Province of the
EASTERN CAPE
EDUCATION

Iphondo leMpuma Kapa: Isebe leMfundo
Provinsie van die Oos Kaap: Department van Onderwys
Porafensie Ya Kapa Botjhabela: Lefapha la Thuto

# NATIONAL SENIOR CERTIFICATE

## GRADE 11

## NOVEMBER 2025

# MATHEMATICS P2

**MARKS: 150**

**TIME: 3 hours**

* I M A T 2 *

This question paper consists of 16 pages, including an information sheet and an answer book of 23 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

The following data represent the prize allocation (in R1 000) for the top ten male finishers in the 2025 20 km Marathon, listed in descending order from 10$^{th}$ place to the first place. Note that the prize money for 6$^{th}$ place and 3$^{rd}$ place were not disclosed.

The mean prize across the available data is R21 770.

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Prizes | 3 600 | 4 500 | 5 400 | 6 200 | $x$ | 12 300 | 15 800 | $y$ | 43 800 | 87 500 |

1.1 Calculate the value of $x$ if the median $(Q_2)$ of the data is 9 700. (2)

1.2 Calculate the value of $y$. (3)

1.3 Identify any outlier. (1)

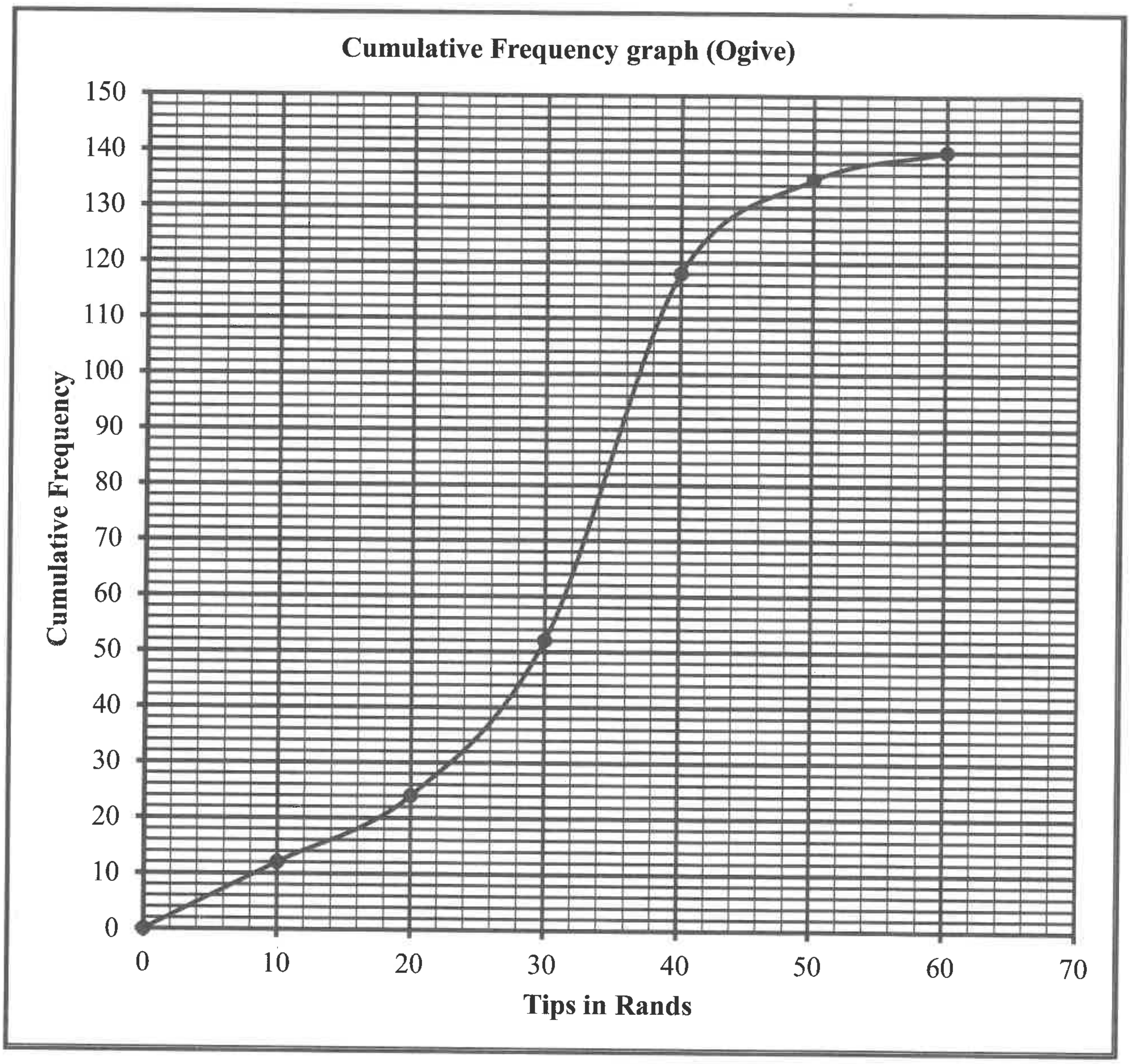
1.4 Determine the standard deviation of the prize money. (2)

