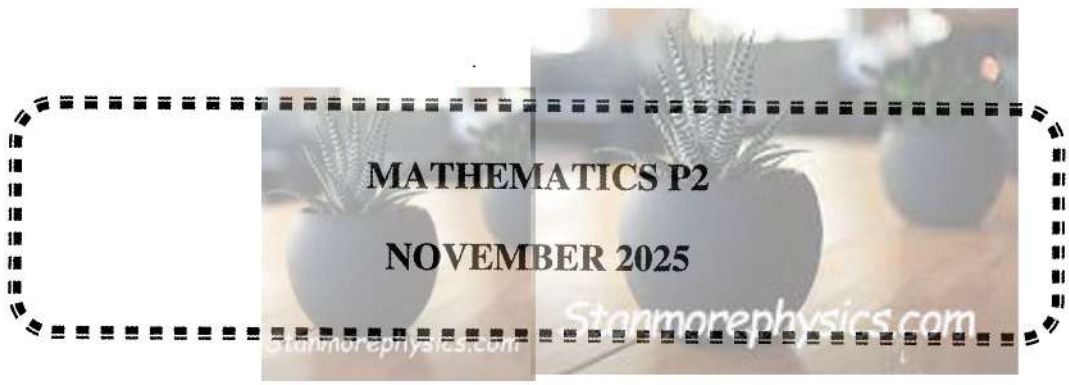
KWAZULU-NATAL PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 11



MARKS: 150

TIME: 3 hours

This question paper consists of 13 pages and 1 information sheet.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of 11 questions.
2. Answer ALL the questions in the SPECIAL ANSWER BOOK provided.
3. Clearly show numbering if additional space has been used to answer a question. If NOT, cross out all rough work done in the additional space.
4. Clearly show ALL calculations, diagrams, graphs, etc. which you have used in determining your answers.
5. Answers only will NOT necessarily be awarded full marks.
6. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
7. If necessary, round off answers correct to TWO decimal places, unless stated otherwise.
8. Diagrams are NOT necessarily drawn to scale.
9. An information sheet with formulae is included at the end of the question paper.
10. Write neatly and legibly.

QUESTION 1

Learners collected cans during "Operation Clean Up". The number of cans collected by 10 classes is shown in the table below.

250	259	265	276	290	290	294	310	315	330

1.1 Calculate the mean number of cans collected by these 10 classes. (2)

1.2 Write down the standard deviation of the above data. (1)

1.3 How many classes are within one standard deviation of the mean? (2)

1.4 Draw a box-and-whisker diagram of the data on the scaled line provided in the ANSWER BOOK. (2)

1.5 When another 10 classes added their cans to the original number of cans collected, the new mean is 250.

1.5.1 Calculate how many cans were collected by the 10 classes that were added. (2)

1.5.2 What effect does adding the cans of these 10 classes have on the original standard deviation? (1)

[10]

QUESTION 2

Learners were asked the time (to the nearest minute) that they usually take to get from home to school each morning. The results are shown in the table below:

Time in minutes	Number of learners
$5 < t \leq 10$	160
$10 < t \leq 15$	150
$15 < t \leq 20$	110
$20 < t \leq 25$	60
$25 < t \leq 30$	45
$30 < t \leq 35$	15

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

2.2 Complete the cumulative frequency column in the table provided in the ANSWER BOOK. (1)

2.3 Draw the ogive of this data on the grid provided in the ANSWER BOOK. (3)

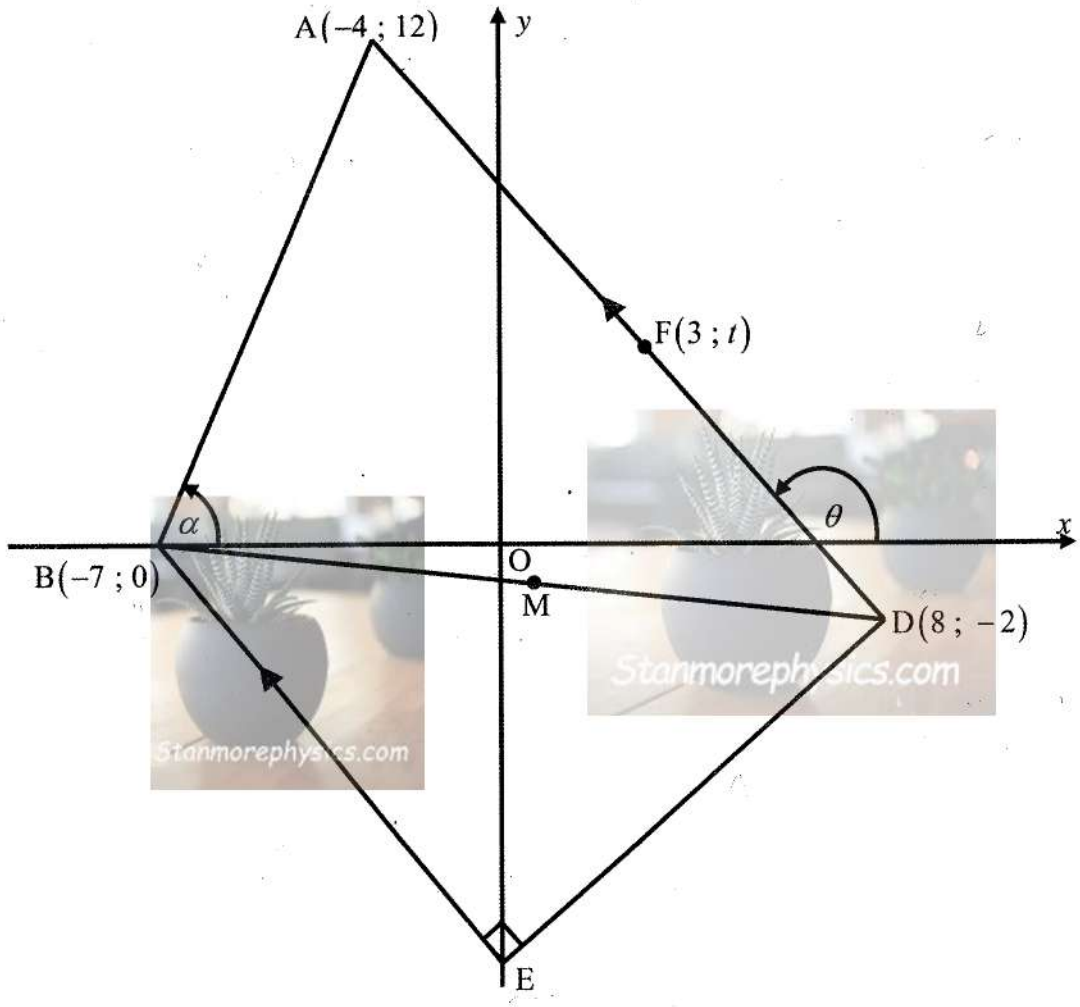
2.4 Estimate the percentage of learners who take more than 25 minutes to get to school. (2)

2.5 Estimate the mean time that these learners take to get to school in the morning. (3)

[10]

QUESTION 3

In the diagram below, $A(-4\,;12)$, $B(-7\,;0)$, E and $D(8\,;-2)$ are the vertices of a trapezium. E lies on the y axis such that BE is perpendicular to DE. The equation of AB is $y=4x+28$. The angles of inclination of AB and AD are α and θ respectively. M is the midpoint of BD. $F(3\,;t)$ is a point on AD.



