KWAZULU-NATAL PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 11

MATHEMATICS P2

NOVEMBER 2025

MARKING GUIDELINES

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MARKS: 150

These marking guidelines consist of 18 pages.

NOTE:

- 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

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]

QUESTION 2

2.1 $5 < t \leq 10$

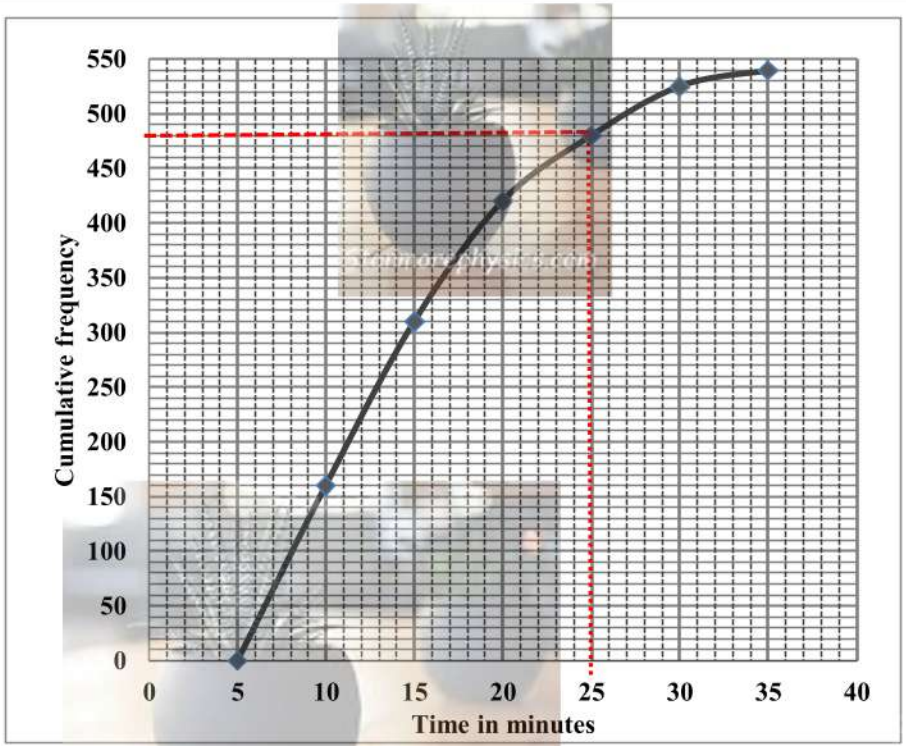
A✓ answer (1)

2.2

Time (in minutes)	Number of learners	Cumulative frequency
$5 < t \leq 10$	160	160
$10 < t \leq 15$	150	310
$15 < t \leq 20$	110	420
$20 < t \leq 25$	60	480
$25 < t \leq 30$	45	525
$30 < t \leq 35$	15	540

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

$$\% \text{ of learners} = \frac{60}{540} \times 100\%$$
$$= 11{,}11\%$$

A✓ 60

CA✓ answer (2)

2.5

$$\bar{x} = \frac{(7{,}5 \times 160) + (12{,}5 \times 150) + (17{,}5 \times 110) + (22{,}5 \times 60) + (27{,}5 \times 45) + (32{,}5 \times 15)}{540}$$
$$= \frac{8075}{540}$$
$$= 14{,}95 \text{ minutes}$$

ANSWER ONLY: Full marks. All ACCURACY marks
Answer must EXACTLY be 14,95 minutes.

A✓ frequency × midpoints

A✓ 8075

CA✓ answer (3)

[10]

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	$m_{BE} = m_{AD} \quad (BE \,//\, AD)$ $= \frac{12-(-2)}{-4-8}$ $= -\frac{14}{12}\ or\ -\frac{7}{6}$ **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)

	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)

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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)

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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 $B\hat{O}E$
	$m_{BE} = \frac{1}{2}$	

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	$\therefore$ *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	CA✓ Area ΔEOC
	OR	**OR**
	Area $\Delta\text{EOC}=\frac{1}{2}\times\left(\frac{25}{2}\right)\times\left(\frac{25}{8}\right)$ $=19,53$ square units	CA✓ Area ΔEOC
	$\therefore$ Area OBEC $=31,26+19,53$ $=51$ square units	CA✓ answer (8)
		[12]

Accept either of the two for the area of ΔEOC

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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)

