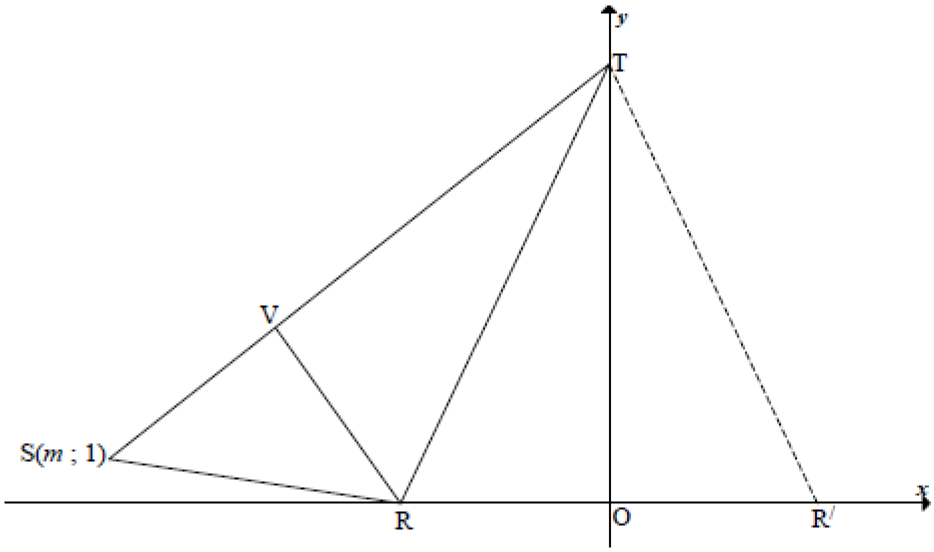
MATHEMATICS ASSESSMENT FRAMEWORK MARKING GUIDELINE

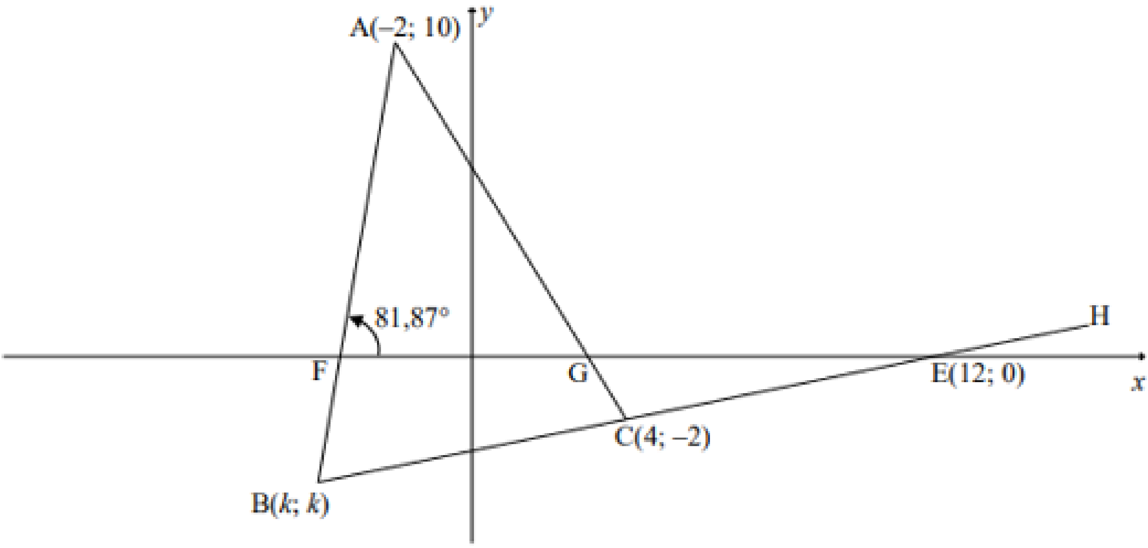
QUESTION/*VRAAG* 3



3.1	$2x - y + 10 = 0$ $2x - 0 + 10 = 0$ $x = -5$ R(–5 ; 0)	✓ $y = 0$ ✓ R(–5 ; 0) (2)
3.2	R(–5 ; 0) T(0 ; 10) $(\text{RT})^2 = (-5-0)^2 + (0-10)^2$ **OR** $(\text{RT})^2 = 5^2 + 10^2$ (Pythag) $\text{RT} = \sqrt{125}$ units **OR/*OF*** $\text{RT} = 5\sqrt{5}$ units	✓ T(0 ; 10) ✓ subst of R & T into distance formula or Pythag ✓ answer (3)
3.3	$2\text{RT}^2 = 5\text{SR}^2$ $2(125) = 5[(m-(-5))^2 + (1-0)^2]$ $5[(m+5)^2 + (1)^2] = 250$ $(m+5)^2 + 1 = 50$ $m^2 + 10m - 24 = 0$ **OR/*OF*** $(m+5)^2 = 49$ $(m-2)(m+12) = 0$ $m+5 = \pm 7$ $m = -5 \pm 7$ $m = 2$ or $m = -12$ $m = 2$ or $m = -12$ N/A N/A $\therefore m = -12$ $\therefore m = -12$	✓ substitution of S & R ✓ equating: $2\text{RT}^2 = 5\text{SR}^2$ ✓ standard form or isolating square ✓ answers with rejection (4)