3.1 Calculate the length of AD. (2)

3.2 Calculate the coordinates of M, the midpoint of BD. (2)

3.3 Calculate the gradient of BE. (3)

3.4 Determine the equation of DE. (3)

3.5 Calculate the value of t, the y-coordinate of F. (3)

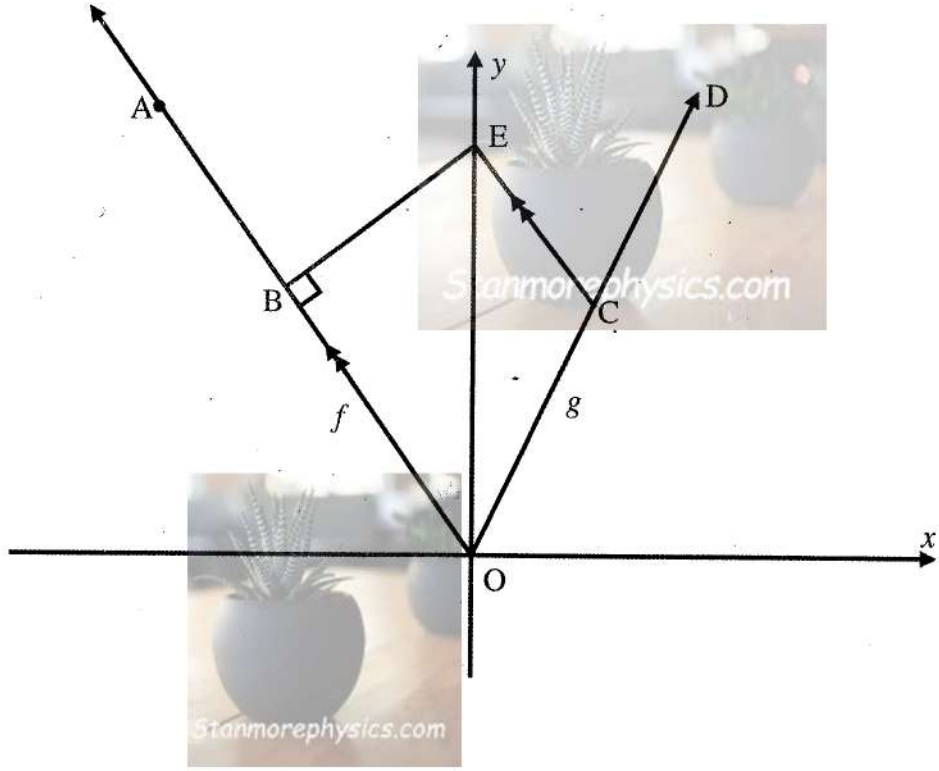
3.6 Calculate the coordinates of C, if ABCD, in that order, is a parallelogram. (2)

3.7 Calculate the size of $B\hat{C}D$, correct to the nearest degree. (5)

[20]

QUESTION 4

In the diagram below, A is a point on the line with equation $y+2x=0$. B is a point on OA such that $OB=5\sqrt{5}$ units. E is a point on the y axis such that EB is perpendicular to OA. The equation of OD is $y=2x$ and CE // OA.



Determine the following:

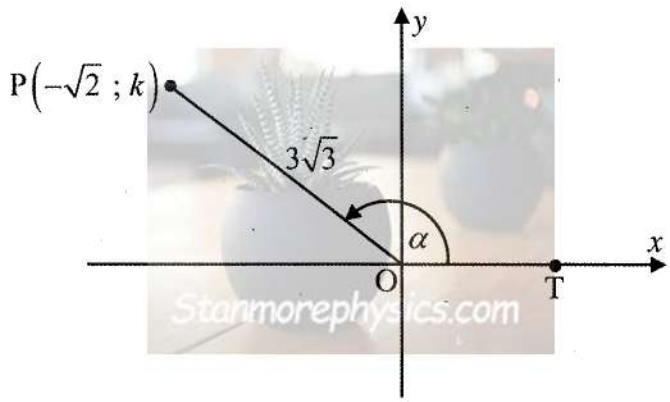
4.1 The coordinates of B. (4)

4.2 The area of the trapezium OBEC correct to the nearest square unit. (8)

[12]

QUESTION 5

5.1 In the diagram below, P is the point $\left(-\sqrt{2}\ ;\ k\right)$ such that $OP = 3\sqrt{3}$ units. $T\hat{O}P = \alpha$ is an obtuse angle.



WITHOUT using a calculator, determine the value of the following:

5.1.1 k. (2)

5.1.2 $\tan(\alpha - 180°)$ (2)

5.1.3 $\cos\beta$, if it is further given that $\alpha + \beta = 180°$. (2)

5.2 If $\sin 34° = p$, determine, in terms of p, the value of $\tan 484°$ **WITHOUT using a calculator.** (4)

5.3 Simplify the following **WITHOUT the use of a calculator:**

$$\frac{\tan 205°.\cos 315°.\sin(-45°)}{\sin 210°.\cos 150°.\tan 25°}$$ (5)

5.4 Simplify the following to a single trigonometric term:

$$\sin(180° + x).\cos(x - 90°) - \frac{\sin x}{\sin(90° - x).\tan(180 - x)}$$ (6)

5.5 Given the identity: $\frac{1+\sin x}{\cos x} + \frac{\cos x}{1+\sin x} = \frac{2}{\cos x}$

5.5.1 Prove the identity. (4)

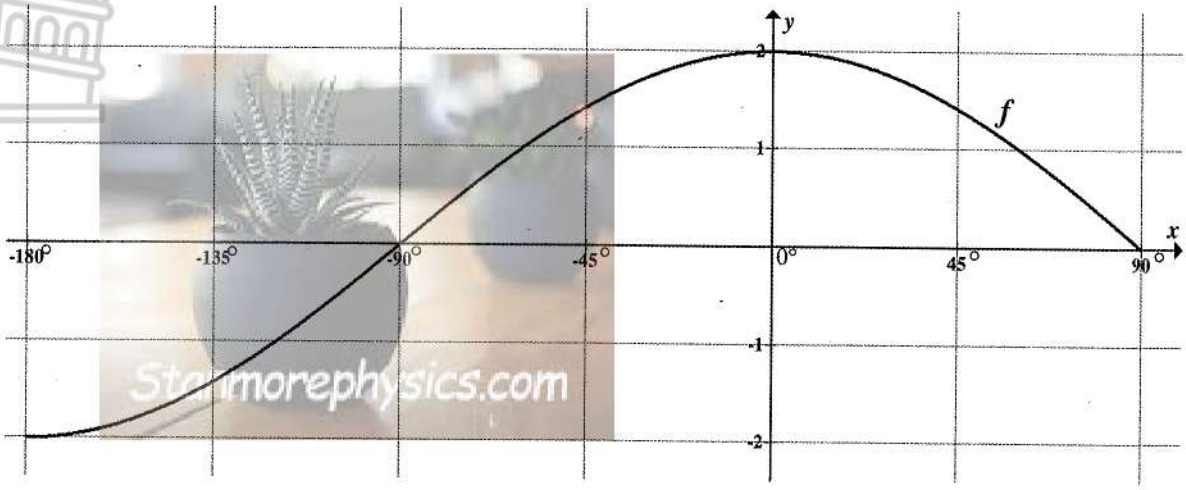
5.5.2 For which values of x in the interval $0° \le x \le 360°$ will the above identity be undefined? (2)

5.6 Determine the general solution of the equation: $\tan x.\sin x = \frac{3}{\sin x} - \cos x$ (6)

[33]

QUESTION 6

Below is a sketch of the graph of $f(x) = a\cos x$ for $x \in [-180° ; 90°]$.



6.1 Write down the value of a. (1)

6.2 Write down the period of $g(x) = -\cos 2x$. (1)

6.3 Sketch the graph of $g(x) = -\cos 2x$ for $x \in [-180° ; 90°]$ on the set of axes provided in the ANSWER BOOK. (3)

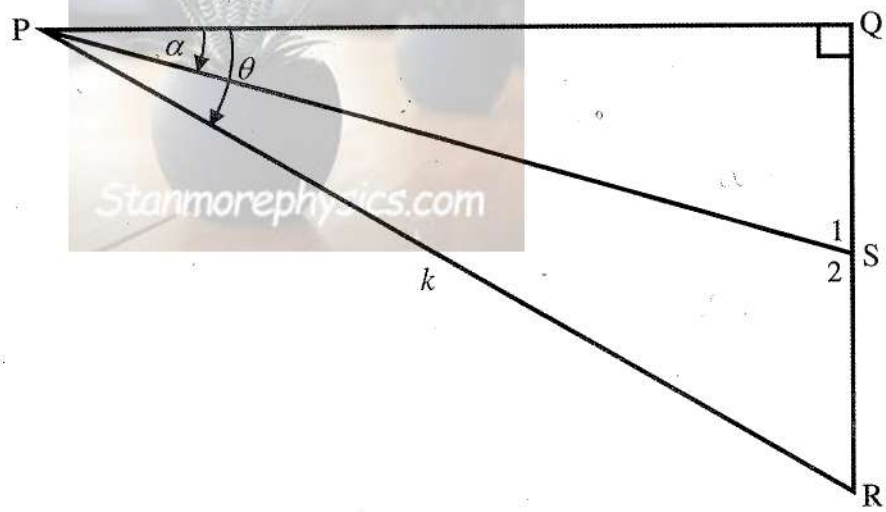
6.4 Use the graphs to write down the value of x for which $f(x) - 1 = g(x) + 2$. (2)

6.5 Determine minimum value of $1 - 2[\sin(90° - x)]$. (3)

[10]

QUESTION 7

In the diagram below, $PQ \perp QR$. $Q\hat{P}S = \alpha$ and $Q\hat{P}R = \theta$ and $PR = k$ units.