1.5 An amount of R200 is added to each of the top 10 participants. How will this adjustment affect the mean, the median and the standard deviation of the data? (3)

**[11]**

## QUESTION 2

The cumulative frequency graph presents data from a survey conducted in a certain restaurant, detailing the distribution of tips earned by employees during their shift.




2.1 How many employees participated in the survey? (1)

2.2 Write down the modal class of the data. (1)

2.3 Determine how many employees earned R24 or less from the cumulative frequency graph. (2)

2.4 Determine the number of employees that earned $R20 \leq x \leq R40$. (2)

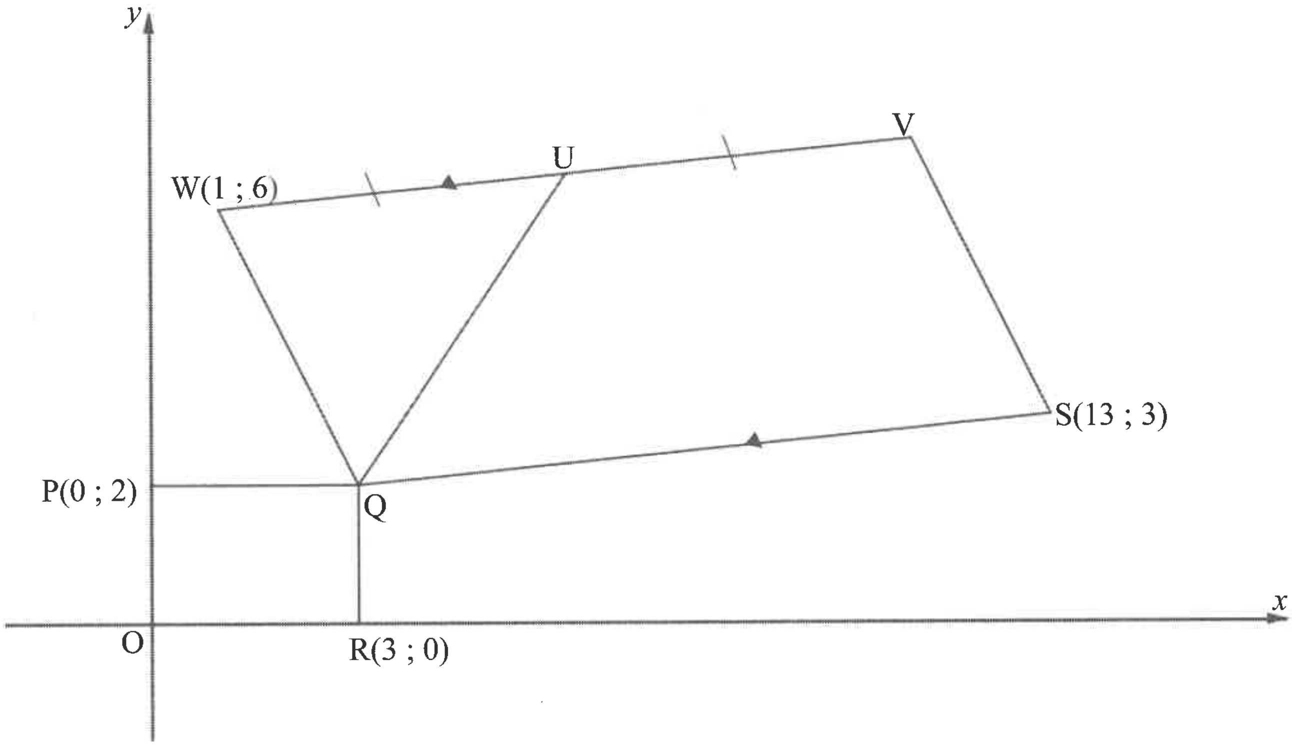
2.5 Determine the 25[th] percentile and the upper quartile of the data. (2)

