FINAL

KWAZULU-NATAL PROVINCE

EDUCATION

REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 11

MATHEMATICS P2

NOVEMBER 2024

MARKING GUIDELINES

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MARKS: **150**

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GRADE 11
Marking Guidelines

GEOMETRY • *MEETKUNDE*	
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

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QUESTION 1

1.1.1	$\bar{x} = \frac{1968}{12}$ $= 164$	✓ $\frac{1968}{12}$ ✓ answer (2)
1.1.2	$\sigma = 65{,}18$	✓ $\sigma = 65{,}18$ (1)
1.1.3	$\bar{x} = 164$ Interval: $(164 - 65{,}18 \; ; \; 164 + 65{,}18)$ $(98{,}82 \; ; \; 229{,}18)$ $\therefore$ 8 days lie within one standard deviation $\therefore$ Percentage of days $= \frac{8}{12} \times 100$ $= 66{,}67\%$	✓ (98,82 ; 229,18) ✓ 8 days ✓ answer (3)
1.2.1	Range $= 220 - 26$ $= 194$	✓ answer (1)
1.2.2	Data is skewed to the right **OR** Data is positively skewed	✓ skewed to the right **OR** ✓ positively skewed (1)
1.2.3	(a) The mean will increase	✓ increase (1)
1.2.3	(b) The median will not change.	✓ not change (1)
1.2.4	$Q_1 = 64$ But there is 25% of the days on the left of Q_1 $\therefore \frac{25}{100} \times 30 = 7{,}5$ $\therefore$ for 7 days there were less than 64 visits a day.	✓25% ✓ 7 days (2)
		[12]

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QUESTION 2

2.1

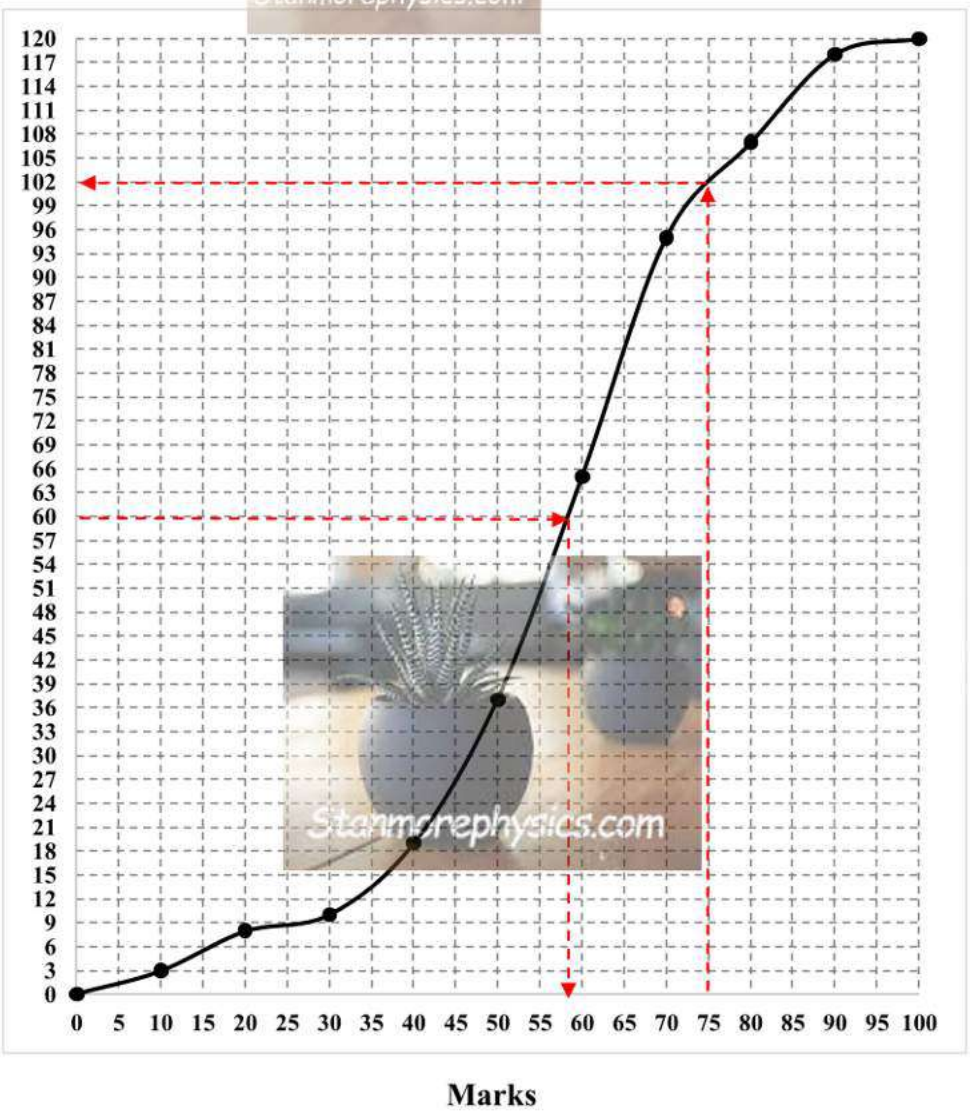
Marks	*f*	C*F*
$0 \le x < 10$	3	3
$10 \le x < 20$	5	8
$20 \le x < 30$	2	10
$30 \le x < 40$	9	19
$40 \le x < 50$	18	37
$50 \le x < 60$	28	65
$60 \le x < 70$	30	95
$70 \le x < 80$	12	107
$80 \le x < 90$	11	118
$90 \le x < 100$	2	120

