education

MPUMALANGA PROVINCE

REPUBLIC OF SOUTH AFRICA

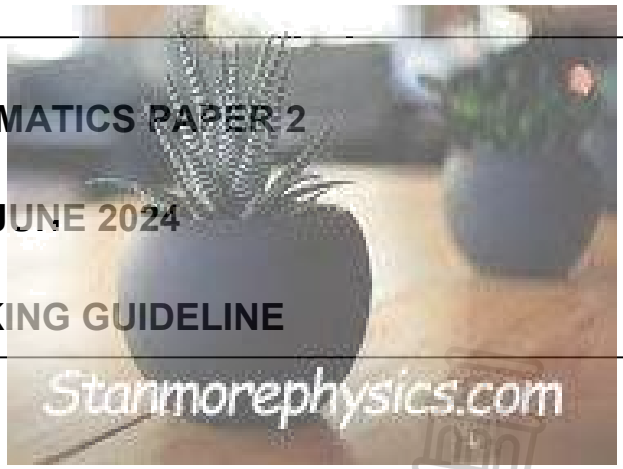
NATIONAL SENIOR CERTIFICATE

GRADE 12

MATHEMATICS PAPER 2

JUNE 2024

MARKING GUIDELINE



MARKS: 150

This marking guideline consist of 18 pages

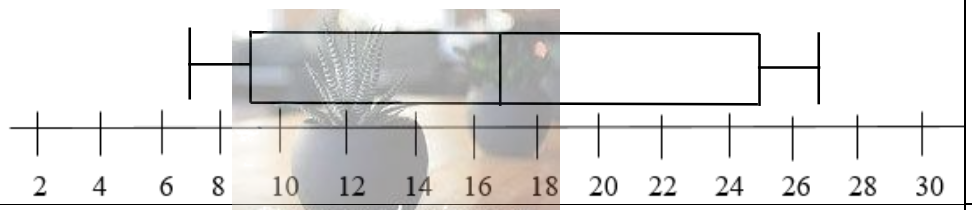
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NOTE:

- If a candidate answered a question TWICE, mark only the FIRST attempt.
- If a candidate crossed out an answer and did not redo it, mark the crossed-out answer.
- Consistent accuracy applies to ALL aspects of the marking guiselines.
- Assuming values/answers in order to solve a problem is unacceptable.

QUESTION 1

7	9	9	13	17	21	24	26	27

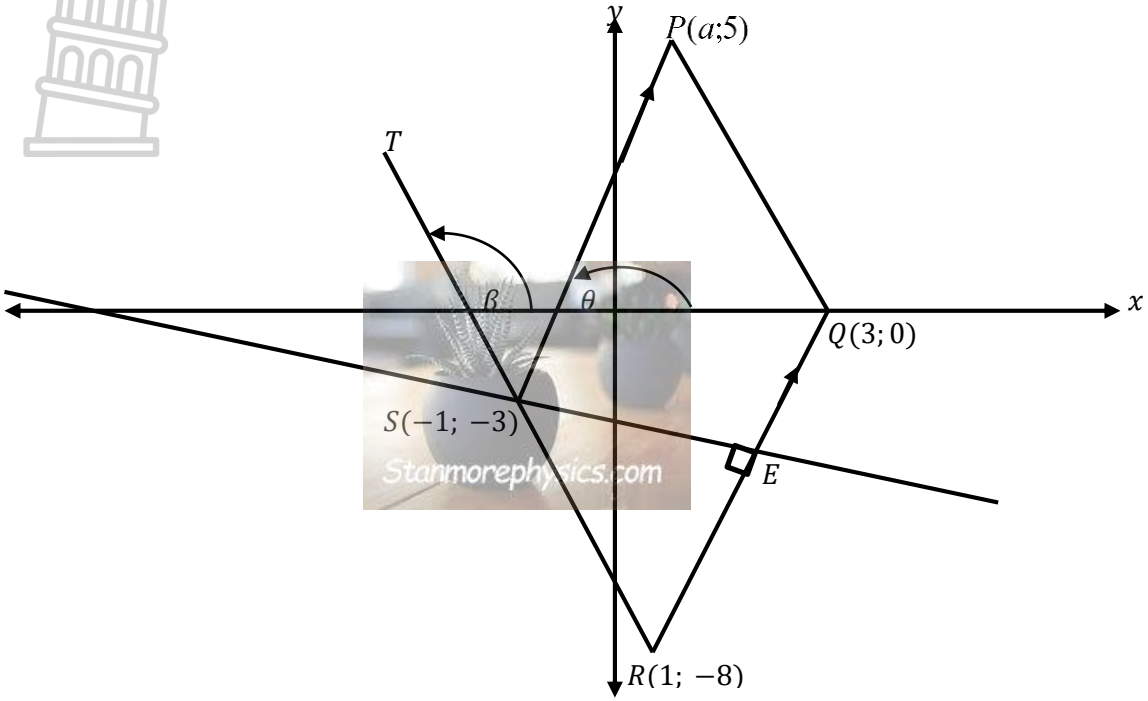
1.1	$Minimum = 7$ $Q_1 = 9$ $Q_2 = 17$ $Q_3 = 25$ $Maximum = 27$	✓ 7 ✓ 9 ✓ 17 ✓ 25 ✓ 27 (5)
1.2		✓ Whiskers ✓ Q_1, Q_3 ✓ Q_2 (3)
1.3	Equally distributed/ Centrally skewed	✓ Answer. (1)
1.4	$\bar{x} = 17$ $\sigma x = 7{,}38$ $\bar{x} - \sigma x = 17 - 7{,}38$ $= 9{,}62$ Only 8 learners	✓ $\bar{x} - \sigma x$ ✓ Answer (2)
1.5.1	$\sigma x = 7{,}38$	✓ Answer. (1)
1.5.2	$\bar{x} = 19$	✓ Answer. (1)
1.5.3	$Q_3 = 27$	✓ Answer. (1)
		[13]