3.4	$m_{ST} = \frac{1-10}{-12-0}$ $m_{ST} = \frac{3}{4}$ $\therefore m_{VR} = -\frac{4}{3}$ $y = -\frac{4}{3}x + c$ **OR/*OF*** $y - y_1 = -\frac{4}{3}(x - x_1)$ $0 = -\frac{4}{3}(-5) + c$ $y - 0 = -\frac{4}{3}(x - (-5))$ $c = -\frac{20}{3}$ $y = -\frac{4}{3}(x+5)$ $y = -\frac{4}{3}x - \frac{20}{3}$ $y = -\frac{4}{3}x - \frac{20}{3}$	✓ substitution of S & T into gradient formula ✓ m_{ST} ✓ $m_{VR} = -\frac{1}{m_{ST}}$ ✓ substitution of R ✓ equation (5)
3.5	VR: $y = -\frac{4}{3}x - \frac{20}{3}$ ST: $y = \frac{3}{4}x + 10$ $\frac{3}{4}x + 10 = -\frac{4}{3}x - \frac{20}{3}$ $9x + 120 = -16x - 80$ $25x = -200$ $x = -8$ $y = 4$ $\therefore$ V(−8 ; 4)	✓ equation of ST ✓ equating VR and ST (2)
3.6	$R'(5;0)$ $VR = \sqrt{[-8-(-5)]^2 + (4-0)^2} = 5$ $VT = \sqrt{(-8-0)^2 + (4-10)^2} = 10$ Area of $RVTR' = \frac{1}{2}(VR)(VT) + \frac{1}{2}(RR')(OT)$ $= \frac{1}{2}(10)(10) + \frac{1}{2}(5)(10)$ $= 50 + 25$ $= 75\,\text{units}^2$	✓ length of VR ✓ length of VT ✓ area ΔVRT ✓ area Δ RTR′ ✓ answer (5)
		[21]

QUESTION/*VRAAG* 3

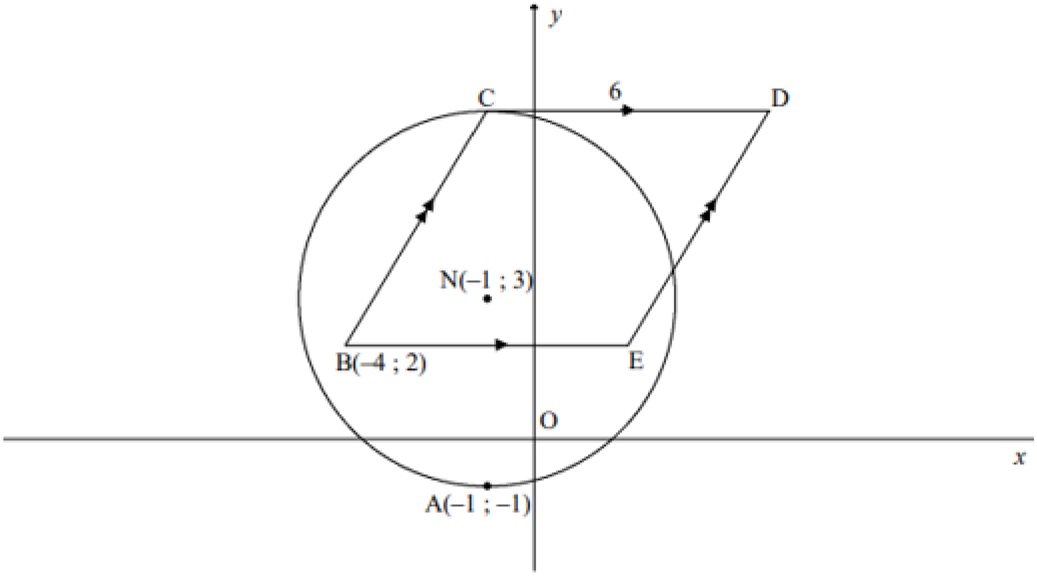


3.1.1	$m_{BE} = m_{CE} = \frac{0-(-2)}{12-4}$ **OR/*OF*** $m_{BE} = m_{CE} = \frac{-2-0}{4-12}$ $= \frac{1}{4}$ $= \frac{1}{4}$	✓ substitution C & E ✓ answer (2)
3.1.2	$m_{AB} = \tan 81{,}87°$ $m_{AB} = 7$ Answer only: Full marks *Slegs antw: Volpunte*	✓ substitution ✓ answer (2)
3.2	$y = mx + c$ or $y - y_1 = m(x - x_1)$ $0 = \frac{1}{4}(12) + c$ or $y - 0 = \frac{1}{4}(x - 12)$ $c = -3$ $y = \frac{1}{4}x - 3$ $y = \frac{1}{4}x - 3$ **OR/*OF*** $y = mx + c$ or $y - y_1 = m(x - x_1)$ $-2 = \frac{1}{4}(4) + c$ or $y - (-2) = \frac{1}{4}(x - 4)$ $c = -3$ $y = \frac{1}{4}x - 3$ $y = \frac{1}{4}x - 3$	✓ substitution of E ✓ answer (2) ✓ substitution of C ✓ answer (2)