✓reading from the histogram (*f*) (all values)

✓✓cumulative frequency
1 mark if 3 – 5 are correct
2 marks if all values are correct

(3)

2.2



✓plotting cumulative frequency at upper limit

✓ shape

✓ grounding at (0 ; 0)

(3)

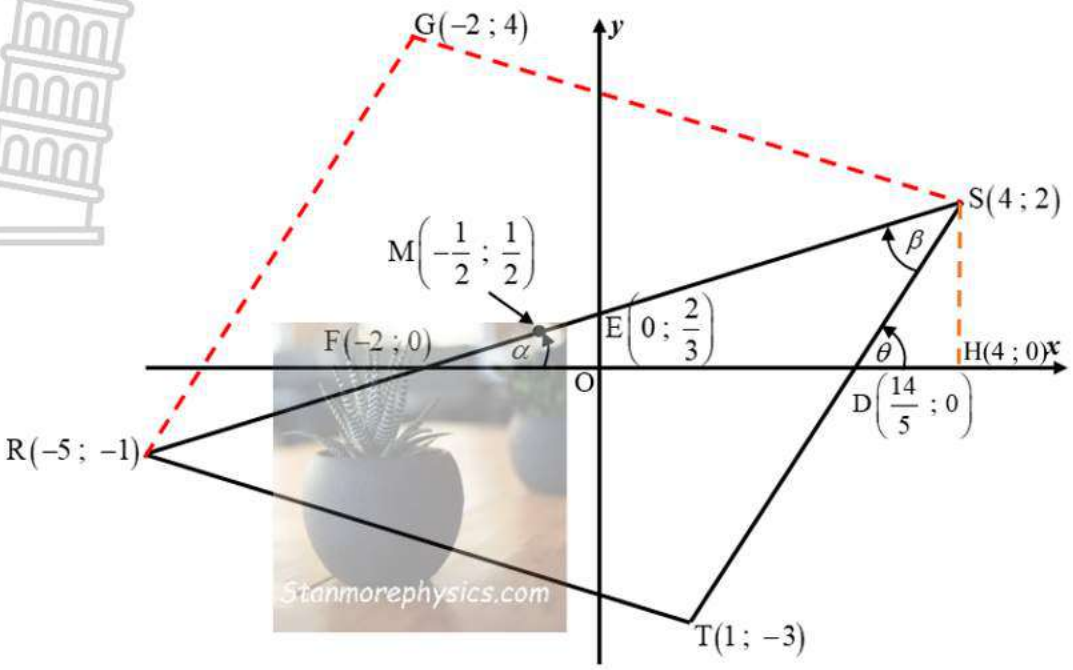
2.3.1	$120-102=18$ $\therefore 18$ learners	✓ 102 (accept reading from 101 to 103) ✓18 learners (accept 17 to 19 learners) (2)
2.3.2	Median position: $\frac{1}{2}\times 120=60$ $\therefore Q_2=58$	✓ 58 (accept 57 to 59) (1)
		[9]