QUESTION 2

2.1	60 parents	✓ Answer. (1)
2.2	$1000 < x < 1500$	✓ Answer. (1)
2.3	46	✓ ✓ Answer. (2)
2.4	$\text{IQR} = 1850 - 1000$ $= 850$ $\therefore \text{Semi} - \text{IQR} = \frac{850}{2}$ $= 425$	✓ IQR ✓ $\frac{850}{2}$ ✓ Answer. (3)
		[7]

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QUESTION 3

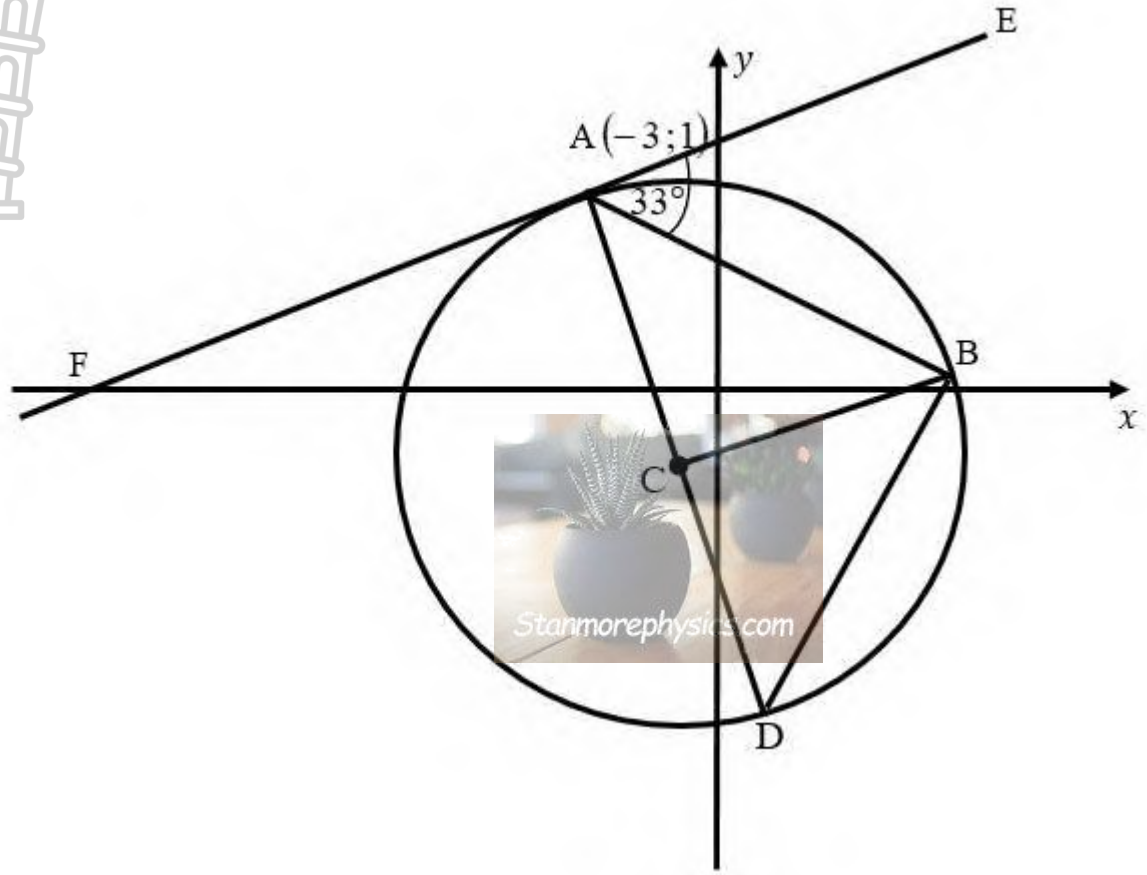


3.1	$QR = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ $QR = \sqrt{((3-1)^2 + (0+8)^2}$ $QR = \sqrt{68}$ $QR = 2\sqrt{17}$ $QR = 8{,}25$	✓ correct subst into the distance formula. ✓ $2\sqrt{17}$ (2)
3.2	$m_{QR} = \frac{0-(-8)}{3-1}$ $m_{QR} = \frac{8}{2}$ $m_{QR} = 4$	✓ Subst into the formula. ✓ Answer. (2)
3.3	$m_{SE} = -\frac{1}{4}$ $-3 = -\frac{1}{4}(-1) + c$ $c = -\frac{13}{4}$ $y = -\frac{1}{4}x - \frac{13}{4}$	✓ m_{SE} ✓ substitution $S(-1;-3)$ ✓ Answer. (3)

3.4	$M_{SE}\left(\frac{-1+1}{2};\frac{-3-8}{2}\right)$ $=M_{SE}\left(0;-\frac{11}{2}\right)$ $(x-a)^2+(y-b)^2=r^2$ $(x-0)^2+\left(y+\frac{11}{2}\right)^2=\left(\sqrt{17}\right)^2$ $x^2+\left(y+\frac{11}{2}\right)^2=17$	✓ *Midpoint* ✓ Substitution ✓ Answer. (3)