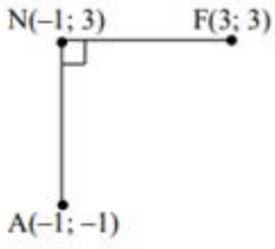
3.3.1	$y=\frac{1}{4}x-3$ $k=\frac{1}{4}k-3$ $\frac{3}{4}k=-3$ $k=-4$ $\therefore B(-4;-4)$	✓ substitution ✓ answer (2)
	OR/*OF* $m_{BE}=\frac{1}{4}$ $\frac{0-k}{12-k}=\frac{1}{4}$ $-4k=12-k$ $k=-4$ $\therefore B(-4;-4)$ **OR/*OF*** $m_{BE}=\frac{1}{4}$ $\frac{k}{k-12}=\frac{1}{4}$ $4k=k-12$ $k=-4$	✓ substitution ✓ answer (2)
	OR/*OF* $m_{AB}=\tan 81{,}87°$ $m_{AB}=7$ $m_{AB}=\frac{10-k}{-2-k}$ $7(-2-k)=10-k$ $-14-7k=10-k$ $-6k=24$ $k=-4$ $\therefore B(-4;-4)$	✓ substitution ✓ answer (2)
	OR/*OF* EB: $y=\frac{1}{4}x-3$ and AB: $y=7x+24$ $\frac{1}{4}x-3=7x+24$ $\frac{27}{4}x=-27$ $x=k=-4$ $\therefore B(-4;-4)$	✓ equating EB & AB ✓ answer (2)

3.3.2	In ΔAFG: $m_{AC} = \frac{10-(-2)}{-2-4} = -2$ $\tan\theta = m_{AC} = -2$ $\theta = 180° - 63{,}43...°$ $\therefore \theta = 116{,}57°$ $\therefore \hat{A} = 116{,}57° - 81{,}87°$ [ext ∠ of Δ] $\therefore \hat{A} = 34{,}70°$ **OR/*OF*** In ΔABC: $a = BC = 2\sqrt{17}; b = AC = 6\sqrt{5}; c = AB = 10\sqrt{2}$ $a^2 = b^2 + c^2 - 2bc.\cos A$ $(2\sqrt{17})^2 = (6\sqrt{5})^2 + (10\sqrt{2})^2 - 2(6\sqrt{5})(10\sqrt{2}).\cos A$ $\cos A = \frac{(6\sqrt{5})^2 + (10\sqrt{2})^2 - (2\sqrt{17})^2}{2(6\sqrt{5})(10\sqrt{2})}$ $= 0{,}822...$ $\therefore A = 34{,}7°$	✓ $m_{AC} = -2$ ✓ $\tan\theta = -2$ ✓ $\theta = 116{,}57°$ ✓ answer (4) ✓ all 3 lengths ✓ substitution into the correct cosine rule ✓ cos A subject ✓ answer (4)
3.3.3	$M\left(\frac{12+(-2)}{2} ; \frac{10+(0)}{2}\right)$ Diagonals intersect at the point (5 ; 5)	✓ *x*-value ✓ *y*-value (2)
3.4.1	BE = ET $4\sqrt{17} = \sqrt{(12-p)^2 + (0-p)^2}$ $(4\sqrt{17})^2 = \left(\sqrt{(12-p)^2 + (0-p)^2}\right)^2$ $272 = 144 - 24p + p^2 + p^2$ $p^2 - 12p - 64 = 0$ $(p-16)(p+4) = 0$ $\therefore p = 16$ or $p = -4$ (n.a.) ∴ T(16; 16)	✓ substitution of E & T ✓ equating ✓ standard form ✓ factors ✓ $p = 16$ (5)
3.4.2a	$(x-12)^2 + y^2 = (4\sqrt{17})^2 = 272$	✓ LHS ✓ RHS (2)
3.4.2b	$m_{radius} = \frac{1}{4}$ $m_{tangent} = -4$ $y = -4x + c$ $-4 = -4(-4) + c$ $c = -20$ $y = -4x - 20$ **OR/*OF*** $y - y_1 = -4(x - x_1)$ $y - (-4) = -4(x - (-4))$ $y = -4x - 20$	✓ $m_{tangent}$ ✓ substitution of B ✓ equation (3)
		[24]