2.6 Calculate the interquartile range of the data. (2)

**[10]**

## QUESTION 3

In the diagram, W(1; 6), V, S and Q are the vertices of a quadrilateral WVSQ. P(0 ; 2) is the point where line PQ intersects the $y$-axis and R(3 ; 0) is the point where line QR intersects the $x$-axis. $WV \parallel QS$ and $WU = UV$. PQRO is a rectangle.




3.1 Write down the coordinates of Q. (1)

3.2 Calculate the gradient of QS. (2)

3.3 Determine the equation of WV. (3)

3.4 If it is further given that the equation of QU is $y = \frac{3}{2}x - \frac{5}{2}$, show that the coordinates of V are $(11; 7)$. (5)

3.5 Prove that WVSQ is a parallelogram. (4)

3.6 Determine the length of WV. **Leave your answer in surd form.** (2)

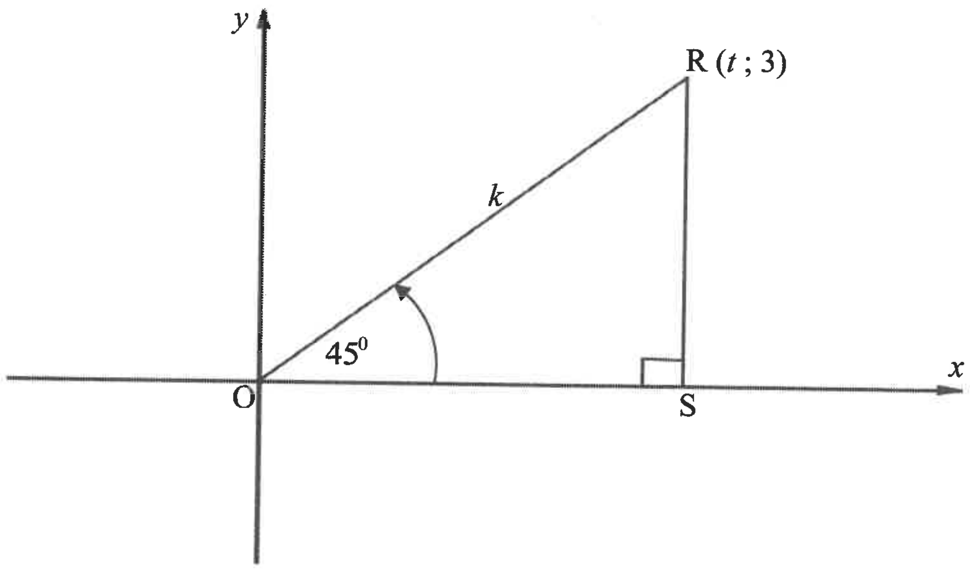
3.7 Calculate the size of $W\hat{U}Q$. (4)

3.8 Determine the ratio: $\dfrac{\text{Area of PQRO}}{\text{Area of } \Delta QUW}$ (6)

**[27]**

## QUESTION 4

4.1 In the diagram below, O is the point of origin. $OR = k$, $R\hat{O}S = 45°$, R $(t\,;\,3)$ is a point in the first quadrant and point S lies on the $x-axis$ such that $OS \perp RS$.