3.5	$m_{RQ}=m_{SP}=4$ $\frac{4}{1}=\frac{5+3}{a+1}$ $8=4a+4$ $4=4a$ $a=1$ OR $-3=4(-1)+c$ $c=1$ $y=4x+1$ $5=4a+1$ $a=1$	✓ Gradient ✓ Substitution ✓ Answer (3) OR ✓ Gradient ✓ Substitution ✓ Answer (3)
3.6.1	$m_{PS}=4$ $\tan\theta=4$ $\theta=75{,}96°$	✓ $\tan\theta=4$ ✓ $75{,}96°$ (2)
3.6.2	$m_{SR}=\frac{-8-(-3)}{1-(-1)}$ $=-\frac{5}{2}$ $\tan\beta=-\frac{5}{2}$ $=180°-68{,}20°$ $=111{,}80°$	✓ $-\frac{5}{2}$ ✓ $\tan\beta=-\frac{5}{2}$ ✓ $111{,}80°$

	$\hat{TSP} = 111{,}80° - 75{,}96°$ ext ∠ of a △ $= 35{,}84°$ $\hat{R} = 35{,}84°$ corresp..∠s (PS ∥ RQ)	✓ $35{,}84°$ ✓ $\hat{R} = 35{,}84°$ (5)
3.7	$d_{PQ} = \sqrt{29}$ $d_{sp} = 2\sqrt{17}$ Area of PSRQ = Area ΔSPQ + Area ΔQRS $= \frac{1}{2}\left(\sqrt{29}\right)\left(2\sqrt{17}\right)\sin 35{,}84$ $= 2(13)$ $= 26$	✓ Subst..into the correct formula ✓ $\sqrt{29}$ ✓ $\frac{\sqrt{29}}{2}$ *or* 2,69 (3)
		[23]