7.1 Write down the size of $R\hat{P}S$ in terms of α and θ. (1)

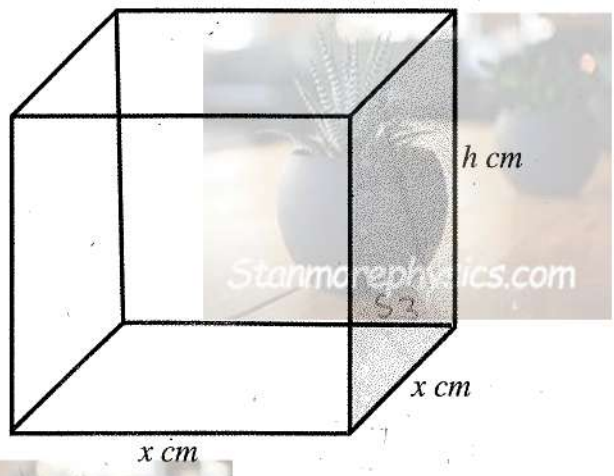
7.2 Show that $RS = \dfrac{k.\sin(\theta - \alpha)}{\cos\alpha}$ (3)

7.3 Calculate the length of RS if $k = 17$ units, $\theta = 58°$ and $\alpha = 23°$. (2)

7.4 Show that the area of $\Delta RSP = 48$ square units, correct to the nearest square unit. (2)
[8]

QUESTION 8

The diagram below represents an open tank with a square base (side dimensions of x *cm*) and a height of h *cm*. The tank has a volume of $490\ cm^3$.



8.1 Determine the height, h, of the tank in terms of x. (2)

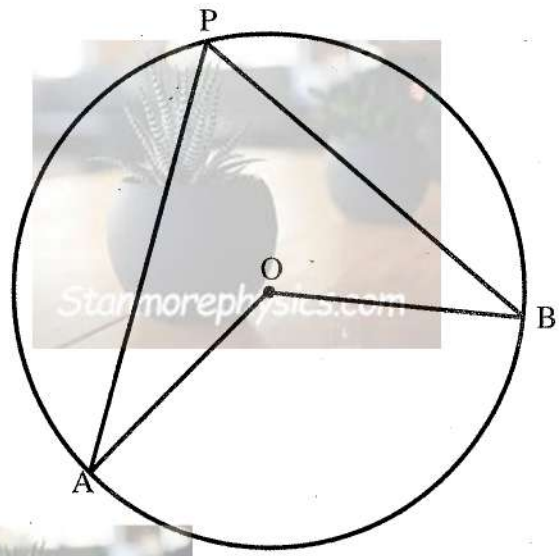
8.2 Show that A, the external surface area of the tank is given by: $A = x^2 + \frac{1960}{x}\ cm^2$. (2)

8.3 Calculate the external surface area of the tank if the height is 10 *cm*. (4)

[8]

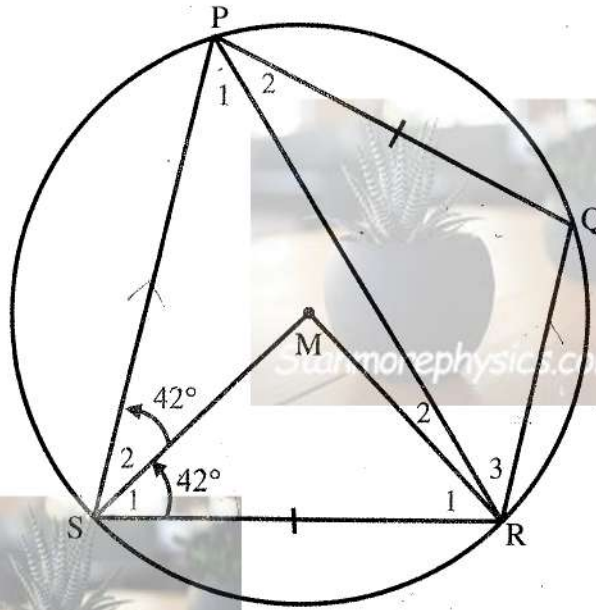
QUESTION 9

9.1 In the diagram below, A, B and P are points on the circle with centre O. PA, PB, AO and BO are joined.



Use the diagram in the ANSWER BOOK to prove the theorem which states that the angle subtended by an arc or chord at the centre of the circle is twice the angle subtended by the same arc or chord at the circumference, that is, prove that $A\hat{O}B = 2A\hat{P}B$.

9.2 In the diagram below, PQRS is a cyclic quadrilateral. M is the centre of the circle. MS bisects $P\hat{S}R$ such that $\hat{S}_1 = \hat{S}_2 = 42°$ and $PQ = SR$.



9.2.1 Name, giving a reason, another angle equal to $42°$. (2)

9.2.2 Calculate, giving reasons, the sizes of:

(a) $P\hat{Q}R$ (2)

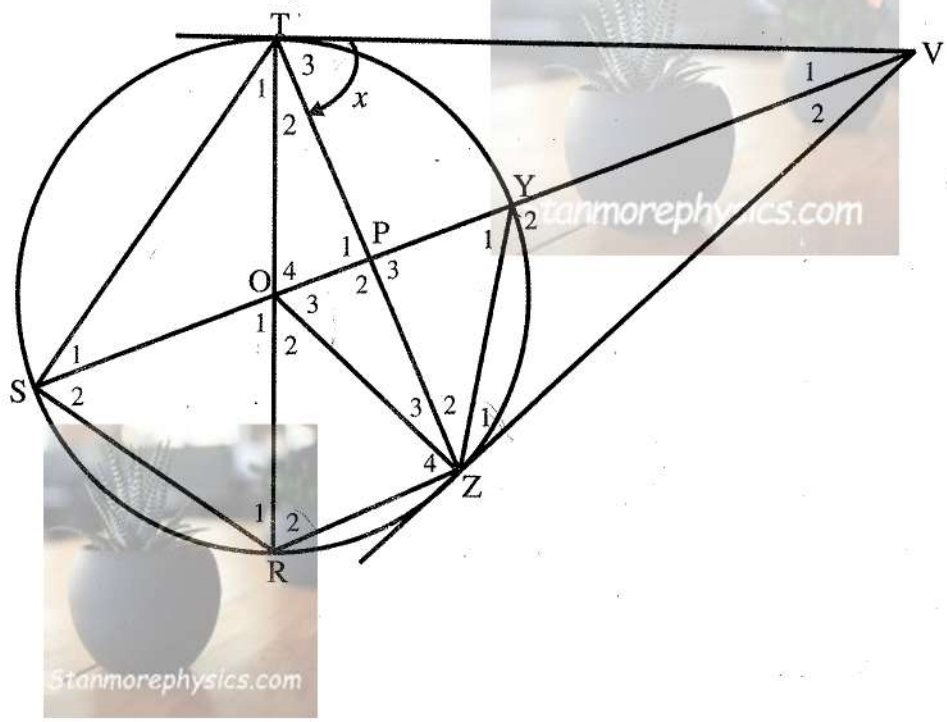
(b) $\hat{P}_1$ (3)

9.2.3 Prove that SP // QR. (3)

[15]

QUESTION 10

In the diagram, VT and VZ are tangents to the circle with centre O at T and Z respectively. T, S, R, Z and Y are points on the circle such that TR is the diameter. P is the midpoint of chord TZ. $\hat{T}_3 = x$.