Without using a calculator, calculate the value(s) of the following:

4.1.1 $t$ (2)

4.1.2 $k$ (2)

4.2 Given: $8\cos^2\alpha - 2 = 0$

4.2.1 Determine the value of $\cos\alpha$ where $\cos\alpha > 0$ and $0^0 < \alpha < 180^0$ (2)

4.2.2 Hence, or otherwise, use a diagram to determine the value of $4\left[\tan^2\alpha - \cos^2\alpha\right]$ (3)

4.3 Given: $\dfrac{\cos x.\tan x}{2\left[\sin x.\cos\left(x-90^0\right)+\cos x.\cos(-x)\right]}$

4.3.1 Simplify the above expression to a single trigonometric ratio of $x$. (6)

4.3.2 Hence, or otherwise, write down the period of the expression in QUESTION 4.3 (1)

4.4 Simplify: $\dfrac{\cos 42^0 \sin 48^0 - \tan^2\left(-45^0\right)}{\cos^2 132^0}$ without using a calculator. (5)

4.5 Given the identity: $\tan\beta - \sin\beta.\cos\beta = \tan\beta.\sin^2\beta$

4:5.1 Prove the above identity. (3)

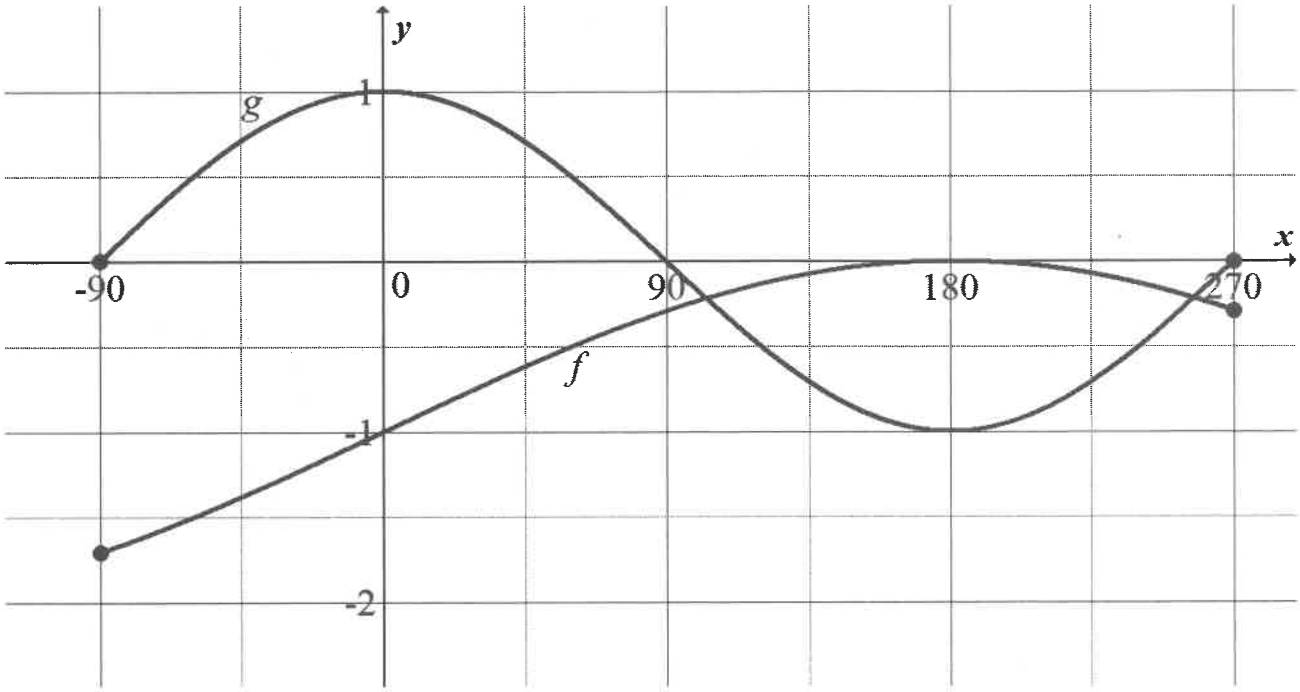
4.5.2 For which value(s) of $\beta$ will the identity in QUESTION 4.5 be undefined in the interval $\beta \in [-180^0 ; 180^0]$? (2)