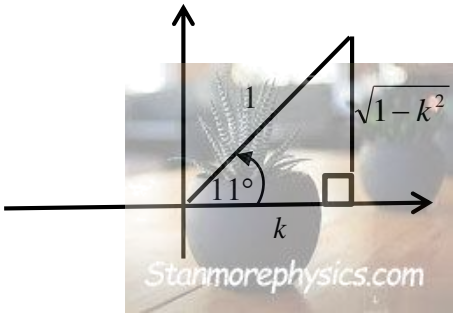
QUESTION 4



4.1	$C(-1;-1)$	✓ $x-value.$ ✓ $y-value.$ (2)
4.2	$m_{\tan gent}=\frac{1+1}{-3+1}=-1$ $1=1(-3)+c$ $c=4$ $y+x+4$	✓ Substitution ✓ $m_{\tan gent}$ ✓ Substitution $A(-3;1)$ ✓ Answer (4)
4.3	$D(1;-3)$ $-3=1(1)+c$ $c=-4$ $y=x-4$ $-4<k<4$	✓ Substitution $D(1;-3)$ ✓ Equation ✓ Notation ✓ Critical Values (4)
4.4	$\hat{D}=33°$ [Tan-Chord Theorem] $A\hat{C}B=66°$ [$\angle at\ centre=2\times\angle at\ circuferemnce$]	✓ S ✓ R ✓ S ✓ R (4)

4.5	$C(-3;-2)$ $\quad r=2$ $d_{CD}=\sqrt{(-1+3)^2+(-1+2)^2}$ $=\sqrt{5}$ $=2{,}24$ $r_{SM}=2+\sqrt{6}$ $=4{,}45$ $\therefore d_{CD}<r_{SM}$, the circles intersecttwice.	✓ Substitution ✓ d_{CD} ✓ r_{SM} ✓ Answer (4)
		[18]

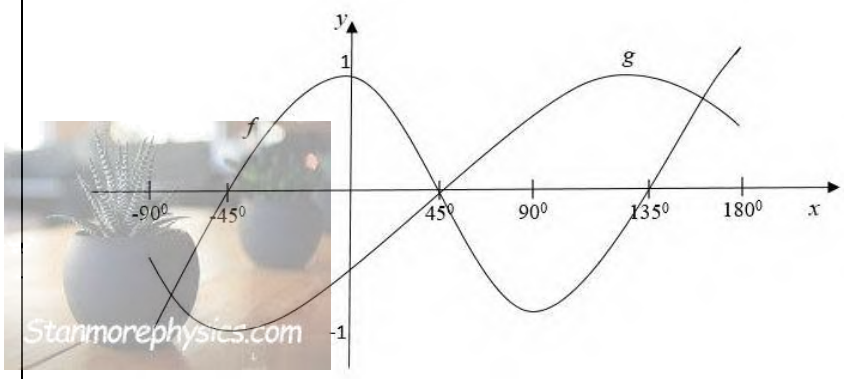
QUESTION 5

5.1.1	 $(k)^2+y^2=(1)^2$ $k^2+y^2=1$ $y=\pm\sqrt{1-k^2}$ $\therefore y=\sqrt{1-k^2}$ $\sin 11°=\sqrt{1-k^2}$	✓ $\sqrt{1-k^2}$ ✓ Answer (2)
5.1.2	$\sin 2(11°)=2\sin(11°)\cos(11°)$ $=2\left(\sqrt{1-k^2}\right)(k)$ $=2k\sqrt{1-k^2}$	✓ Expansion ✓ $2k\sqrt{1-k^2}$ (2)