Prove that:

10.1 TOZV is a cyclic quadrilateral.

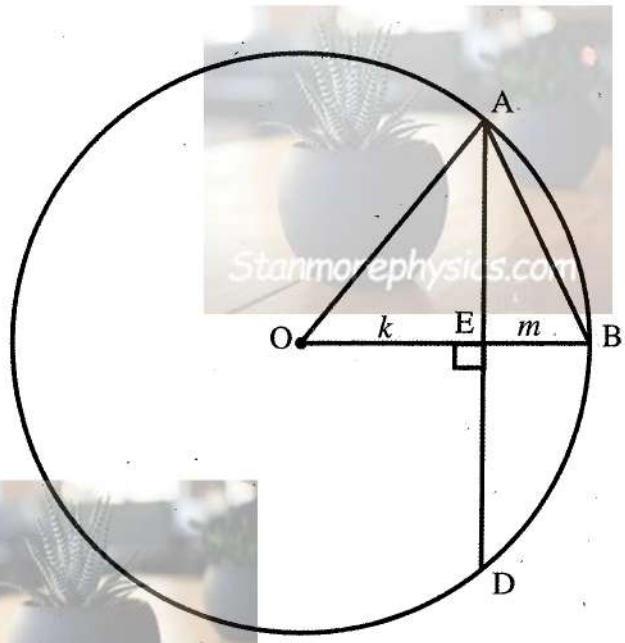
10.2 RZ // SY

10.3 $\hat{T}_1 = \frac{1}{2}x$

10.4 $\hat{Y}_2 = 90° + \hat{T}_1$

QUESTION 11

In the diagram below, AD is a chord of circle with centre O. OB is drawn perpendicular to AD and cuts AD at E. OE = k and EB = m. OA and AB are drawn.



11.1 Prove that $AB^2 = 2km + 2m^2$ (4)

11.2 Write down, giving a reason, the length of DE in terms of k and m. (2)

[6]

TOTAL: 150 MARKS

INFORMATION SHEET

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

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

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

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

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

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

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

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

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

In ΔABC: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

$a^2 = b^2 + c^2 - 2bc.\cos A$

$area\ \Delta ABC = \frac{1}{2}ab.\sin C$

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

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

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

$\sin 2\alpha = 2\sin\alpha.\cos\alpha$

$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$ $\sigma^2 = \frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n}$

$P(A) = \frac{n(A)}{n(S)}$ $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$

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

FINAL

KWAZULU-NATAL PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 11

MATHEMATICS P2

NOVEMBER 2025

MARKING GUIDELINES

MARKS: 150

These marking guidelines consist of 18 pages.

NOTE:

GRADE 11

Marking Guideline

- If a candidate answers a question TWICE, only mark the FIRST attempt.
- Consistent accuracy applies in ALL aspects of the Marking Guidelines. Stop marking at the second calculation error.
- Assuming answers/values in order to solve a problem is NOT acceptable.

NOTA:

- *As 'n kandidaat 'n vraag TWEE KEER beantwoord, merk slegs die EERSTE poging.*
- *Volgehoue akkuraatheid word in ALLE aspekte van die Nasienriglyne toegepas. Hou op nasien by die tweede berekeningsfout.*
- *Aanvaar van antwoorde/waardes om 'n probleem op te los, word NIE toegelaat nie.*

GEOMETRY	
S	**A mark for a correct statement** **(A statement mark is independent of a reason)**
	'n Punt vir 'n korrekte bewering **('n Punt vir 'n bewering is onafhanklik van die rede)**
R	**A mark for the correct reason** **(A reason mark may only be awarded if the statement is correct)**
	'n Punt vir 'n korrekte rede **('n Punt word slegs vir die rede toegeken as die bewering korrek is)**
S/R	**Award a mark if statement AND reason are both correct**
	Ken 'n punt toe as die bewering EN rede beide korrek is

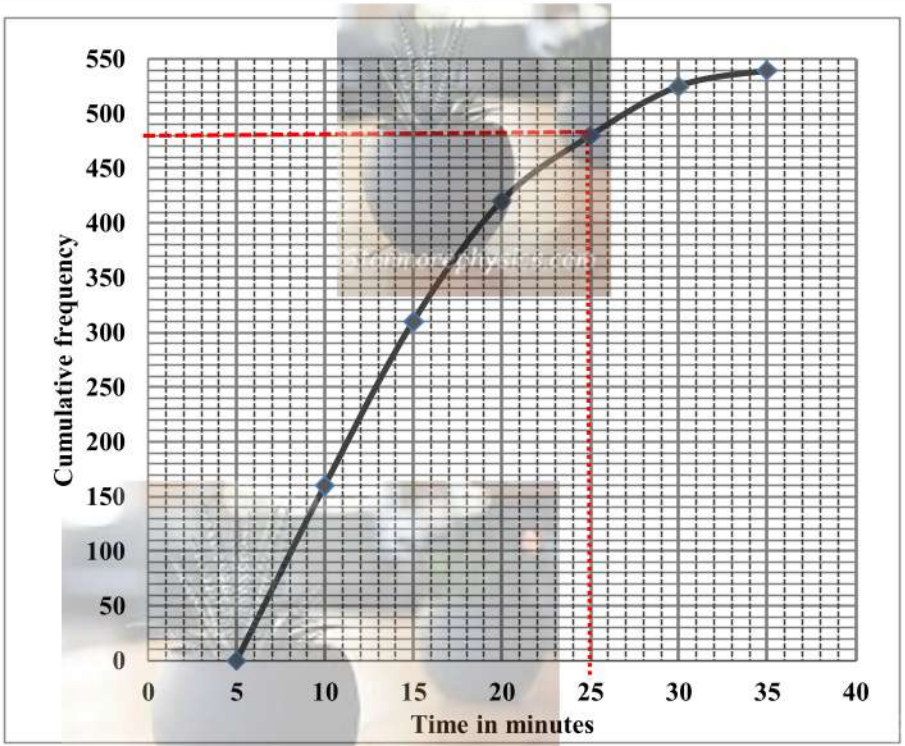
GRADE 11
Marking Guideline

QUESTION 1

1.1	$\bar{x} = \frac{2879}{10}$ $= 287,9$ **ANSWER ONLY: Full marks**	A✓ 2879 CA✓ answer (2)
1.2	$\sigma = 24,45$	A✓ $\sigma = 24,45$ (1)
1.3	Interval: (263,45 ; 312,35) ∴ 6 classes	CA✓ $(\bar{x} - \sigma \; ; \; \bar{x} + \sigma)$ CA✓ answer (2)
1.4		A✓ whiskers ending at 250 & 330 A✓ box with Q_1=265 Q_2=290 & Q_3 = 310 (2)
1.5.1	Let the number of cans added be k. ∴ $\frac{2879+k}{20} = 250$ $2879 + k = 5000$ $k = 2121$ ∴ 2121 cans were added.	CA✓ $\frac{2879+k}{20} = 250$ CA✓ answer (2)
1.5.2	The standard deviation will increase.	A✓ increase (1)
		[10]

GRADE 11
Marking Guideline

QUESTION 2

2.1	$5 < t \leq 10$	A✓ answer (1)
2.2	<table><tr><th>Time (in minutes)</th><th>Number of learners</th><th>Cumulative frequency</th></tr><tr><td>$5 < t \leq 10$</td><td>160</td><td>160</td></tr><tr><td>$10 < t \leq 15$</td><td>150</td><td>310</td></tr><tr><td>$15 < t \leq 20$</td><td>110</td><td>420</td></tr><tr><td>$20 < t \leq 25$</td><td>60</td><td>480</td></tr><tr><td>$25 < t \leq 30$</td><td>45</td><td>525</td></tr><tr><td>$30 < t \leq 35$</td><td>15</td><td>540</td></tr></table>	A✓ all cumulative frequency values correct (1)
2.3		A✓ grounding at (5;0) CA✓ plotting cumulative frequency at upper limits A✓ smooth increasing curve (3)
2.4	No. of learners = 540 – 480 = 60 learners % of learners = $\frac{60}{540} \times 100\%$ = 11,11%	A✓ 60 CA✓ answer (2)
2.5	$\bar{x} = \frac{(7,5 \times 160) + (12,5 \times 150) + (17,5 \times 110) + (22,5 \times 60) + (27,5 \times 45) + (32,5 \times 15)}{540}$ $= \frac{8075}{540}$ =14,95 minutes **ANSWER ONLY: Full marks. All ACCURACY marks Answer must EXACTLY be 14,95 minutes.**	A✓ frequency ×midpoints A✓ 8075 CA✓ answer (3)
		[10]