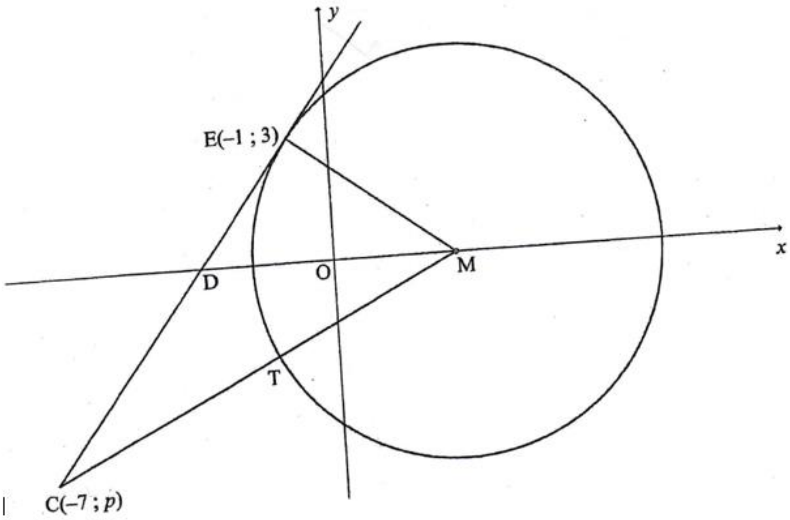
QUESTION/*VRAAG* 4



4.1	Radius = 4 units/*eenhede*	✓ answer (1)
4.2.1	$CD \perp CN$ $\therefore C(-1\ ;\ 7)$	✓*x* value ✓ *y* value (2)
4.2.2	CD = 6 units $\therefore D(5\ ;\ 7)$	✓*x* value ✓ *y* value (2)
4.2.3	$\perp h = 5$ units DC = 6 units Area $\Delta BCD = \frac{1}{2}(6)(5)$ $= 15 \text{ units}^2$	✓ $\perp h = 5$ units ✓ substitution into Area formula ✓ answer (3)
	OR/*OF*	
	$\perp h = 5$ units DC = 6 units Area $\Delta BCD = \frac{1}{2}[\text{Area of } \|^{m}]$ $= \frac{1}{2}[(5)(6)]$ $= 15 \text{ units}^2$	✓ $\perp h = 5$ units ✓ substitution into Area formula ✓ answer (3)

	OR/*OF* Let angle of inclination of BC = α $\tan\alpha = \frac{5}{3}$ $\alpha = 59{,}036...^\circ$ $B\hat{C}D = 180^\circ - \alpha$ $B\hat{C}D = 180^\circ - 59{,}036...^\circ$ $B\hat{C}D = 120{,}96^\circ$ Area $\Delta BCD = \frac{1}{2}\left(\sqrt{34}\right)(6)\sin 120{,}96^\circ$ $= 15 \text{ units}^2$	✓ $B\hat{C}D = 120{,}96^\circ$ ✓ substitution into Area rule ✓ answer (3)
4.3.1	M(3 ; −1) [reflection of N(−1 ; 3) about the line $y = x$] $\therefore MN = \sqrt{(3-(-1))^2 + (-1-3)^2}$ $MN = \sqrt{32} = 4\sqrt{2} = 5{,}66$ units	✓ coordinates of M (A) ✓ substitution of M&N ✓ answer (3)
4.3.2	M(3 ; −1) $m_{MN} = \frac{3-(-1)}{-1-3} = -1$ MN: $-1 = -(3) + c$ or $y - 3 = -1(x+1)$ $c = 2$ $y - 3 = -x - 1$ $\therefore y = -x + 2$ $y = -x + 2$ $x = -x + 2$ $2x = 2$ $x = 1$ $\therefore y = 1$ midpoint (1 ; 1) **OR/*OF***  N(−1 ; 3) $y_F = y_N = 3$ Reflected about $y = x$ $\therefore$ F(3 ; 3) midpoint$\left(\frac{-1+3}{2};\frac{-1+3}{2}\right)$ = (1 ; 1)	 ✓ equation of MN ✓ equating AF & MN ✓x value ✓ y value (4) ✓✓ coordinates of F ✓x value ✓ y value (4)

QUESTION 4



4.1	$C\hat{E}M = 90°$	✓ answer (1)
4.2	$m_{ME} = \frac{0-3}{3-(-1)}$ $m_{ME} = -\frac{3}{4}$ $\therefore m_{ED} = \frac{4}{3}$ $3 = \frac{4}{3}(-1)+c$ **OR/*OF*** $y-3 = \frac{4}{3}(x-(-1))$ $y = \frac{4}{3}x + \frac{13}{3}$ $\quad$ $y = \frac{4}{3}x + \frac{13}{3}$	 ✓ $m_{ME} = -\frac{3}{4}$ ✓ m_{ED} ✓ substitution of E(−1 ; 3) ✓ equation (4)
	OR/*OF* $DM = \frac{25}{4} = 6,25$ units $\therefore D\left(-\frac{13}{4};0\right)$ $m_{ED} = \frac{3-0}{-1-\left(-\frac{13}{4}\right)}$ $\therefore m_{ED} = \frac{4}{3}$ $3 = \frac{4}{3}(-1)+c$ **OR/*OF*** $y-3 = \frac{4}{3}(x-(-1))$ $y = \frac{4}{3}x + \frac{13}{3}$ $\quad$ $y = \frac{4}{3}x + \frac{13}{3}$	 ✓ coordinates of D ✓ m_{ED} ✓ substitution of E(−1 ; 3) ✓ equation (4)

4.3	$y=\frac{4}{3}x+\frac{13}{3}$ $0=\frac{4}{3}x+\frac{13}{3}$ $x_D=-\frac{13}{4}$ $\therefore DM=3-\left(-\frac{13}{4}\right)$ $DM=\frac{25}{4}$ or 6,25 units **OR**/***OF*** EM = 5 units $ED=\frac{15}{4}$ units $DM=\sqrt{(5)^2+\left(\frac{15}{4}\right)^2}$ [Pythagoras] $DM=\frac{25}{4}$ or 6,25 units	✓ x_D ✓ x_M-x_D ✓ answer (3) ✓ EM = 5 units ✓ substitution of EM & ED ✓ answer (3)
4.4	EC: $y=\frac{4}{3}x+\frac{13}{3}$ $p=\frac{4}{3}(-7)+\frac{13}{3}$ $p=-5$	✓ substitution of $C(-7\,;p)$ (1)
4.5	$M\rightarrow E$: $(x\,;y)\rightarrow(x-4\,;y+3)$ [translation] $C\rightarrow S$: $(-7\,;-5)\rightarrow(-7-4\,;-5+3)$ $\therefore S(-11\,;-2)$ **OR**/***OF*** $M\rightarrow C$: $(x\,;y)\rightarrow(x-10\,;y-5)$ [translation] $E\rightarrow S$: $(-1\,;3)\rightarrow(-1-10\,;3-5)$ $\therefore S(-11\,;-2)$ **OR**/***OF***	✓ method: translation ✓ $x_S=-11$ ✓ $y_S=-2$ (3) ✓ method: translation ✓ $x_S=-11$ ✓ $y_S=-2$ (3)