5.1.3	$\cos 19° = \cos(30° - 11°)$ $= \cos 30° \cos 11° + \sin 30° \sin 11°$ $= \left(\frac{\sqrt{3}}{2}\right)\left(\frac{k}{1}\right) + \left(\frac{1}{2}\right)\left(\frac{\sqrt{1-k^2}}{1}\right)$ $= \frac{\sqrt{3}k}{2} + \frac{\sqrt{1-k^2}}{2}$ $= \frac{\sqrt{3}k + \sqrt{1-k^2}}{2}$	✓ $-\cos 60°$ ✓ $\tan 45°$ ✓ $\left(-\frac{1}{2}\right)$(1) ✓ -4 (4)
5.1.4	$\cos 11° = \cos 2(5{,}5°) = k$ $2\cos^2 5{,}5° - 1 = k$ $\frac{2\cos^2 5{,}5°}{2} = \frac{k+1}{2}$ $\sqrt{\cos^2 5{,}5°} = \sqrt{\frac{k+1}{2}}$ $\cos 5{,}5° = \sqrt{\frac{k+1}{2}}$	✓ $2\cos^2(5{,}5°) - 1$ ✓ Simplification ✓ Answer (3)
5.2	$\frac{\sin 25°(-\cos x)2\sin x\cos x}{\cos^2 x.\sin 25°}$ $= \frac{-2\cos^2 x \sin x}{\cos^2 x}$ $= -2\sin x$	✓ $-\cos x$ ✓ $2\sin x\cos x$ ✓ $\cos^2 x$ ✓ $\sin 25°$ ✓ Answer. (3)
5.3.1	$\frac{\sin x - \cos x}{\sin x + \cos x} - \frac{\sin x + \cos x}{\sin x - \cos x}$ $= \frac{(\sin x - \cos x)^2 - (\sin x + \cos)^2}{(\sin x + \cos x)(\sin x - \cos x)}$ $= \frac{\sin^2 x - 2\sin x\cos x + \cos^2 x - (\sin^2 x + 2\sin x\cos x + \cos^2 x)}{\sin^2 x - \cos^2 x}$ $= \frac{-4\sin x\cos x}{-(\cos^2 x - \sin^2 x)}$ $= \frac{2\sin 2x}{\cos 2x}$ $= 2\tan 2x$	✓ $(\sin x - \cos x)^2$ ✓ $(\sin x + \cos x)^2$ ✓ Simplification ✓ $2\sin 2x$ ✓ $\cos 2x$ (5)

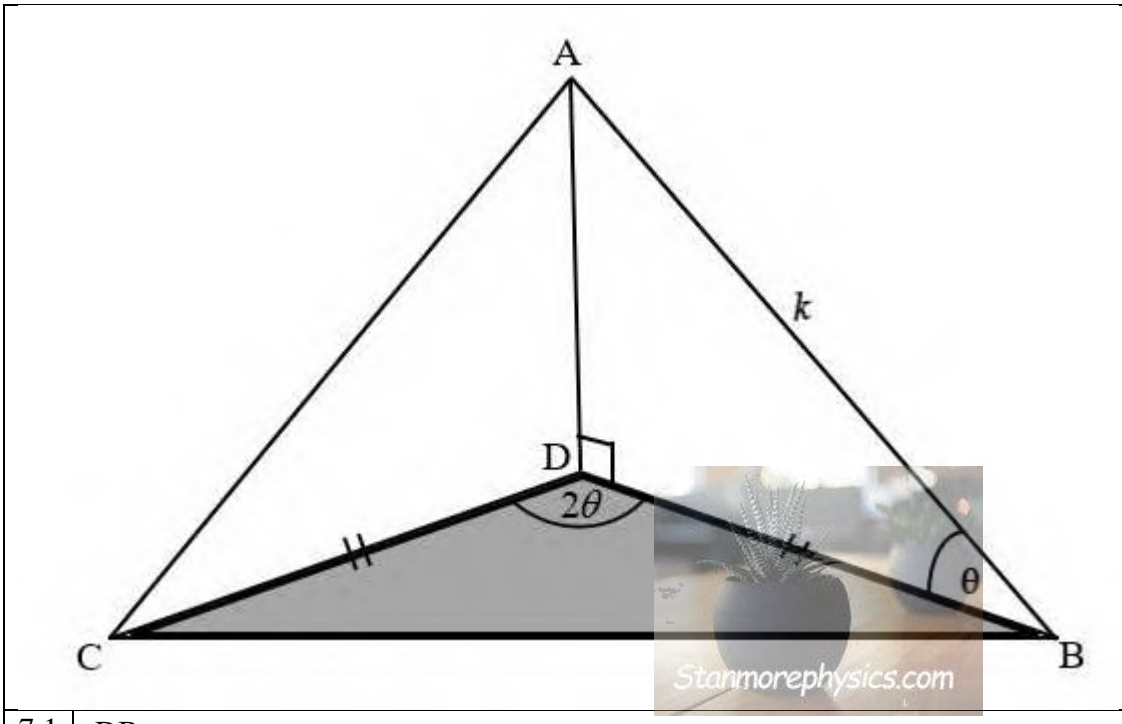
5.3.2	$\cos x + \sin x = 0$ $\cos x = -\sin x$ $\tan x = -1$ $x = 135° + k180°, k \in Z$ $\cos x - \sin x = 0$ $\cos x = \sin x$ $\tan x = 1$ $x = 45° + k180°, k \in Z$	✓ $\cos x + \sin x = 0$ ✓ $x = 135°$ ✓ $\cos x - \sin x = 0$ ✓ $x = 45°$ (4)
		[24]