4.6 Determine the general solution of : $3\sin\theta = -2\cos^2\theta$ (6)

**[32]**

## QUESTION 5

Given: $f(x) = a\sin\left(\frac{x}{2}\right) - 1$ and $g(x) = \cos x + q$, $x \in [-90^0; 270^0]$




Use the graphs to answer the following questions where $x \in [-90^0; 270^0]$:

5.1 Determine the values of $a$ and $q$ (2)

5.2 Write down the range of $f$ (2)

5.3 Write down the amplitude of $g$ (1)

5.4 Write down the value(s) of $x$ where $f(x) - g(x) = -2$ (1)

5.5 For which values of $x$ is $f(x).g(x) \leq 0$? (2)

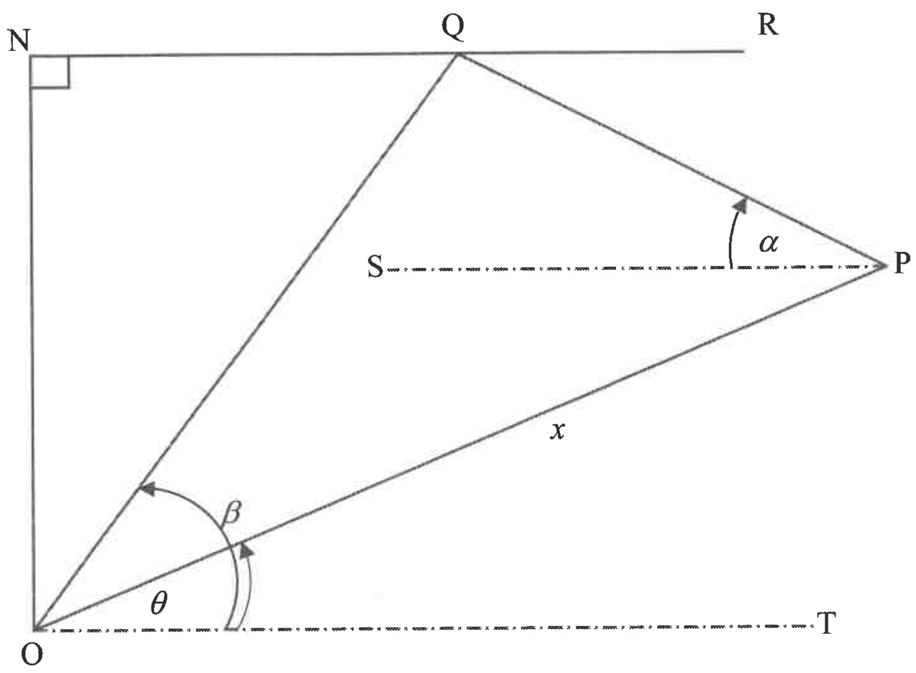
5.6 The graph of $h$ is obtained by shifting the graph of $g$ by $90^0$ to the left. Determine the equation of $h$ in its simplest form. (2)

**[10]**

## QUESTION 6

A man standing on a horizontal plane at point O observes two helicopters positioned at points P and Q. The lines of sight from point O to each helicopter form angles of elevation $\theta$ and $\beta$ with the horizontal plane. Additionally, a second man located in the helicopter at point P observes the helicopter at point Q, and his line of sight forms an angle of elevation $\alpha$ with the horizontal plane at P, measured along line PQ.

$\mathrm{ON} \perp \mathrm{NR}$ and $\mathrm{OP} = x$.