GRADE 11
Marking Guideline

QUESTION 3

3.1.	$AD = \sqrt{[-4-8]^2 + [12-(-2)]^2}$ $= \sqrt{340}$ or $2\sqrt{85}$ units or 18,44 units	A✓ substitution in correct formula CA✓ answer (2)
3.2	$M\left(\frac{-7+8}{2} ; \frac{0-2}{2}\right)$ $M\left(\frac{1}{2} ; -1\right)$	A✓ x-coordinate of $\frac{1}{2}$ A✓ y-coordinate of -1 (2)
3.3	$m_{BE} = m_{AD} \quad (BE \parallel AD)$ $= \frac{12-(-2)}{-4-8}$ $= -\frac{14}{12}$ *or* $-\frac{7}{6}$ **If $m_{BE} = m_{AD}$ is not stated: Award 2 marks here**	A✓ $m_{BE} = m_{AD}$ A✓ substitution CA✓ answer (3)
3.4	$m_{DE} = \frac{6}{7} (BE \perp DE)$ $y - y_1 = m(x - x_1)$ $y+2 = \frac{6}{7}(x-8)$ $y+2 = \frac{6}{7}x - \frac{48}{7}$ $y = \frac{6}{7}x - \frac{62}{7}$ **If $m_{DE} = -\frac{1}{m_{BE}}$ is not stated: Award 2 marks here** **OR** $m_{DE} = \frac{6}{7} (DE \perp DE)$ $y = mx + c$ $-2 = \frac{6}{7}(8) + c$ $c = -\frac{62}{7}$ $y = \frac{6}{7}x - \frac{62}{7}$ **If $m_{DE} = -\frac{1}{m_{BE}}$ is not stated: Award 2 marks here**	CA✓ $m_{DE} = -\frac{1}{m_{BE}}$ CA✓ substitution of $D(8 ; -2)$ & m_{DE} into equation of a line CA✓ answer (3) **OR** CA✓ $m_{DE} = -\frac{1}{m_{BE}}$ CA✓ substitution of $D(8 ; -2)$ & m_{DE} into equation of a line CA✓ answer (3)
3.5	$m_{AF} = m_{FD}$ $\frac{t-12}{3-(-4)} = \frac{t+2}{3-8}$ $7t+14 = -5t+60$ $12t = 46$ $t = \frac{23}{6}$ or $3\frac{5}{6}$ or 3,83	A✓condition A✓substitution CA✓answer (3)

GRADE 11
Marking Guideline

	OR $m_{AD} = -\frac{7}{6}$ $\frac{t-(-2)}{3-8} = -\frac{7}{6}$ $t+2 = -5\left(-\frac{7}{6}\right)$ $t = \frac{23}{6}$ or $3\frac{5}{6}$ or 3,83	A✓condition A✓substitution CA✓answer (3)
3.5	**OR** Equation of AD: $y-12 = -\frac{7}{6}[x-(-4)]$ or $12 = -\frac{7}{6}(-4)+c$ $y-12 = -\frac{7}{6}x-\frac{28}{6}$ or $c = \frac{22}{3}$ $y = -\frac{7}{6}x+\frac{22}{3}$ $t = -\frac{7}{6}(3)+\frac{22}{3}$ $t = \frac{23}{6}$ or $3\frac{5}{6}$ or 3,83 **OR** Equation of AD: $y-(-2) = -\frac{7}{6}(x-8)$ or $-2 = -\frac{7}{6}(8)+c$ $y+2 = -\frac{7}{6}x+\frac{28}{3}$ or $c = \frac{22}{3}$ $y = -\frac{7}{6}x+\frac{22}{3}$ $t = -\frac{7}{6}(3)+\frac{22}{3}$ $t = \frac{23}{6}$ or $3\frac{5}{6}$ or 3,83	A✓ substitution of A(– 4 ; 12) & m_{AD} into equation of a line A✓ substitution of $F(3\,;t)$ CA✓ answer (3) A✓ substitution of D(8 ; –2) & m_{AD} into equation of a line A✓ substitution of $F(3\,;t)$ CA✓ answer (3)
3.6	$C(5\,;-14)$ [by translation] **OR** $C(x\,;y)$ $M\left(\frac{1}{2}\,;-1\right)$ $A(-4\,;12)$ $\frac{x_C-4}{2} = \frac{1}{2}$ and $\frac{y_C+12}{2} = -1$ $x_C-4 = 1$ and $y_C+12 = -2$ $x_C = 5$ and $y_C = -14$ $\therefore C(5\,;-14)$	AA✓✓ answer (2) AA✓✓ answer (2)

GRADE 11
Marking Guideline

3.7	$\tan\theta = m_{AD}$ $= -\frac{7}{6}$ $\theta = 130,60°$ $\tan\alpha = m_{AB} = 4$ $\alpha = 75,96°$ $B\hat{A}D = 130,60° - 75,96°$ [ext. $\angle$ of Δ] $= 54,64°$ $\therefore B\hat{C}D = B\hat{A}D = 55°$ [opp. $\angle$s of a parm.]	CA✓ $\tan\theta = m_{AD}$ CA✓ θ A✓ α CA✓ $B\hat{A}D$ CA✓ answer (5)
		[20]

QUESTION 4

4.1	Equation of AO: $y = -2x$ $\therefore B(x\ ;\ -2x)$ OB $= 5\sqrt{5}$ $\sqrt{(x-0)^2 + (-2x-0)^2} = 5\sqrt{5}$ $\sqrt{x^2 + 4x^2} = 5\sqrt{5}$ $5x^2 = 125$ $x^2 = 25$ $x = -5$ $\therefore B(-5\ ;\ 10)$	A✓ substitution of O(0 ; 0) & $B(x\ ;\ -2x)$ into distance formula A✓ equating to $5\sqrt{5}$ CA✓ x value CA✓ y value (4)

GRADE 11
Marking Guideline

4.2	$m_{OB} = -2 \quad \therefore m_{BE} = \frac{1}{2} \quad (EB \perp OA)$	A✓ $m_{BE} = \frac{1}{2}$
	Equation BE: $y - 10 = \frac{1}{2}(x+5)$ $\therefore y = \frac{1}{2}x + \frac{25}{2}$	
	$\therefore E\left(0\,;\,\frac{25}{2}\right)$	CA✓ $E\left(0\,;\,\frac{25}{2}\right)$
	$m_{EC} = -2 \qquad [EC \,//\, OB]$	
	Equation of EC: $y = -2x + \frac{25}{2}$	CA✓ equation of EC
	at C: $-2x + \frac{25}{2} = 2x$ $x = \frac{25}{8}$	
	$y = 2\left(\frac{25}{8}\right) = \frac{25}{4}$	
	$\therefore C\left(\frac{25}{8}\,;\,\frac{25}{4}\right)$	CA✓ $C\left(\frac{25}{8}\,;\,\frac{25}{4}\right)$
	$EC = \sqrt{\left(\frac{25}{8}-0\right)^2 + \left(\frac{25}{4}-\frac{25}{2}\right)^2} = \frac{25\sqrt{5}}{8}$ units	CA✓ length of EC
	$BE = \sqrt{(-5-0)^2 + \left(10-\frac{25}{2}\right)^2} = \frac{5\sqrt{5}}{2}$	CA✓ length of BE
	Area OBEC $= \frac{1}{2}(BO + EC)(BE)$ $= \frac{1}{2}\left(5\sqrt{5} + \frac{25\sqrt{5}}{8}\right)\left(\frac{5\sqrt{5}}{2}\right)$ $= 51$ square units	CA✓ substitution into area of a trapezium CA✓ answer (8)
	OR $\tan\theta = m_{OB} = -2$ $\therefore \theta = 180^o - \tan^{-1}(2)$ $\theta = 116{,}57^o$	A✓ $\theta = 116{,}57°$
	$\therefore B\hat{O}E = 116{,}57 - 90^o$ $= 26{,}57^o$	CA✓ size of $B\hat{O}E$
	$m_{BE} = \frac{1}{2}$	