QUESTION 6

6.1	Stanmorephysics.com	$f(x)$ ✓ $x - intercepts$ ✓ $y - intercept$ ✓ Shape. $g(x)$ ✓ $x\ and\ y - intercept$ ✓ Shape. (5)
6.2	$\sin(x - 45°) = \cos 2x$ $\sin(x - 45°) = \sin(90° - 2x)$ $x - 45° = 90° - 2x$ $x = 45° - 120°k, k \in Z$ $x - 45° = 180° - (90° - 2x)$ $x - 45° = 90° + 2x$ $-x = 135° + k360°, k \in Z$ $x = -135° - k360°, k \in Z$	✓ $\sin(90° - 2x)$ ✓ $x = 45°$ ✓ $-120°k, k \in Z$ ✓ $x = -135°$ (4)
6.3.1	$0° < x < 45°$	✓ $0° < x < 45°$

	$165° < x < 180°$	✓ $165° < x < 180°$ (2)
6.3.2	$0° < x < 45°$	✓ Notation ✓ Endpoints. (2)
		[13]

QUESTION 7

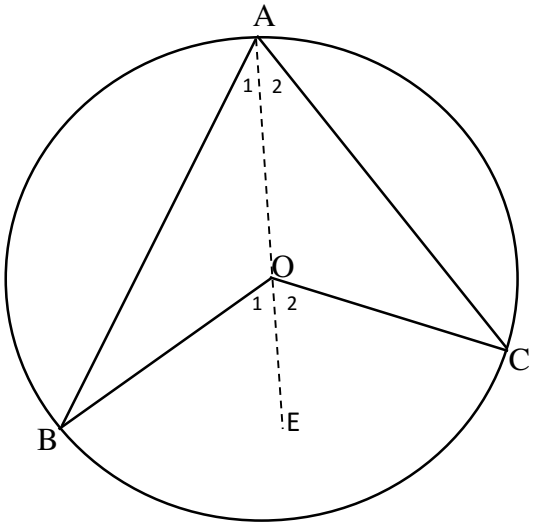


7.1	$\frac{DB}{k} = \cos\theta$ $BD = k\cos\theta$ In ΔCDB $CD = DB = k\cos\theta$ $CB^2 = CD^2 + DB^2 - 2CD.BD\cos\hat{D}$ $CB^2 = (k\cos\theta)^2 + (k\cos\theta)^2 - 2(k\cos\theta)(k\cos\theta)\cos 2\theta$ $CB^2 = k^2\cos^2\theta + k^2\cos^2\theta - 2k^2\cos^2\theta.\cos 2\theta$ $CB^2 = 2k^2\cos^2\theta(1-\cos 2\theta)$ $CB^2 = 2k^2\cos^2\theta(1-(1-2\sin^2\theta))$ $= 2k^2\cos^2\theta.2\sin^2\theta$ $CD = \sqrt{4k^2\cos^2\theta.2\sin^2\theta}$ $= 2k\cos\theta.\sin\theta$ $CD = k\sin 2\theta$	✓Trig ratio ✓ BD ✓Correct substitution ✓Simplification ✓$1-\cos 2\theta$ ✓$1-\sin^2\theta$ ✓$2k\cos\theta.\sin\theta$ (7)