6.1 Show that: $\mathrm{O\hat{Q}P} = 180° - (\beta + \alpha)$ (2)

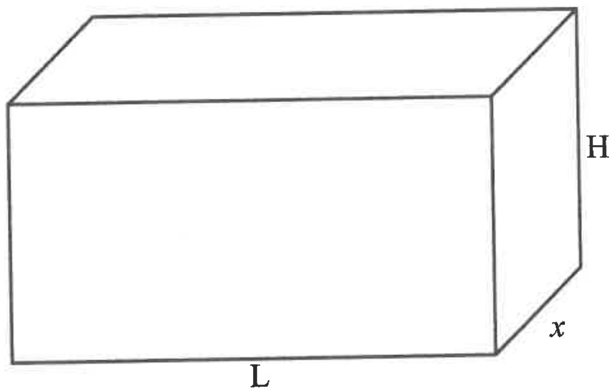
6.2 Show that $\mathrm{OQ} = \dfrac{x.\sin(\alpha + \theta)}{\sin(\beta + \alpha)}$ (3)

6.3 Determine the value of $x$ if $\theta = 15°$, $\beta = 60°$, $\alpha = 30°$ and $\mathrm{OQ} = 5\sqrt{2}$ (2)

**[7]**

**QUESTION 7**

A closed rectangular box has a length(L) that is twice its width(W), and its height(H) is 3 cm more than its width. The surface area of the box is $784\ \text{cm}^2$. The length of the width is $x$ cm.




$P = 2l + 2b$
$A = l \times b$
$V = lbh$
$SA = 2lb + 2lh + 2bh$

7.1 Write the down length(L) and height(H) of the box in terms of $x$. (2)

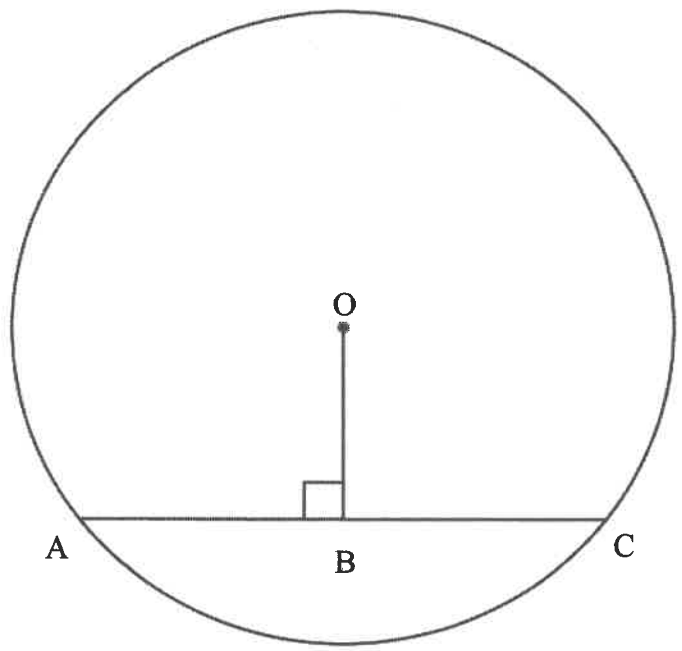
7.2 Write an expression for the total surface area of the rectangular box in terms of $x$. (3)

7.3 Hence or otherwise, determine the value of $x$. (4)

7.4 Calculate the volume of the box. (2)
**[11]**

## QUESTION 8

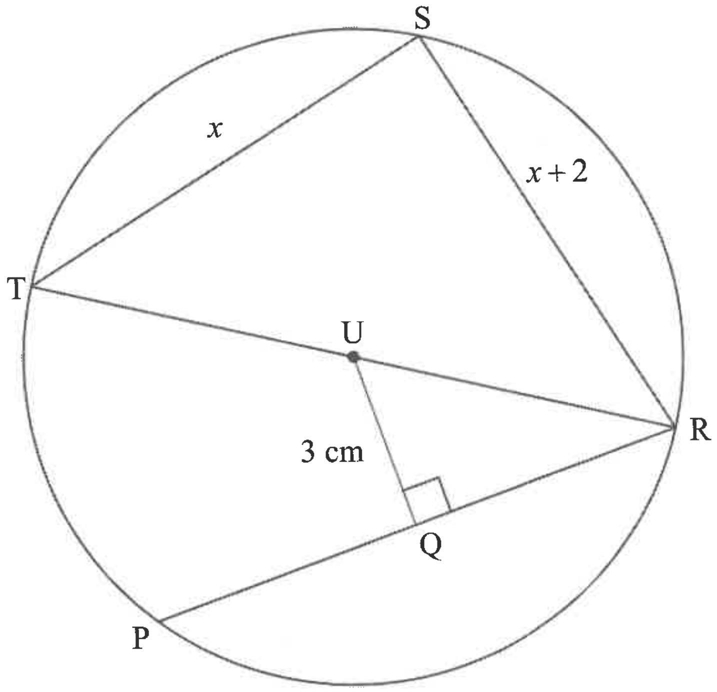
8.1. In the diagram below, O is the centre of the circle. AC is a chord. OB is drawn perpendicular to the chord.