QUESTION 3

3.1.1	$P(-1\,;1)\quad Q(2\,;5)\quad R(5\,;y)$ $m_{PQ}=\frac{5-1}{2-(-1)}$ $=\frac{4}{3}$ $m_{PQ}=m_{QR}$ $\frac{4}{3}=\frac{y-5}{5-2}$ $3y-15=12$ $y=9$	✓ m_{PQ} ✓ condition ✓ substitution ✓ answer (4)
3.1.2	$m_{PQ}\times m_{QR}=-1$ $\frac{4}{3}\times\frac{y-5}{3}=-1$ $4y-20=-9$ $4y=11$ $y=\frac{11}{4}$ **OR** $m_{PQ}=\frac{-1}{m_{QR}}$ $\frac{y-5}{3}=-\frac{3}{4}$ $4y-20=-9$ $4y=11$ $y=\frac{11}{4}$	✓ condition ✓ substitution ✓ answer (3)

3.2



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3.2.1	$RT = \sqrt{(-5-1)^2 + (-1+3)^2}$ $= \sqrt{40}$ $= 2\sqrt{10}$ or 6,32 units	✓ substitution of R and T into correct formula ✓ answer (2)
3.2.2	$m_{ST} = \frac{2-(-3)}{4-1}$ $= \frac{5}{3}$	✓ substitution of S and T into correct formula ✓ answer (2)
3.2.3	$M\left(\frac{4-5}{2} ; \frac{2-1}{2}\right)$ $M\left(-\frac{1}{2} ; \frac{1}{2}\right)$	✓ x-value ✓ y-value (2)
3.2.4	$m = \frac{5}{3}$ point: $M\left(-\frac{1}{2} ; \frac{1}{2}\right)$ $y - y_1 = m(x - x_1)$ $y - \frac{1}{2} = \frac{5}{3}\left(x + \frac{1}{2}\right)$ $y - \frac{1}{2} = \frac{5}{3}x + \frac{5}{6}$ $y = \frac{5}{3}x + \frac{4}{3}$ **OR** $y = mx + c$ $\frac{1}{2} = \frac{5}{3}\left(-\frac{1}{2}\right) + c$ $c = \frac{4}{3}$ $y = \frac{5}{3}x + \frac{4}{3}$	✓ $m = \frac{5}{3}$ ✓ subst $M\left(-\frac{1}{2} ; \frac{1}{2}\right)$ into equation of line ✓ answer (3)

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3.2.5	By using transformation: $T \rightarrow S: (1\ ;\ -3) \rightarrow (4\ ;\ 2)$ $(x\ ;y) \rightarrow (x+3\ ;y+5)$ $\therefore R \rightarrow G:\ G(-5+3\ ;\ -1+5)$ $\therefore G(-2\ ;\ 4)$	✓x value ✓y value (2)
	OR $T \rightarrow R:\ (1\ ;\ -3) \rightarrow (-5\ ;\ -1)$ $(x\ ;y) \rightarrow (x-6\ ;y+2)$ $\therefore S \rightarrow G:\ G(4-6\ ;\ 2+2)$ $\therefore G(-2\ ;\ 4)$	✓x value ✓y value (2)
	OR Midpoint RS: $M\left(-\frac{1}{2}\ ;\ \frac{1}{2}\right)$ $x_M = \frac{x_G + x_T}{2}$ and $y_M = \frac{y_G + y_T}{2}$ $-\frac{1}{2} = \frac{x_G + 1}{2}$ and $\frac{1}{2} = \frac{y_G - 3}{2}$ $2x_G + 2 = -2$ and $2y_G - 6 = 2$ $x_G = -2$ and $y_G = 4$ $\therefore G(-2\ ;\ 4)$ **Answer only: Full marks**	✓x value ✓y value (2)
3.2.6	$m_{ST} = \frac{5}{3}$ $\tan\theta = \frac{5}{3}$ $\theta = 59,04°$	✓ $\tan\theta = m_{ST}$ ✓ size of θ
	$m_{RS} = \frac{1}{3}$ $\tan\alpha = \frac{1}{3}$ $\alpha = 18,43°$	✓ $m_{RS} = \frac{1}{3}$ ✓ size of α
	$\beta = \theta - \alpha$ $\beta = 59,04° - 18,43°$ $\beta = 40,61°$	✓ answer (5)