	E(–1 ; 3) and C(–7 ; –5) $\left(\frac{-1+(-7)}{2};\frac{3+(-5)}{2}\right)$ [Midpoint of EC] $=(-4;-1)$ S(x ; y) and M(3 ; 0) $\frac{x_S+3}{2}=-4$ $\frac{y_S+0}{2}=-1$ $x_S=-11$ $y_S=-2$ $\therefore$ S(–11 ; –2)	✓ method: midpoint ✓ $x_S=-11$ ✓ $y_S=-2$ (3)
4.6	$r_{NEW}=5+7$ $r_{NEW}=12$ $MS=\sqrt{(3-(-11))^2+(0-(-2))^2}$ $MS=\sqrt{200}=10\sqrt{2}=14{,}14$ units $14{,}14>12$ $\therefore S(-11;-2)$ lies outside the circle	✓ $r_{NEW}=12$ ✓ MS ✓ conclusion (3)
4.7	Inclination of EM: $\tan\hat{M}=-\frac{3}{4}$ ref.$\angle=36{,}87°$ Inclination of EM $=143{,}13°$ $\therefore E\hat{M}D=36{,}87°$ Inclination of CM: $\tan\hat{M}=\frac{5}{10}$ $\therefore\hat{M}=26{,}57°$ $\therefore E\hat{M}T=26{,}57°+36{,}87°$ $=63{,}44°$ But EM = MT [radii] $\therefore E\hat{T}M=\frac{180°-63{,}44°}{2}$ $\therefore E\hat{T}M=58{,}28°$	✓ Inclination of EM ✓ $E\hat{M}D$ ✓ Inclination of CM ✓ $E\hat{M}T$ ✓ answer (5)
		[20]

TRIGONOMETRY

QUESTION/*VRAAG* 5

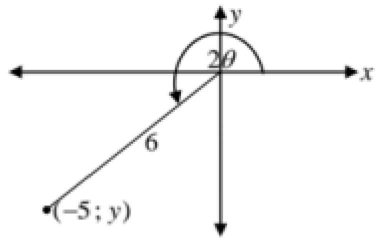
5.1.1	$y^2 = \sqrt{13^2 - (-5)^2}$ [Pythagoras] $y = -12$ $\sin^2\theta$ $= \left(-\frac{12}{13}\right)^2$ $= \frac{144}{169}$ **OR/*OF*** $\sin^2\theta = 1 - \cos^2\theta$ $\sin^2\theta = 1 - \left(-\frac{5}{13}\right)^2$ $\sin^2\theta = \frac{144}{169}$	✓ $y = -12$ ✓ substitution ✓ answer (3) ✓ square identity ✓ substitution ✓ answer (3)
5.1.2	$\tan(360° - \theta)$ $= -\tan\theta$ $= -\left(\frac{-12}{-5}\right)$ $= -\frac{12}{5}$	✓ $-\tan\theta$ ✓ answer (2)
5.1.3	$\cos(\theta - 135°)$ $= \cos\theta\cos135° + \sin\theta\sin135°$ $= \cos\theta(-\cos45°) + \sin\theta(\sin45°)$ $= \left(-\frac{5}{13}\right)\left(-\frac{\sqrt{2}}{2}\right) + \left(-\frac{12}{13}\right)\left(\frac{\sqrt{2}}{2}\right)$ OR $\left(-\frac{5}{13}\right)\left(-\frac{1}{\sqrt{2}}\right) + \left(-\frac{12}{13}\right)\left(\frac{1}{\sqrt{2}}\right)$ $= -\frac{7\sqrt{2}}{26}$ $= -\frac{7}{13\sqrt{2}}$	✓ cpd. ∠ expansion ✓ reduction ✓ subst.: special∠s ✓ subst.: trig ratios (4)

