^2 - 2bc.\cos A$ $area\,\Delta ABC = \frac{1}{2}ab.\sin C$

$\sin(\alpha + \beta) = \sin\alpha.\cos\beta + \cos\alpha.\sin\beta$ $\sin(\alpha - \beta) = \sin\alpha.\cos\beta - \cos\alpha.\sin\beta$

$\cos(\alpha + \beta) = \cos\alpha.\cos\beta - \sin\alpha.\sin\beta$ $\cos(\alpha - \beta) = \cos\alpha.\cos\beta + \sin\alpha.\sin\beta$

$\cos 2\alpha = \begin{cases} \cos^2\alpha - \sin^2\alpha \\ 1 - 2\sin^2\alpha \\ 2\cos^2\alpha - 1 \end{cases}$ $\sin 2\alpha = 2\sin\alpha.\cos\alpha$

$\bar{x} = \frac{\sum x}{n}$ $\sigma^2 = \frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n}$ $P(A) = \frac{n(A)}{n(S)}$ $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$

$\hat{y} = a + bx$ $b = \frac{\sum(x - \bar{x})(y - \bar{y})}{\sum(x - \bar{x})^2}$