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3.2.7	$RS_{equation}: y-2=\frac{1}{3}(x-4)$ $y=\frac{1}{3}x+\frac{2}{3}$	
	$\therefore E\left(0;\frac{2}{3}\right)$	✓ coordinates of E
	$ST_{equation}: y-2=\frac{5}{3}(x-4)$ $y=\frac{5}{3}x-\frac{14}{3}$	✓ equation of ST
	$\therefore D\left(\frac{14}{5};0\right)$	✓ coordinates of D
	Area SEOD = Area ΔFSD − Area ΔFEO $=\frac{1}{2}(FD\times SH)-\frac{1}{2}(FO\times EO)$ $=\frac{1}{2}\left(\frac{24}{5}\times 2\right)-\frac{1}{2}\left(2\times\frac{2}{3}\right)$ $=\frac{24}{5}-\frac{2}{3}$ $=\frac{62}{15}$ or $4\frac{2}{15}$ or 4,13 square units	✓ substitution into area ΔFSD ✓ substitution into area ΔFEO ✓ answer (6)
	OR	
	$RS_{equation}: y=\frac{1}{3}x+\frac{2}{3}$	
	$\therefore E\left(0;\frac{2}{3}\right)$	✓ coordinates of E
	$ST_{equation}: y=\frac{5}{3}x-\frac{14}{3}$	✓ equation of ST
	$\therefore D\left(\frac{14}{5};0\right)$	✓ coordinates of D
	Area SEOD = Area SEOH − Area ΔSDH $=\frac{1}{2}(EO+SH)\times OH-\left(\frac{1}{2}\times DH\times SH\right)$ $=\frac{1}{2}\left(\frac{2}{3}+2\right)\times 4-\left(\frac{1}{2}\times\frac{6}{5}\times 2\right)$ $=\frac{16}{3}-\frac{6}{5}$ $=\frac{62}{15}$ or $4\frac{2}{15}$ or 4,13 square units	✓ substitution into area SEOH ✓ substitution into area ΔSDH ✓ answer (6)

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OR

$RS_{equation}: y = \frac{1}{3}x + \frac{2}{3}$

$\therefore E\left(0\ ;\ \frac{2}{3}\right)$ ✓ coordinates of E

$ST_{equation}: y - 2 = \frac{5}{3}(x - 4)$

$y = \frac{5}{3}x - \frac{14}{3}$ ✓ equation of ST

$\therefore D\left(\frac{14}{5}\ ;\ 0\right)$ ✓ coordinates of D

Area SEOD = Area ΔSFH $-$ (Area ΔEFO + Area ΔSDH)

$= \frac{1}{2}(FH \times SH) - \left(\frac{1}{2} \times FO \times EO + \frac{1}{2} \times DH \times SH\right)$

$= \frac{1}{2}(6 \times 2) - \left(\frac{1}{2} \times 2 \times \frac{2}{3} + \frac{1}{2} \times \frac{6}{5} \times 2\right)$ ✓ subst into area of ΔSFH
✓ subst into area of ΔEFO & ΔSDH

$= 6 - \frac{23}{15}$

$= \frac{62}{15}$ or $4\frac{2}{15}$ or 4,13 square units ✓ answer

(6)

OR

$RS_{equation}: y - 2 = \frac{1}{3}(x - 4)$

$y = \frac{1}{3}x + \frac{2}{3}$

$\therefore E\left(0\ ;\ \frac{2}{3}\right)$ ✓ coordinates of E

$ST_{equation}: y - 2 = \frac{5}{3}(x - 4)$

$y = \frac{5}{3}x - \frac{14}{3}$ ✓ equation of ST

$\therefore D\left(\frac{14}{5}\ ;\ 0\right)$ ✓ coordinates of D

Area SEOD = Area SKOD $-$ Area ΔSKE

$= \frac{1}{2}(SK + OD) \times KO - \frac{1}{2}(KE \times KS)$

$= \frac{1}{2}\left(4 + \frac{14}{5}\right) \times 2 - \frac{1}{2}\left(2 - \frac{2}{3}\right) \times 4$ ✓ subst into area SKOD
✓ subst into area ΔSKE

$= \frac{34}{5} - \frac{8}{3}$

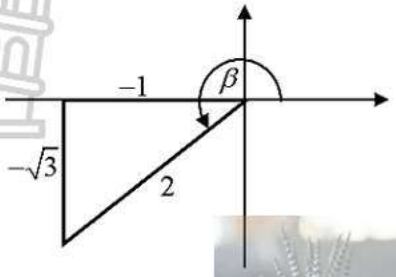
$= \frac{62}{15}$ or $4\frac{2}{15}$ or 4,13 square units ✓ answer

(6)

[29]