5.2	$\frac{2\cos(180°-x)\sin(-x)}{1-2\cos^2(90°-x)}$ $=\frac{2(-\cos x)(-\sin x)}{1-2\sin^2 x}$ $=\frac{2\sin x\cos x}{\cos 2x}$ $=\frac{\sin 2x}{\cos 2x}$ $=\tan 2x$	✓ $\cos(180°-x)=-\cos x$ ✓ $\sin(-x)=-\sin x$ ✓ $\cos^2(90°-x)=\sin^2 x$ ✓ $1-2\sin^2 x=\cos 2x$ ✓ $2\sin x\cos x=\sin 2x$ ✓ answer (6)
5.3	$(\tan 92°)(\tan 94°)(\tan 96°)...(\tan 176°)(\tan 178°)$ $=\left(\frac{\sin 92°}{\cos 92°}\right)\left(\frac{\sin 94°}{\cos 94°}\right)\left(\frac{\sin 96°}{\cos 96°}\right)...\left(\frac{\sin 176°}{\cos 176°}\right)\left(\frac{\sin 178°}{\cos 178°}\right)$ $=\left(\frac{\cos 2°}{-\sin 2°}\right)\left(\frac{\cos 4°}{-\sin 4°}\right)\left(\frac{\cos 6°}{-\sin 6°}\right)...\left(\frac{\sin 4°}{-\cos 4°}\right)\left(\frac{\sin 2°}{-\cos 2°}\right)$ $=1$ **OR** $(\tan 92°)(\tan 94°)(\tan 96°)...(\tan 176°)(\tan 178°)$ $=(\tan 92°)(\tan 94°)(\tan 96°)....(-\tan 4°)(-\tan 2°)$ $=\left(\frac{\sin 92°}{\cos 92°}\right)\left(\frac{\sin 94°}{\cos 94°}\right)\left(\frac{\sin 96°}{\cos 96°}\right)...\left(-\frac{\sin 4°}{\cos 4°}\right)\left(-\frac{\sin 2°}{\cos 2°}\right)$ $=\left(\frac{\cos 2°}{-\sin 2°}\right)\left(\frac{\cos 4°}{-\sin 4°}\right)\left(\frac{\cos 6°}{-\sin 6°}\right)...\left(-\frac{\sin 4°}{\cos 4°}\right)\left(-\frac{\sin 2°}{\cos 2°}\right)$ $=1$	✓ quotient identity ✓ co-ratios ✓ reduction ✓ answer (4) ✓ reduction ✓ quotient identity ✓ co-ratios ✓ answer (4)
		[19]

QUESTION/*VRAAG* 6

6.1	LHS $= 2\cos^2(45°+x)$ RHS $= 1-\sin 2x$ $= 2[\cos(45°+x)]^2$ $= 2(\cos 45°\cos x - \sin 45°\sin x)^2$ $= 2\left(\frac{\sqrt{2}}{2}\cos x - \frac{\sqrt{2}}{2}\sin x\right)^2$ $= 2\left(\frac{1}{2}\cos^2 x - \sin x\cos x + \frac{1}{2}\sin^2 x\right)$ $= \cos^2 x - 2\sin x\cos x + \sin^2 x$ $= 1-\sin 2x$ $\therefore$ LHS = RHS	✓ compound $\angle$ expansion ✓ subst. special $\angle$ values ✓ simplification ✓ $\sin^2 x + \cos^2 x = 1$ (4)
	OR/*OF*	
	LHS $= 2\cos^2(45°+x)$ $= 1-1+2\cos^2(45°+x)$ $= 1+[2\cos^2(45°+x)-1]$ $= 1+[\cos 2(45°+x)]$ $= 1+[\cos(90°+2x)]$ $= 1+(-\sin 2x)$ $= 1-\sin 2x$ $\therefore$ LHS = RHS	✓ $+1-1$ ✓ double angle ✓ simplification ✓ reduction (4)
6.2.1	LHS $= \sin(A-B)-\sin(A+B)$ RHS $= -2\cos A\sin B$ $= \sin A\cos B - \cos A\sin B - (\sin A\cos B + \cos A\sin B)$ $= \sin A\cos B - \cos A\sin B - \sin A\cos B - \cos A\sin B$ $= -2\cos A\sin B$ $\therefore$ LHS = RHS	✓ $\sin A\cos B - \cos A\sin B$ ✓ $\sin A\cos B + \cos A\sin B$ (2)
6.2.2	$\sin 4x - \sin 10x$ $= \sin(7x-3x) - \sin(7x+3x)$ $= -2\cos 7x\sin 3x$	✓ $4x = 7x - 3x$ & $10x = 7x + 3x$ ✓ answer (2)
6.2.3	$\sin 4x - \sin 10x = \sin 3x$ $-2\cos 7x\sin 3x - \sin 3x = 0$ $2\cos 7x\sin 3x - \sin 3x = 0$ $\sin 3x(2\cos 7x + 1) = 0$ $\sin 3x = 0$ or $\cos 7x = -\frac{1}{2}$ $3x = 0°$ $7x = 120°$ or $7x = 240°$ $x = 0°$ $x = 17{,}14°$ $x = 34{,}29°$ N/A	✓ substitution ✓ common factor ✓ both equations ✓ $x = 0°$ ✓ $x = 17{,}14°$ (5)
		[13]

QUESTION/*VRAAG* 5

5.1.1 **no calculator in 5.1**	$\cos 2\theta = -\frac{5}{6}$, where $2\theta \in [180°; 270°]$  $y^2 = 6^2 - (-5)^2$ [Pythagoras] $y = \pm\sqrt{11}$ (5 ; y) is in 3rd quadrant: $\therefore y = -\sqrt{11}$ $\sin 2\theta = -\frac{\sqrt{11}}{6}$ Getting to $\sin 2\theta = \frac{\sqrt{11}}{6}$: 3/4 **OR/*OF*** $\sin^2 2\theta = 1 - \cos^2 2\theta$ $= 1 - \left(-\frac{5}{6}\right)^2$ $= 1 - \frac{25}{36}$ $= \frac{11}{36}$ $\sin 2\theta = -\frac{\sqrt{11}}{6}$	✓ diagram (3rd quadrant only) ✓ using Pythagoras ✓ y – value ✓ answer (4) ✓ $\sin^2 2\theta = 1 - \cos^2 2\theta$ ✓ substitution ✓ value of $\sin^2 2\theta$ ✓ answer (4)