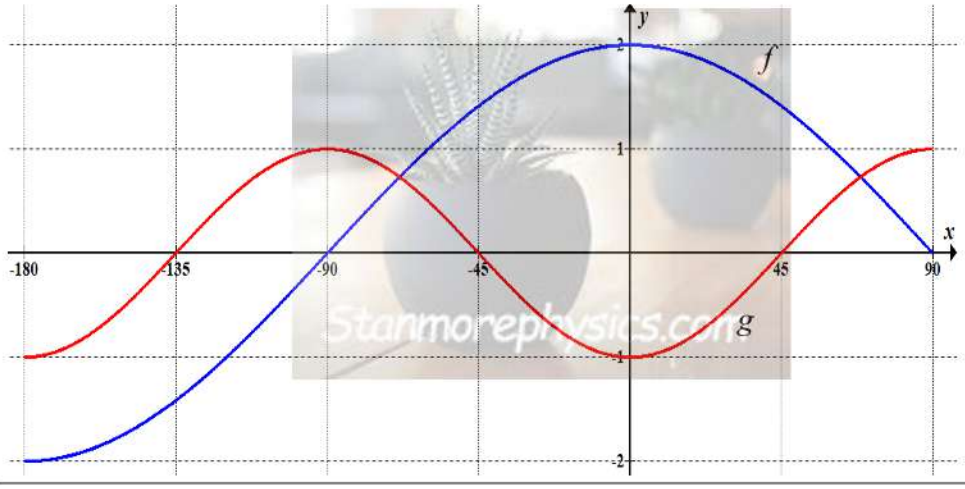
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5.3	$\frac{\tan 205°.\cos 315°.\sin(-45°)}{\sin 210°.\cos 150°.\tan 25°} = \frac{(\tan 25°)(\cos 45°)(-\sin 45°)}{(-\sin 30°)(-\cos 30°)(\tan 25°)}$ $= \frac{\left(\frac{\sqrt{2}}{2}\right)\left(-\frac{\sqrt{2}}{2}\right)}{\left(-\frac{1}{2}\right)\left(-\frac{\sqrt{3}}{2}\right)}$ $= -\frac{\frac{1}{2}}{\frac{\sqrt{3}}{4}}$ $= -\frac{2}{\sqrt{3}}$	A✓ reductions in numerator A✓ reductions in denominator CA✓ substitution of special $\angle$ values for $45°$ CA✓ substitution of special $\angle$ 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)

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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)

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]

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QUESTION 7

7.1	$R\hat{P}S=(\theta-\alpha)$	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]

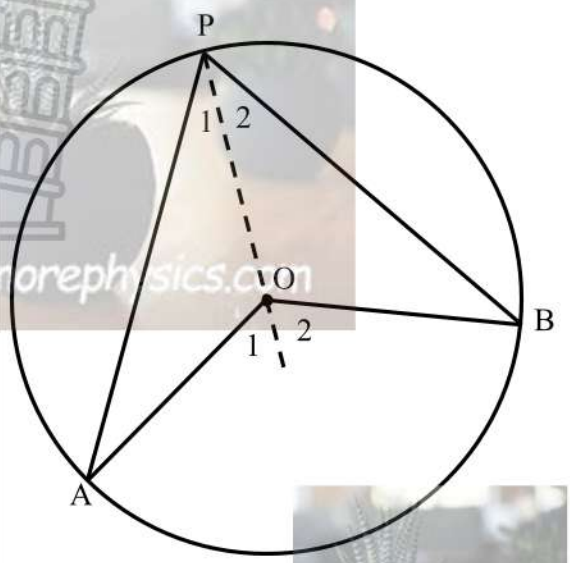
QUESTION 8

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]

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QUESTION 9

9.1



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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 ΔAPO] ✓ 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 ΔBPO]

$A\hat{O}B = 360° - \left(P\hat{O}A + P\hat{O}B\right)$ [∠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)

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	$\hat{R}_3 = \hat{P}_1 = 48°$ $\therefore SP \,//\, QR$ **OR** $S\hat{R}Q = 96°$ $P\hat{S}R + S\hat{R}Q = 84° + 96°$ $= 180°$ $\therefore SP \,//\, QR$	[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]

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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	$R\hat{Z}T = 90°$ $\hat{P}_1 = 90°$ $\therefore RZ \,//\, SY$ **OR** $R\hat{Z}T = 90°$ $\hat{P}_2 = 90°$ $\therefore RZ \,//\, SY$	[∠ 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)

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)
	$= 90 + \hat{T}_1$		

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	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

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