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QUESTION 4

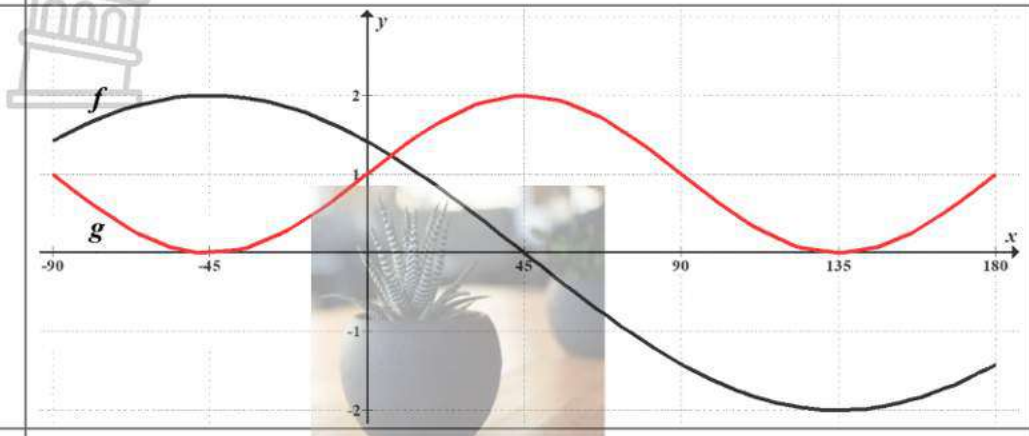
4.1.1	$2\cos\beta+1=0$ $\cos\beta=-\frac{1}{2}$  $y^2=r^2-x^2$ $y^2=(2)^2-(-1)^2$ $y^2=3$ $y=\pm\sqrt{3}$ $y=-\sqrt{3}$ $\sin\beta=\frac{-\sqrt{3}}{2}$	✓ diagram in quadrant 3 ✓ substitution of x and r ✓ value of y ✓ answer (4)
4.1.2	$2\tan^2\beta-\cos^2\beta=2\left(\frac{-\sqrt{3}}{-1}\right)^2-\left(\frac{-1}{2}\right)^2$ $=5\frac{3}{4}$ or $\frac{23}{4}$	✓ substitution ✓ answer (2)
4.2	$\frac{\cos(\theta-90°).\cos(-\theta).\tan(360°-\theta)}{\sin(180°+\theta)}$ $=\frac{\sin\theta.\cos\theta.-\tan\theta}{-\sin\theta}$ $=\cos\theta.\frac{\sin\theta}{\cos\theta}$ $=\sin\theta$	✓ $\sin\theta$ ✓ $\cos\theta$ ✓ $-\tan\theta$ ✓ $-\sin\theta$ ✓ quotient identity ✓answer (6)
4.3	$\frac{2\sin 510°-\cos 340°.\cos 20°}{\cos^2 110°}=\frac{2\sin 30°-\cos 20°.\cos 20°}{(-\cos 70°)^2}$ $=\frac{2\left(\frac{1}{2}\right)-\cos^2 20°}{\cos^2 70°}$ $=\frac{1-\cos^2 20°}{\sin^2 20°}$ $=\frac{\sin^2 20°}{\sin^2 20°}$ $=1$	✓ $\sin 30°$ ✓ $\cos 20°$ ✓ $\frac{1}{2}$ ✓ $\sin^2 20°$ ✓ square identity ✓ answer (6)

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4.4.1	$\text{LHS} = \dfrac{\sin x}{1+\cos x} + \dfrac{\cos x}{\sin x}$ $= \dfrac{\sin^2 x + \cos x + \cos^2 x}{(1+\cos x)(\sin x)}$ $= \dfrac{\sin^2 x + \cos^2 x + \cos x}{(1+\cos x)(\sin x)}$ $= \dfrac{\cancel{1+\cos x}}{\cancel{(1+\cos x)}(\sin x)}$ $= \dfrac{1}{\sin x}$ $= \text{RHS}$	✓ numerator ✓ LCD $= (1+\cos x)(\sin x)$ ✓ identity ✓ simplification (4)
4.4.2	(i): $1+\cos x = 0$ $\cos x = -1$ $x = 180° + k.360° ; k \in Z$ (ii): $\sin x = 0$ $x = 0° + k.360°$ or $x = 180° + k.360° ; k \in Z$ OR $x = 0° + k.180° ; k \in Z$	✓ $\cos x = -1$ ✓ $180°$ ✓ $\sin x = 0$ ✓ $0°$ ✓ $k.360°; k \in Z$ (5)
		[27]