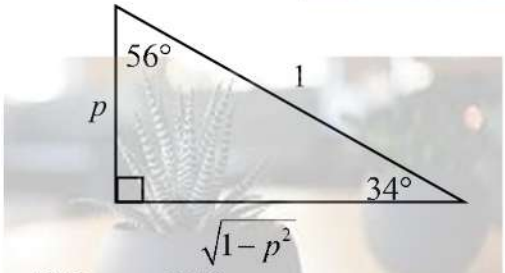
GRADE 11
Marking Guideline

	$\therefore$ *Equation* BE : $y-10=\frac{1}{2}(x+5)$ $\therefore y=\frac{1}{2}x+\frac{25}{2}$ $\therefore \text{E}\left(0\,;\frac{25}{2}\right)$	CA✓ coordinates of E
	$\therefore \text{EO}=\frac{25}{2}$ units and $\text{OB}=5\sqrt{5}$ units	
	Area $\Delta BOE=\frac{1}{2}\times\left(\frac{25}{2}\right)\times\left(5\sqrt{5}\right)\times\sin 26{,}57^{o}$ $=31{,}26$ square units	CA✓ substitution into area formula CA✓ Area ΔBOE
	In ΔEOC: $\text{C}\hat{\text{E}}\text{O}=26{,}57^{o}$ [alt ∠s=; BO // EC] $m_{EC}=-2$ [EC // OB] *Equation of* EC: $y=-2x+\frac{25}{2}$ *at* E: $2x=-2x+\frac{25}{2}$ $x=\frac{25}{8}$ $y=2\left(\frac{25}{8}\right)$ $y=\frac{25}{4}$ $\therefore \text{C}\left(\frac{25}{8}\,;\frac{25}{4}\right)$	CA✓ coordinates of C
	$\text{EC}=\sqrt{\left(\frac{25}{8}-0\right)^{2}+\left(\frac{25}{4}-\frac{25}{2}\right)^{2}}=\frac{25\sqrt{5}}{8}$	
	Area $\Delta\text{EOC}=\frac{1}{2}\times\left(\frac{25}{2}\right)\times\left(\frac{25\sqrt{5}}{8}\right)\times\sin 26{,}57°$ $=19{,}53$ square units **OR** Area $\Delta\text{EOC}=\frac{1}{2}\times\left(\frac{25}{2}\right)\times\left(\frac{25}{8}\right)$ $=19{,}53$ square units $\therefore$ Area OBEC $=31{,}26+19{,}53$ $=51$ square units	CA✓ Area ΔEOC **OR** CA✓ Area ΔEOC CA✓ answer (8)
		[12]

Accept either of the two for the area of ΔEOC

GRADE 11
Marking Guideline

QUESTION 5

5.1.1	$\left(-\sqrt{2}\right)^2 + k^2 = \left(3\sqrt{3}\right)^2$ $2 + k^2 = 27$ $k^2 = 25$ $k = \pm 5$ $\therefore k = 5$	A✓ substitution CA✓ answer (2)
5.1.2	$\tan(\alpha - 180^\circ) = \tan\alpha$ $= -\frac{5}{\sqrt{2}}$	A✓ $\tan\theta$ CA✓ answer (2)
5.1.3	$\cos\beta = \cos(180^\circ - \alpha)$ $= -\cos\alpha$ $= -\frac{\left(-\sqrt{2}\right)}{3\sqrt{3}}$ $= \frac{\sqrt{2}}{3\sqrt{3}}$	A✓ $-\cos\alpha$ A✓ answer (2)
5.2	$\sin 34^\circ = p$  $\tan 484^\circ = \tan 124^\circ$ $= -\tan 56^\circ$ $= -\frac{\sqrt{1-p^2}}{p}$ **OR** $\tan 484^\circ = \tan 124^\circ$ $= \frac{\sin 124^\circ}{\cos 124^\circ}$ $= \frac{\sin(90^\circ + 34^\circ)}{\cos(90^\circ + 34^\circ)}$ $= \frac{\cos 34^\circ}{-\sin 34^\circ}$ $= -\frac{\sqrt{1-p^2}}{p}$	A✓ third side = $\sqrt{1-p^2}$ A✓ $\tan 124^\circ$ CA✓ reduction CA✓ answer (4) **OR** A✓ $\tan 124^\circ$ A✓ $\frac{\sin 124^\circ}{\cos 124^\circ}$ CA✓ $\frac{\cos 34^\circ}{-\sin 34^\circ}$ CA✓ answer (4)

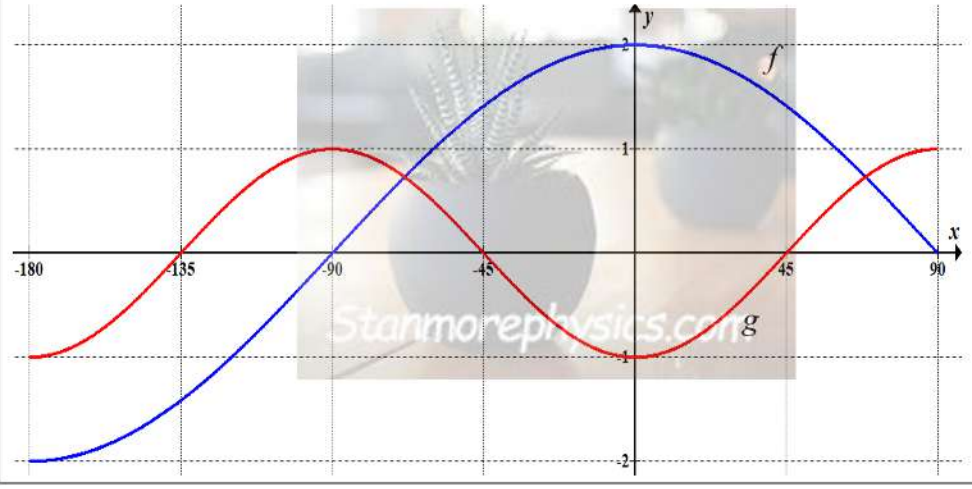
GRADE 11
Marking Guideline

5.3	$\frac{\tan 205°.\cos 315°.\sin(-45°)}{\sin 210°.\cos 150°.\tan 25°} = \frac{(\tan 25°)(\cos 45°)(-\sin 45°)}{(-\sin 30°)(-\cos 30°)(\tan 25°)}$ $= \frac{\left(\frac{\sqrt{2}}{2}\right)\left(-\frac{\sqrt{2}}{2}\right)}{\left(-\frac{1}{2}\right)\left(-\frac{\sqrt{3}}{2}\right)}$ $= -\frac{\frac{1}{2}}{\frac{\sqrt{3}}{4}}$ $= -\frac{2}{\sqrt{3}}$	A✓ reductions in numerator A✓ reductions in denominator CA✓ substitution of special ∠ values for 45° CA✓ substitution of special ∠ values for 30° CA✓answer (5)
5.4	$\sin(180°+x).\cos(x-90°) - \frac{\sin x}{\sin(90°-x).\tan(180-x)}$ $= (-\sin x)(\sin x) - \frac{\sin x}{(\cos x)(-\tan x)}$ $= -\sin^2 x + \frac{\sin x}{\cos x\left(\frac{\sin x}{\cos x}\right)}$ $= -\sin^2 x + 1$ $= \cos^2 x$	A✓ $\sin(180°+x) = -\sin x$ A✓ $\cos(x-90°) = \sin x$ A✓ $\sin(90°-x) = \cos x$ A✓ $\tan(180°-x) = -\tan x$ A✓ $\tan x = \frac{\sin x}{\cos x}$ CA✓ answer (6)
5.5.1	$\text{LHS} = \frac{1+\sin x}{\cos x} + \frac{\cos x}{1+\sin x}$ $= \frac{(1+\sin x)^2 + (\cos x)^2}{\cos x(1+\sin x)}$ $= \frac{1+2\sin x+\sin^2 x+\cos^2 x}{\cos x(1+\sin x)}$ $= \frac{1+2\sin x+1}{\cos x(1+\sin x)}$ $= \frac{2+2\sin x}{\cos x(1+\sin x)}$ $= \frac{2(1+\sin x)}{\cos x(1+\sin x)}$ $= \frac{2}{\cos x}$ $= \text{RHS}$	A✓ numerator A✓ LCD A✓ identity: $\sin^2 x + \cos^2 x = 1$ A✓ factorization (4)
5.5.2	Undefined: $\cos x = 0$ or $\sin x = -1$ $x = 90°$ or $x = 270°$ or $x = 270°$ $\therefore x \in \{90° ; 270°\}$	✓A 90° ✓A 270° (2)