5.1.2	$\cos 2\theta = 1 - 2\sin^2\theta$ $2\sin^2\theta = 1 - \cos 2\theta$ $\sin^2\theta = \frac{1 - \left(-\frac{5}{6}\right)}{2}$ $= \frac{11}{6} \times \frac{1}{2}$ $= \frac{11}{12}$	✓ $\cos 2\theta = 1 - 2\sin^2\theta$ ✓ substitution ✓ answer (3)

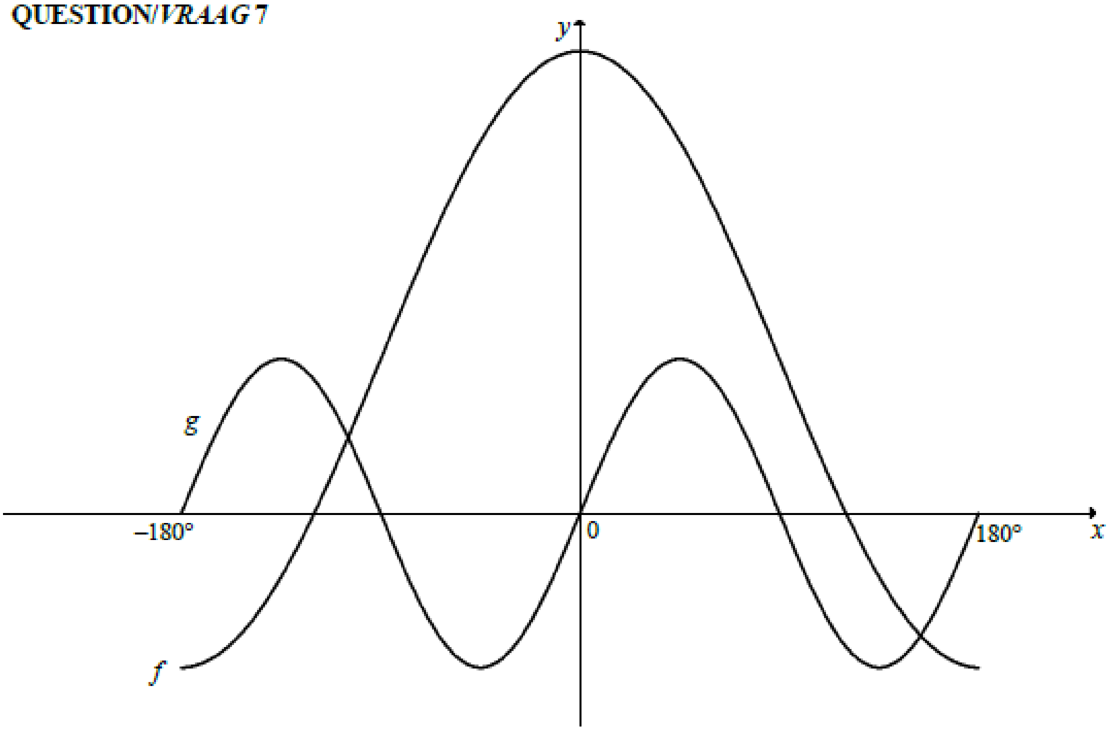
5.2	$\sin(180° - x).\cos(-x) + \cos(90° + x).\cos(x - 180°)$ $= \sin x.\cos x - \sin x(-c$ $= 2\sin x.\cos x$ $= \sin 2x$ Second line written as $\sin x \cos x + \sin x \cos x$: max 5/6	✓ $\sin x$ ✓ $\cos x$ ✓ $-\sin x$ ✓ $-\cos x$ ✓ simplification ✓ answer (6)
5.3	$\sin 3x.\cos y + \cos 3x.\sin y$ $\sin(3x + y)$ $= \sin 270°$ $= -1$	✓ compound angle ✓ answer (2)
5.4.1	$2\cos x = 3\tan x$ $2\cos x = \frac{3\sin x}{\cos x}$ $2\cos^2 x = 3\sin x$ $2(1 - \sin^2 x) = 3\sin x$ $2 - 2\sin^2 x = 3\sin x$ $2\sin^2 x + 3\sin x - 2 = 0$	✓ $\tan x = \frac{\sin x}{\cos x}$ ✓ multiplying by $\cos\theta$ ✓ $\cos^2 x = 1 - \sin^2 x$ (3)
5.4.2	$2\sin^2 x + 3\sin x - 2 = 0$ $(2\sin x - 1)(\sin x + 2) = 0$ $\sin x = \frac{1}{2}$ or $\sin x = -2$ (no solution) $x = 30° + k.360°$ or $x = 150° + k.360°$; $k \in Z$	✓ factors ✓ both values of $\sin x$ ✓ no solution ✓ $30° + k.360°$ ✓ $150° + k.360°$; $k \in Z$ (5)
5.4.3	$5y = 30° + k.360°$ or $5y = 150° + k.360°$ $y = 6° + k.72°$ or $y = 30° + k.72°$ $\therefore y = 144° + 6°$ or $y = 144° + 30°$ $y = 150°$ or $y = 174°$	✓ $y = 6° + k.72°$ ✓ $y = 30° + k.72°$ ✓ 150° ✓ 174° (4)