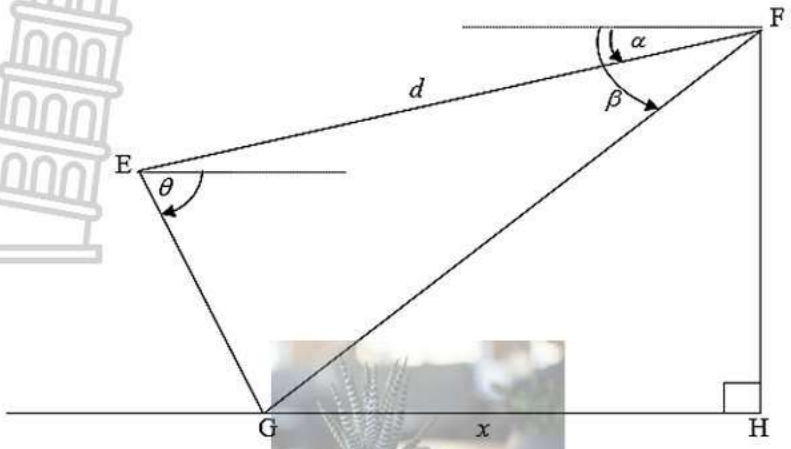
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QUESTION 5

5.1	Amplitude = 2	✓ answer (1)
5.2	$p = 45°$	✓ answer (1)
5.3	Period $= 180°$	✓ answer (1)
5.4		Graph of g: ✓ shape ✓ x and y intercepts ✓ turning points (3)
5.5.1	$45° < x < 180°; x \neq 135°$ **OR** $x \in (45° ; 135°) \cup (135° ; 180°)$	✓ endpoints ✓ notation ✓ rejection (3) ✓ endpoints ✓ notation ✓ exclude $135°$ (3)
5.5.2	$f(x) = -g(x) + 2$ $f(x) + g(x) = 2$ $x = -45°$ and $x = 45°$	✓ $f(x) + g(x) = 2$ ✓ $x = -45°$ ✓ $x = 45°$ (3)
5.6	$f(x) = 2\cos(x + 45°)$ $h(x) = 2\cos(x + 45° + 45°)$ $h(x) = 2\cos(90° + x)$ $h(x) = -2\sin x$	✓ adding $45°$ ✓ answer (2)
		[14]

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QUESTION 6

6.1	 In ΔEFG: $\theta+\alpha+\beta-\alpha+\hat{FGE}=180°$ .....∠s of Δ $\hat{FGE}=180°-(\theta+\beta)$	✓ S ✓ answer (2)
6.2	In ΔEFG: $\frac{FG}{\sin\hat{FEG}}=\frac{EF}{\sin\hat{EFG}}$ $\frac{AC}{\sin(\alpha+\theta)}=\frac{d}{\sin[180°-(\theta+\beta)]}$ $FG=\frac{d.\sin(\alpha+\theta)}{\sin(\theta+\beta)}$ In ΔFGH: $FH^2=FG^2-GH^2$ (Pythagoras) $=\left[\frac{d.\sin(\alpha+\theta)}{\sin(\theta+\beta)}\right]^2-x^2$ $FH=\sqrt{\left[\frac{d.\sin(\alpha+\theta)}{\sin(\theta+\beta)}\right]^2-x^2}$	✓ use of sine rule ✓ substitution into sine rule ✓ expression of FG ✓ substitution into Pythagoras ✓ simplification (5)
		[7]

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QUESTION 7

7.1	$V_{cylinder} = 4000\,m^3$ $V_{cylinder} = \pi r^2 h$ $\pi r^2 (15) = 4000$ $r^2 = \frac{4000}{15\pi}$ $r = \sqrt{\frac{4000}{15\pi}}$ or $9,21\ cm$ $H = \sqrt{(10)^2 - \left(\sqrt{\frac{4000}{15\pi}}\right)^2}$ $= \sqrt{100 - \frac{4000}{15\pi}}$ or $3,89\ cm$ $V_{cone} = \frac{1}{3} \times \pi \times \left(\sqrt{\frac{4000}{15\pi}}\right)^2 \times \sqrt{100 - \frac{4000}{15\pi}}$ $= 345,61\ cm^3$ or $345,54\ cm^3$ (if rounded off for r & H) $V_{container} = 4\,000\ cm^3 + 345,61\ cm^3$ $= 4\,345,61\ cm^3$ or $4\,345,54\ cm^3$ (if rounded off for r & H)	✓ substitution of 15 & 4 000 into $V_{cylinder}$ ✓ value of r ✓ using Theorem of Pythagoras to calculate H ✓ value of H ✓ substitution into V_{cone} ✓ V_{cone} ✓ answer (7)
7.2	$SA = \pi r^2 + 2\pi rh + \pi rs$ $= \pi\left(\sqrt{\frac{4000}{15\pi}}\right)^2 + 2\pi\left(\sqrt{\frac{4000}{15\pi}}\right)(15) + \pi\left(\sqrt{\frac{4000}{15\pi}}\right)(10)$ $= 1\,423,43\ cm^2$ or $1\,423,85\ cm^2$ (if rounded off for r)	substitution into: ✓ $SA_{cylinder}$ ✓ SA_{cone} ✓ answer (3)
		[10]