GRADE 11
Marking Guideline

5.6	$\tan x.\sin x = \frac{3}{\sin x} - \cos x$ $\frac{\sin x}{\cos x}.\sin x = \frac{3}{\sin x} - \cos x$ $\sin^3 x = 3\cos x - \sin x.\cos^2 x$ $\sin^3 x + \sin x.\cos^2 x = 3\cos x$ $\sin x\left(\sin^2 x + \cos^2 x\right) = 3\cos x$ $\frac{\sin x(1)}{\cos x} = 3$ $\tan x = 3$ $x = 71,57° + k.180;\ k \in Z$ **OR** $\tan x.\sin x = \frac{3}{\sin x} - \cos x$ $\frac{\sin x}{\cos x}.\frac{\sin x}{1} + \cos x = \frac{3}{\sin x}$ $\frac{\sin^2 x + \cos^2 x}{\cos x} = \frac{3}{\sin x}$ $\frac{1}{\cos x} = \frac{3}{\sin x}$ $\frac{\sin x}{\cos x} = 3$ $\tan x = 3$ $x = 71,57° + k.180;\ k \in Z$	A✓ $\tan x = \frac{\sin x}{\cos x}$ A✓ $\sin^3 x = 3\cos x - \sin x.\cos^2 x$ CA✓ factors on LHS CA✓ equation CA✓ answer A✓ $+k.180\ ;\ k \in Z$ (6) **OR** A✓ $\tan x = \frac{\sin x}{\cos x}$ A✓ $\frac{\sin^2 x + \cos^2 x}{\cos x}$ CA✓ $\sin^2 x + \cos^2 x = 1$ CA✓ equation CA✓ answer A✓ $+k.180\ ;\ k \in Z$ (6)
		[33]

QUESTION 6

6.1	$a = 2$	A✓ answer (1)
6.2	Period $= 180°$	A✓ answer (1)
6.3		Graph of g: A✓ x-intercepts and y-intercept A✓ turning points A✓ shape (3)

GRADE 11
Marking Guideline

6.4	$f(x)-1=g(x)+2$ $f(x)=g(x)+3$ $\therefore x=0°$	A✓ $f(x)=g(x)+3$ A✓ answer (2)
6.5	$1-2\left[\sin(90°-x)\right]=1-2\cos x=-2\cos x+1$ Minimum value of $-2\cos x$ is -2 Minimum value of $1-2\cos x=-2+1$ $=-1$ **OR** $1-2\left[\sin(90°-x)\right]=1-2\cos x$ Maximum value of $2\cos x$ is 2 $\therefore$ Minimum value of $1-2\cos x=-1$	A✓ $1-2\cos x$ A✓ min. of $-2\cos x$ A✓ answer (3) A✓ $1-2\cos x$ A✓ max of $2\cos x$ A✓ answer (3)
		[10]

QUESTION 7

7.1	$\hat{RPS}=(\theta-\alpha)$	A✓ answer (1)
7.2	$\hat{S}_2=(90°+\alpha)$ [exterior angle of Δ] In ΔRPS: $\dfrac{RS}{\sin(\theta-\alpha)}=\dfrac{k}{\sin(90°+\alpha)}$ $\therefore RS=\dfrac{k.\sin(\theta-\alpha)}{\cos\alpha}$	A✓ $\hat{S}_2=(90°+\alpha)$ A✓ substitution into the sine rule A✓ $\sin(90°+\alpha)=\cos\alpha$ (3)
7.3	$RS=\dfrac{17.\sin(58°-23°)}{\cos 23°}$ $=10,59$ units	A✓ substitution CA✓ answer (2)
7.4	$\hat{R}=90°-58°$ [sum of $\angle$s in a Δ] $=32°$ Area $\Delta RSP=\dfrac{1}{2}(RS)(PR)\sin\hat{R}$ $=\dfrac{1}{2}\times 10,59\times 17\times\sin 32°$ $=48$ square units	A✓ $\hat{R}=32°$ A✓ substitution into the area rule (2)
		[8]

GRADE 11
Marking Guideline

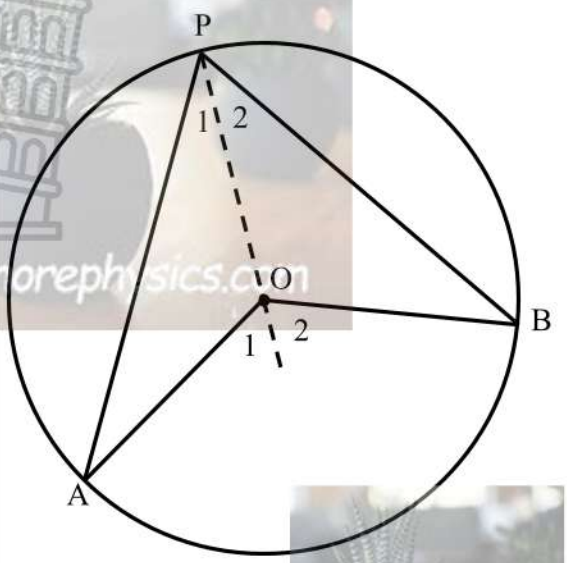
QUESTION 8

8.1	$V = x^2h$ $\therefore x^2h = 490$ $h = \frac{490}{x^2}$	A✓ $x^2h = 490$ A✓ $h = \frac{490}{x^2}$ (2)
8.2	$A = x^2 + 4xh$ $= x^2 + 4x\left(\frac{490}{x^2}\right)$ $= x^2 + \frac{1960}{x} cm^2$	A✓ $A = x^2 + 4xh$ A✓ $x^2 + 4x\left(\frac{490}{x^2}\right)$ (2)
8.3	$\frac{490}{x^2} = 10$ $x^2 = 49$ $x = 7$ $A = (7)^2 + \frac{1960}{7}$ $= 329\ cm^2$	A✓ substitution of $h = 10$ A✓ $x = 7$ CA✓ substitution into external surface area CA✓ answer (4)
		[8]

GRADE 11
Marking Guideline

QUESTION 9

9.1



RTP: $A\hat{O}B = 2\hat{P}$

Construction: Draw PO produced ✓ construction

Proof:

$\hat{O}_1 = \hat{P}_1 + \hat{A}$ [ext. ∠ of Δ] ✓ S/R

But $\hat{P}_1 = \hat{A}$ [∠s opp. = sides] ✓ S/R

$\therefore \hat{O}_1 = 2\hat{P}_1$

Similarly: $\hat{O}_2 = 2\hat{P}_2$ ✓ S

$\therefore \hat{O}_1 + \hat{O}_2 = 2\hat{P}_1 + 2\hat{P}_2$ ✓ S

$= 2\left(\hat{P}_1 + \hat{P}_2\right)$

i.e. $A\hat{O}B = 2A\hat{P}B$

If there is no construction: $\frac{0}{5}$

(5)

OR

Construction: Draw PO ✓ construction

Proof:

$\hat{A} = \hat{P}_1$ [∠s opp. equal sides] ✓ S/R

$\therefore P\hat{O}A = 180° - 2\hat{P}_1$ [sum of ∠s of Δ APO] ✓ S/R

$\hat{B} = \hat{P}_2$ [∠s opp. equal sides]

$\therefore P\hat{O}B = 180° - 2\hat{P}_2$ [sum of ∠s of Δ BPO]

$A\hat{O}B = 360° - \left(P\hat{O}A + P\hat{O}B\right)$ [∠s around a point] ✓ S

$= 360° - \left(180° - 2\hat{P}_1 + 180° - 2\hat{P}_2\right)$

$= 2\hat{P}_1 + 2\hat{P}_2$ ✓ S

$= 2\left(\hat{P}_1 + \hat{P}_2\right)$

$= 2A\hat{P}B$

If there is no construction: $\frac{0}{5}$

(5)

GRADE 11
Marking Guideline

9.2.1	$\hat{R}_1 = \hat{S}_1 = 42°$	[∠s opp. = sides]	✓S✓ R (2)
9.2.2 (a)	$P\hat{Q}R = 96°$	[opp. ∠s of a cyclic quad]	✓S ✓R (2)
9.2.2 (b)	$S\hat{M}R = 96°$ $\therefore P_1 = 48°$	[sum of angles of Δ] [∠ at centre = 2×∠ at circumference]	✓ S/R ✓ S ✓R (3)
9.2.3	$\hat{R}_3 = \hat{P}_1 = 48°$ $\therefore SP \parallel QR$ **OR** $S\hat{R}Q = 96°$ $P\hat{S}R + S\hat{R}Q = 84° + 96°$ $= 180°$ $\therefore SP \parallel QR$	[equal chords; equal ∠s] [alt ∠s=] [opp. ∠s of a cyclic quad supplementary] [co-int ∠s supplementary]	✓ S ✓R ✓ R (3) ✓ S ✓R ✓ R (3)
			[15]

QESTION 10

10.1	$O\hat{T}V = 90°$ $O\hat{Z}V = 90°$ $O\hat{T}V + O\hat{Z}V = 180°$ $\therefore$ TOZV is a cyclic quadrilateral **OR** TV = ZV $\therefore T\hat{Z}V = \hat{T}_3 = x$ $O\hat{Z}V = 90°$ $\therefore \hat{Z}_3 = 90° - x$ but $\hat{P}_2 = 90°$ $\therefore \hat{O}_3 = x$ $\therefore \hat{O}_3 = \hat{T}_3$ $\therefore$ TOZV is a cyclic quadrilateral	[tan ⊥ radius] [tan ⊥ radius] [converse opp. ∠s of a cyclic quad. suppl.] [two tans from same point] [∠s opp. = sides] [tan ⊥ radius] [line from centre to midpoint] [sum of angles of Δ] [converse ∠s in the same segment]	✓ S ✓ R ✓ S/R ✓ R (4) ✓ S/R ✓ S/R ✓ S/R ✓ R (4)
10.2	$R\hat{Z}T = 90°$ $\hat{P}_1 = 90°$ $\therefore RZ \parallel SY$ **OR** $R\hat{Z}T = 90°$ $\hat{P}_2 = 90°$ $\therefore RZ \parallel SY$	[∠ in semi-circle] [line from centre to midpoint of chord] [corresponding ∠s =] [angle in semi-circle] [line from centre to midpoint of chord] [co-interior ∠s supplementary]	✓ S ✓ R ✓ S ✓ R ✓ R (5) ✓ S ✓ R ✓ S ✓R ✓ R (5)

GRADE 11
Marking Guideline

10.3	$\hat{R}_2 = x$	[tan chord theorem]	✓ S ✓ R
	$\hat{O}_1 = \hat{R}_2 = x$	[alt ∠s = ; RZ // SY]	✓ S/R
	But $\hat{T}_1 = \frac{1}{2}\hat{O}_1$	[∠ at centre = 2×∠ at circumference]	✓ S/R
	$\therefore \hat{T}_1 = \frac{1}{2}x$		(4)
	OR		
	$\hat{R}_2 = x$		✓ S ✓ R
	$\hat{O}_1 = \hat{R}_2 = x$	[tan chord theorem]	✓ S/R
	and $\hat{T}_1 = \hat{S}_1$	[alt ∠s = ; RZ // SY]	
	but $\hat{T}_1 + \hat{S}_1 = \hat{O}_1$	[∠s opp. = sides]	✓ S/R
	$\therefore \hat{T}_1 + \hat{T}_1 = x$	[ext. ∠ of Δ]	
	$\therefore 2\hat{T}_1 = x$		
	$\therefore \hat{T}_1 = \frac{1}{2}x$		(4)
10.4	$\hat{S}_1 = \hat{T}_1 = \frac{1}{2}x$	[∠s opp. = sides]	✓ S/R
	$\hat{Z}_2 = \hat{S}_1 = \frac{1}{2}x$	[∠s in the same segment]	✓ S ✓ R
	$\hat{Y}_2 = \hat{P}_3 + \hat{Z}_2$	[ext. ∠ of Δ]	✓ S/R
	$= 90° + \frac{1}{2}x$		✓ S
	$= 90° + \hat{T}_1$		(5)
	OR		**OR**
	$\hat{T}_1 = \frac{1}{2}x$	[proved in 10.3]	
	$\hat{T}_2 = 90° - x$	[tan ⊥ radius]	✓ S/R
	but $\hat{Y}_1 = \hat{T}_1 + \hat{T}_2$	[∠s in the same segment]	✓ S ✓ R
	$\therefore \hat{Y}_1 = \frac{1}{2}x + 90° - x$		
	$= 90 - \frac{1}{2}x$		✓ S/R
	$\hat{Y}_2 = 180° - \hat{Y}_1$	[∠s on a straight line]	
	$= 180° - \left(90 - \frac{1}{2}x\right)$		✓ S
	$= 90° + \frac{1}{2}x$		(5)
	$= 90 + \hat{T}_1$		

GRADE 11
Marking Guideline

	OR		**OR**
	$T\hat{S}R = 90°$	[∠ in a semi-circle]	✓ S ✓R
	$\therefore \hat{R}_1 = 180° - 90° - \frac{1}{2}x$	[sum of ∠s of a Δ]	✓ S/R
	$\therefore \hat{R}_1 = 90° - \frac{1}{2}x$		
	$\hat{Y}_2 = \hat{R}_1 + \hat{R}_2$	[ext. ∠of a cyclic quad]	✓ S/R
	$= 90° - \frac{1}{2}x + x$		
	$= 90° + \frac{1}{2}x$		✓ S
	$= 90° + \hat{T}_1$		(5)
			[15]

QUESTION 11

11.1	$OA = OB = k + m$	[radii]	✓ S/R
	In ΔAOE: $AE^2 = OA^2 - OE^2$	[Pythagoras]	✓ S/R
	$= (k+m)^2 - k^2$		
	$= k^2 + 2km + m^2 - k^2$		
	$= 2km + m^2$		✓ S
	In ΔAEB: $AB^2 = AE^2 + EB^2$	[Pythagoras]	
	$= 2km + m^2 + m^2$		✓ S
	$= 2km + 2m^2$		(4)
	OR		
	In ΔAEB: $AB^2 = EB^2 + AE^2$	[Pythagoras]	✓ S/R
	In ΔOEA: $AE^2 = OA^2 - OE^2$	[Pythagoras]	
	$\therefore AB^2 = EB^2 + OA^2 - OE^2$		
	and $OA = OB$	[radii]	✓ S/R
	$\therefore AB^2 = EB^2 + OB^2 - OE^2$		
	$= EB^2 + OB^2 - (OB - EB)^2$		✓ S
	$= EB^2 + OB^2 - OB^2 + 2OB.EB - EB^2$		
	$= 2OB.EB$		✓ S
	$= 2(k+m).m$		
	$= 2km + 2m^2$		(4)
11.2	$DE = AE$	[line from centre ⊥ chord]	✓ R
	$= \sqrt{2km + 2m^2}$		✓ S
			(2)
			[6]

TOTAL: 150 MARKS