Use the diagram above to prove the theorem which states that the line drawn from the centre of a circle perpendicular to a chord bisects the chord, that is, prove that $AB = BC$. (5)

8.2 In the diagram, TR is the diameter of the circle that passes through centre U. P, R, S and T are points on the circumference of the circle. UQ is a line from centre such that $UQ \perp PR$ and PR is drawn.

$TS = x\ cm$, $SR = (x+2)\ cm$, $PR = 8cm$ and $UQ = 3cm$




Calculate, giving reasons, the length of:

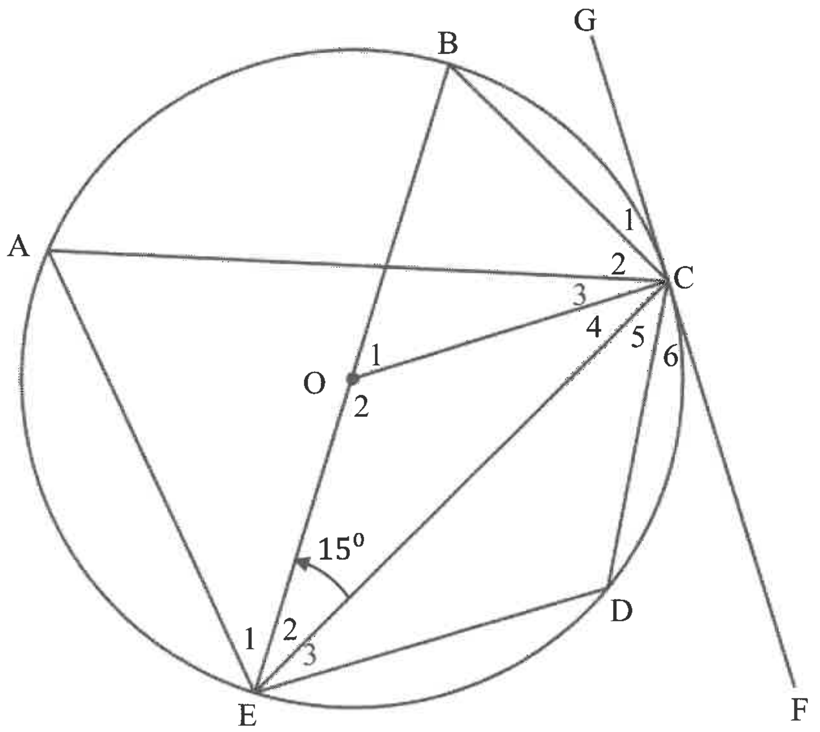
8.2.1 UR (4)

8.2.2 TS (6)

**[15]**

## QUESTION 9

9.1 In the diagram below, O is the centre of the circle. ACDE and BCDE are cyclic quadrilaterals. GCF is a tangent to the circle at point C. Chord CE and line OC are drawn. $\hat{E}_2 = 15^0$.