QUESTION 8

8.1	$M\hat{O}L = 100°$	[∠ @ centre = 2×∠ @ circumf]	✓S ✓R (2)
8.2	MO = LO $\hat{M}_2 = \hat{L}_1$ $\hat{L}_1 = \frac{180° - 100°}{2}$ $= 40°$	[radii] [∠s opp = sides] [sum of ∠s of isosceles Δ MOL]	✓ S/R ✓ S/R (2)
8.3	KJ = JL $\hat{J}_1 = 90°$ $\hat{N} = 40°$	[given] [line from centre to midpoint of chord] [sum of angles in a Δ]	✓ S ✓R ✓ S/R (3)
			[7]

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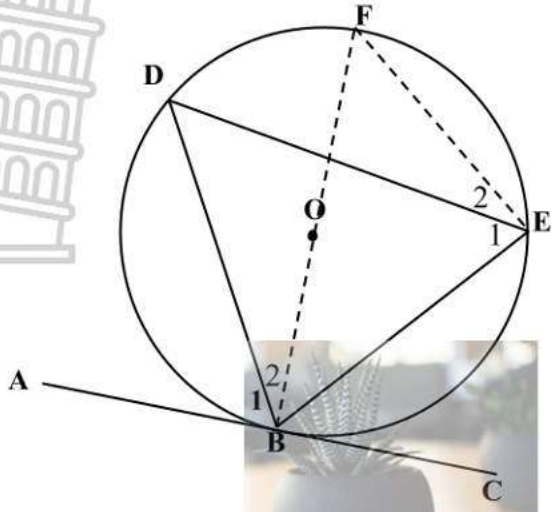
QUESTION 9

9.1.1	$\hat{R}_1 = \hat{S}_1 = x$ $\therefore \hat{O}_1 = 180° - 2x$ but $\hat{P} = \frac{1}{2}\hat{O}_1$ $\therefore \hat{P} = 90° - x$	[∠s opp = sides] [sum of ∠s in a Δ] [∠ @ centre = 2×∠ @ circumference]	✓S/R ✓S/R ✓R ✓ answer (4)
9.1.2	PS = SR $\therefore \hat{R}_1 + \hat{R}_2 = \hat{P} = 90° - x$ In ΔPSR: $\hat{S}_2 + \hat{P} + S\hat{R}P + \hat{S}_1 = 180°$ $\therefore \hat{S}_2 = 180° - (90° - x + 90° - x + x)$ $\therefore \hat{S}_2 = x$ $\therefore \hat{S}_2 = \hat{S}_1$ **OR** PS = SR $\hat{R}_1 + \hat{R}_2 = \hat{P} = 90° - x$ $\hat{R}_2 = 90° - 2x$ $\hat{O}_2 = 2x$ $O\hat{T}P = 90°$ $\hat{S}_2 = x$ $\therefore \hat{S}_2 = \hat{S}_1$	[given] [∠s opp = sides] [sum of ∠s in a Δ] [both = to x] [given] [∠s opp = sides] [adj ∠s on a str line] [ext ∠ of Δ] [sum of ∠s in a Δ] [both = to x]	✓S/R ✓S/R ✓S (3) ✓S/R ✓S/R ✓S (3)
9.2	BE = BD – ED BD = 2AO $\therefore$ BE = 2AO – ED In ΔBEC: $BE^2 = BC^2 - EC^2$ $\therefore (2AO - ED)^2 = BC^2 - EC^2$ but EC = AE $\therefore (2AO - ED)^2 = BC^2 - AE^2$	[diameter = 2×radius] [Pythagoras] [line from centre ⊥ to chord]	✓ expression for BE ✓ BD = 2AO ✓S/R using Theorem of Pythagoras ✓S ✓R (5)
			[12]