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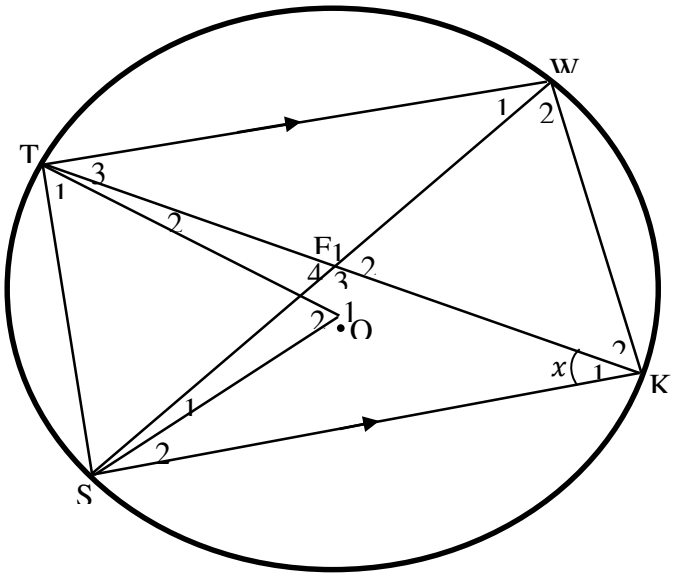
7.2	$CD = (10)\cos 2(30°)$ $= 5$ $Area = \frac{1}{2} CD.BD \sin \hat{D}$ $= \frac{1}{2}(5)(5)\sin 60°$ $= \frac{25\sqrt{3}}{4}$ $= 10{,}83$	✓ Substitution ✓ CD ✓ Substistution ✓ Answer (4)
		[11]

QUESTION 8

8.1	 Construction: Draw OA produced to E $\hat{A}_1 + \hat{B} = \hat{O}_1$ [Ext $\angle$ of Δ] $OA = OB$ [Radii] $\hat{A}_1 = \hat{B}$ [$\angle$ $opp = sides$.] $\therefore\ \hat{O}_1 = 2\hat{A}_1$ Similarly $\hat{O}_2 = 2\hat{A}_2$ $\therefore\ \hat{O}_1 + \hat{O}_1 = 2\hat{A}_1 + 2\hat{A}_2$ $\therefore\ \hat{O}_1 + \hat{O}_1 = 2(\hat{A}_1 + \hat{A}_2)$	✓ Construction. ✓ S/R ✓ S ✓ R ✓ S/R (5)
8.2.1.	$\hat{O}_3 = 46$ [$\angle$ $at\ centre = 2 \times \angle$ $at\ cicumference$]	✓ S ✓ R (2)

8.2.2.	$\widehat{D}_1 = \widehat{B}_1$ $\widehat{B}_1 = 23°$	[$\angle$ $opp = sides$] [sum of $\angle$'s in Δ]	✓ S ✓ R ✓ S/R (3)
8.2.3.	$\widehat{A}_1 = 23°$	[tan chord theorem]	✓ S ✓ R (2)
8.2.4.	$\widehat{C}_1 = 23°$	[= chords = $\angle$'s]	✓ S ✓ R (2)
8.2.5.	$O\widehat{C}D = 46$ $\widehat{C}_2 = 46 \circ - \widehat{C}_1$ $\widehat{C}_2 = 23°$	[Alt $\angle$'s, $BO//CD$]	✓ S/R ✓ S (2)
			[16]