Determine the size of the following angles below, giving reasons:

9.1.1 $\hat{O}_1$ (2)

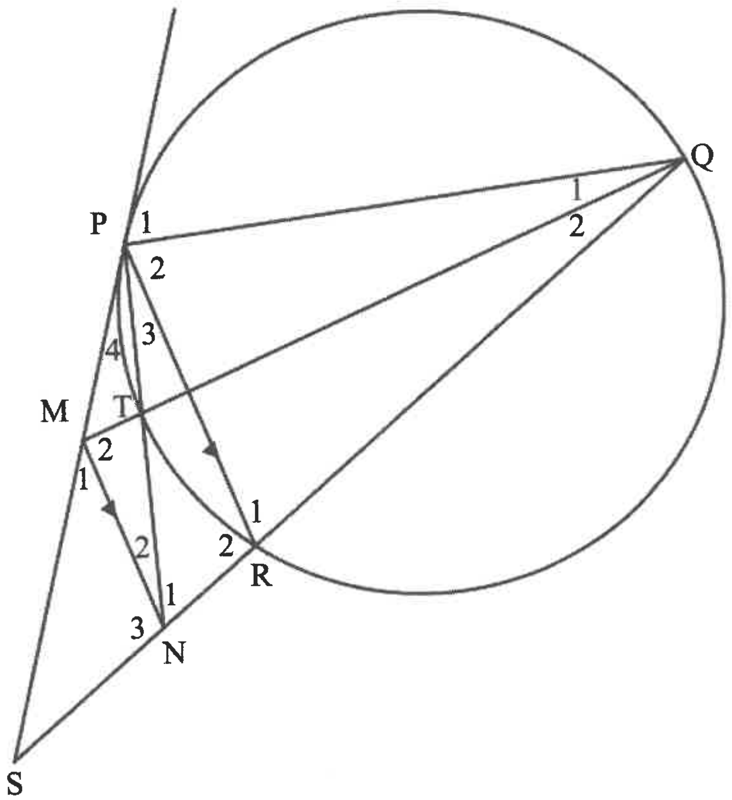
9.1.2 $\hat{A}$ (2)

9.1.3 $\hat{D}$ (2)

9.1.4 $E\hat{C}F$ (2)

9.1.5 $O\hat{C}G$ (2)

9.2 In the diagram below, P, Q, R and T are points on the circumference of the circle. PS is a tangent to the circle at P. Chord QR is produced to S. M and N are points on PS and RP respectively such that $MN \parallel PR$. PN is drawn. QT is produced to M.




9.2.1 Name TWO other angles each equal to $\hat{P}_1$ (4)

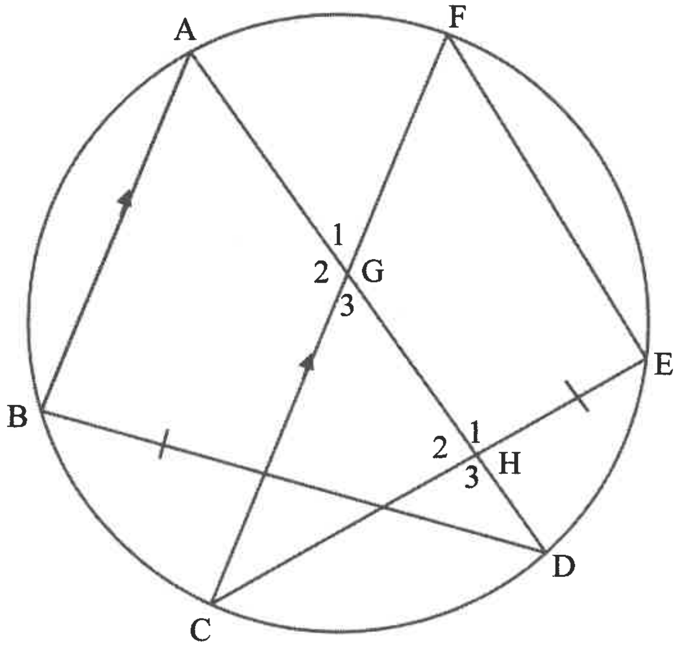
9.2.2 Prove that MNQP is a cyclic quadrilateral. (4)

9.2.3 Prove that PN bisects $S\hat{P}R$ (4)

**[22]**

## QUESTION 10

In the diagram below, A, B, C, D, E and F are points on the circumference of the circle. AD intersect CF at point G and CE at point H. $AB \parallel FC$ and $CE = BD$.




Prove that $AD \parallel FE$ **[5]**

**TOTAL: 150**

# INFORMATION SHEET: MATHEMATICS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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