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QUESTION 10

10.1



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Construction: Draw diameter BF & join FE. ✓ construction

Proof

$\hat{B}_1 + \hat{B}_2 = 90°$ [rad $\perp$ tan] ✓S ✓R

$\hat{E}_1 + \hat{E}_2 = 90°$ [angle in semi-circle] ✓S/R

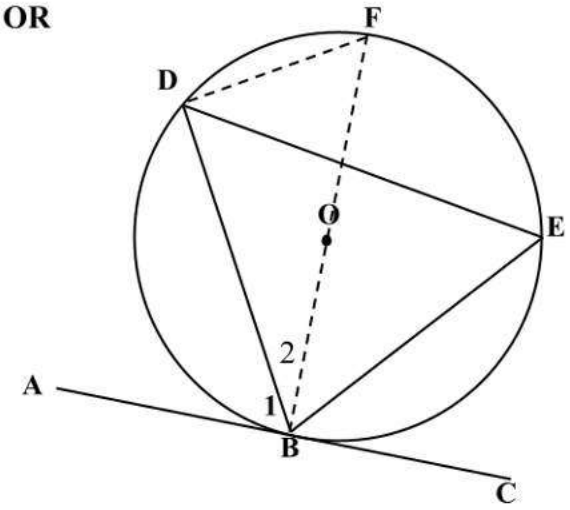
but $\hat{B}_2 = \hat{E}_2$ [angles in same segment] ✓S/R

$\therefore \hat{B}_1 = \hat{E}_1$ ✓S

$\Rightarrow \hat{B}_1 = D\hat{E}B$

(5)

OR



Construction: Draw diameter BF & join FD. ✓ construction

Proof:

$F\hat{D}B = 90°$ [angle in semi-circle] ✓S/R

$\therefore \hat{F} + \hat{B}_2 = 90°$ [sum of ∠s in a Δ]

but $\hat{B}_1 + \hat{B}_2 = 90°$ [rad $\perp$ tan] ✓S ✓R

$\therefore \hat{F} = \hat{B}_1$

but $\hat{F} = \hat{E}$ [angles in same segment] ✓S/R

$\Rightarrow \hat{B}_1 = D\hat{E}B$

(5)

10.2.1	$\hat{F}_3 = 90°$ $\therefore AC \perp DB$	[angle in the semi-circle]	✓S ✓R (2)
10.2.2	$\hat{B}_1 = \hat{C}_3$ $\hat{B}_1 = \hat{P}$ $\hat{C}_3 = \hat{P}$ AC DP	[tan chord theorem] [tan chord theorem] [corresp ∠s =]	✓S ✓R ✓S/R ✓R (4)
10.2.3	AD = AB $\hat{D}_1 = \hat{B}_1$ but $\hat{B}_1 = \hat{C}_3$ $\therefore \hat{D}_1 = \hat{C}_3$ $\therefore$ ABCD is a cyclic quad.	[tans from same point] [∠s opp = sides] [proved above] [both = to $\hat{B}_1$] [conv ∠s in same segment]	✓S/R ✓S/R ✓S ✓R (4)
10.2.4	$\hat{D}_3 = \hat{C}_2$ $\hat{C}_2 = \hat{B}_1$ $\hat{B}_1 = \hat{P}$ $\therefore \hat{D}_3 = \hat{P}$ $\therefore CP = CD$	[alt ∠s = ; AC DP] [∠s in same segment] [tan chord theorem] [sides opp = ∠s]	✓S/R ✓S/R ✓ S ✓ R (4)
10.2.5	$\hat{B}_2 + \hat{B}_3 = \hat{C}_2$ $\hat{C}_2 = \hat{B}_1$ $\hat{B}_1 = \hat{D}_1$ $\therefore \hat{D}_1 = \hat{B}_2 + \hat{B}_3$ $\therefore BR \parallel AD$ **OR** $\hat{D}_1 + \hat{D}_2 = 90°$ $\hat{R} = 90°$ $\therefore \hat{D}_1 + \hat{D}_2 + \hat{R} = 180°$ $\Rightarrow BR \parallel AD$	[ext ∠ of cyclic quad] [∠s in same segment] [proved in Q10.2.3] [alt ∠s =] [opp ∠s of cyclic quad] [angle in the semi-circle] [co-int ∠s supplementary]	✓S ✓R ✓ S ✓ R (4) ✓S ✓R ✓ S ✓ R (4)
			[23]

TOTAL: 150 MARKS

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