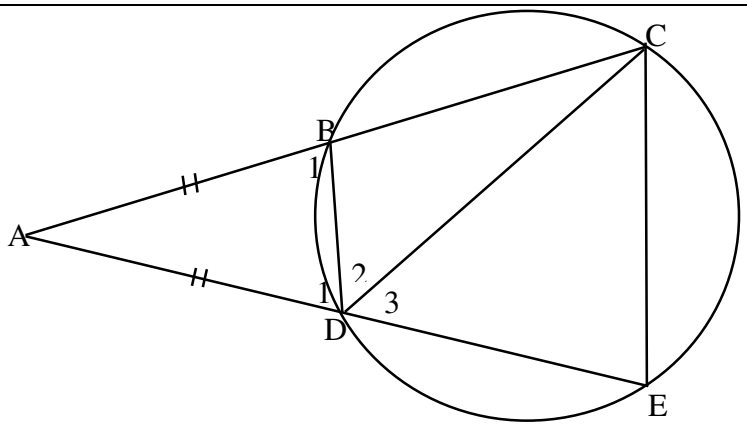
QUESTION 9



9.1.	$\widehat{T}_3 = \widehat{K}_1 = x$ $\widehat{W}_1 = \widehat{K}_1 = x$ $W\widehat{S}K = \widehat{W}_1 = x$	[$Alt \angle's\ TW \parallel SK$] [$\angle's\ in\ the\ same\ seg$] [$Alt \angle's\ TW \parallel SK$]	✓ S /R ✓ S ✓ R ✓ S /R (4)
9.2.	$\widehat{O}_1 = 2x$ $\widehat{F}_4 = 2x$ $SOFT$ is a cyclic quad	[$\angle$ at centre = 2 × $\angle$ at circumference] [Ext $\angle's$ of a Δ] [converse $\angle's$ in the same seg]	✓ S ✓ R ✓ S /R ✓ R (4)

9.3.	$SO = TO$ [Radii] $\hat{O}_1 = 2x$ [Proven] $ST = \sqrt{2(SO)^2 - 2(SO)^2\cos^2 2x}$ $ST = \sqrt{2(SO)^2(1 - \cos^2 2x)}$ $ST = \sqrt{2(SO)^2[1 - (1 - 2\sin^2 x)]}$ $ST = \sqrt{2(SO)^2(2\sin^2 x)}$ $ST = \sqrt{4(SO)^2\sin^2 x)}$ $ST = 2SO\sin x$ **OR** $in\ \triangle STO$: $SO = TO$ [Radii] $\hat{T}_1 = T\hat{S}O = 90° - x$ [sum of $\angle's$ in $\triangle$] $\frac{ST}{\sin 2x} = \frac{SO}{\sin(90° - x)}$ $ST\cos x = 2SO\sin x\cos x$ $\frac{ST\cos x}{\cos x} = \frac{2SO\sin x\cos x}{\cos x}$ $ST = 2SO\sin x$	✓ S/R ✓ Sub in correct formula ✓ Double angle ✓ Square root (4) ✓ S/R ✓ Sub in correct formula ✓ Double angle ✓ Dividing by $\cos x$ (4)
		[12]

QUESTION 10

		
10.1.	$\hat{B}_1 = \hat{D}_1$ [$\angle's\ opp = sides$] $\hat{B}_1 = \hat{E}$ [$Ext\ \angle's\ of\ cyclic\ quad$] $\hat{D}_1 = \hat{E}$ [$Each = \hat{B}_1$] $BD//CE$ [$corresp\ \angle's =$]	✓ S /R ✓ S /R ✓ R (3)
10.2.	$\frac{2}{DE} = \frac{2}{3}$ [prop theorem, $BD//CE$] $\frac{2DE}{2} = \frac{6}{2}$ $DE = 3\ cm$	✓ S/R ✓ Answer (2)

10.3.	$in\ \Delta ADB\ \&\ \Delta AEC$ $\hat{A} = \hat{A}$ $[common\ \angle]$ $\hat{D}_1 = \hat{E}$ $[corresp\ \angle's, BD//CE]$ $\hat{B}_1 = \hat{C}$ $[corresp\ \angle's, BD//CE]$ $\Delta ADB \|\|\| \Delta AEC$ [A,A,A]	✓ S/R ✓ S/R ✓ S/R (3)
10.4.	$\frac{AD}{AE} = \frac{BD}{EC}$ [///'s] $\frac{2}{5} = \frac{4}{EC}$ $\frac{2EC}{2} = \frac{20}{2}$ $EC = 10\ cm$	✓ S/R ✓ Answer (2)
10.5.	$\frac{Area\ \Delta ECD}{Area\ \Delta ABD} = \frac{Area\ \Delta ECD}{Area\ \Delta ACE} \times \frac{Area\ \Delta ACE}{Area\ \Delta ABD}$ $= \frac{\frac{1}{2}EC.ED \sin \hat{E}}{\frac{1}{2}EC.AE \sin \hat{E}} \times \frac{\frac{1}{2}AB.AD \sin \hat{A}}{\frac{1}{2}AC.AE \sin \hat{A}}$ $= \frac{3}{5} \times \frac{(2)(2)}{(5)(5)}$ $= \frac{12}{125}$	✓ Formula ✓ Substitution ✓ Answer (3)
		[13]

TOTAL:		**150**