QUESTION/VRAAG 5

5.1	$x^2 + y^2$ $=(3\sin\theta)^2 + (3\cos\theta)^2$ $=9\sin^2\theta + 9\cos^2\theta$ $=9(\sin^2\theta + \cos^2\theta)$ $=9(1)$ $=9$	✓ simpl/*vereenv* ✓ CF/*GF* = 9 ✓ answer/*antw* (3)
5.2	$\sin(540° - x).\sin(-x) - \cos(180° - x).\sin(90° + x)$ $\sin(180° - x).\sin(-x) - \cos(180° - x).\sin(90° + x)$ $= (\sin x)(-\sin x) - (-\cos x)(\cos x)$ $= -\sin^2 x + \cos^2 x$ $= \cos 2x$	✓ $\sin(540° - x) = \sin x$ ✓ $\sin(-x) = -\sin x$ ✓ $\cos(180° - x) = -\cos x$ ✓ $\sin(90° + x) = \cos x$ ✓ $-\sin^2 x + \cos^2 x$ ✓ $\cos 2x$ (6)
5.3.1	$OT = \sqrt{x^2 + p^2}$ $\sin\alpha = \frac{y_T}{OT}$ $= \frac{p}{\sqrt{x^2 + p^2}}$ $\frac{p}{\sqrt{x^2 + p^2}} = \frac{p}{\sqrt{1 + p^2}}$ $x^2 = 1$ $x = -1$ **OR/*OF*** (P lies in 3rd quadrant) $x^2 + y^2 = r^2$ $x^2 + p^2 = \left(\sqrt{1 + p^2}\right)^2$ $x^2 + p^2 = 1 + p^2$ $x^2 = 1$ $x = -1$ (P lies in 3rd quadrant)	✓ $OT = \sqrt{x^2 + p^2}$ ✓ $\sin\alpha = \frac{y_T}{OT}$ ✓ $x^2 = 1$ (3) ✓ $x^2 + y^2 = r^2$ ✓ subst ✓ $x^2 = 1$ (3)
5.3.2	$\cos(180° + \alpha)$ $= -\cos\alpha$ $= -\left(\frac{-1}{\sqrt{1 + p^2}}\right)$ $= \frac{1}{\sqrt{1 + p^2}}$	✓ $-\cos\alpha$ ✓ answer/*antw* (2)

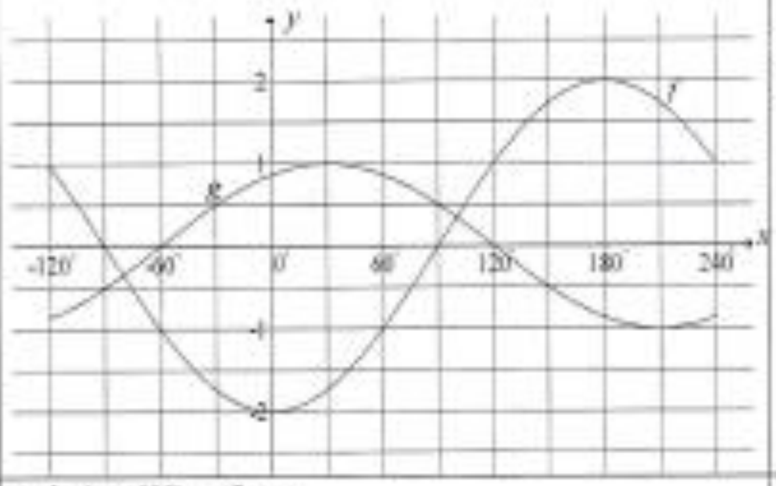
Trig Graphs

QUESTION/*VRAAG* 7

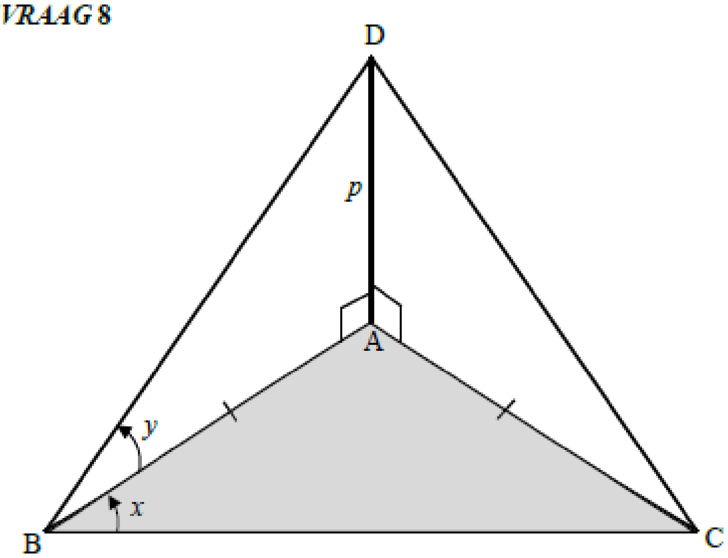


7.1	Range of f: $y \in [-1\ ;\ 3]$ **OR** $-1 \leq y \leq 3$	✓ $y \in [-1\ ;\ 3]$ (1) ✓ $-1 \leq y \leq 3$ (1)
7.2	Period of g: $180°$	✓ $180°$ (1)
7.3	f increasing: $x \in (-180°\ ;\ 0°)$ **OR** $-180° < x < 0°$	✓ $x \in (-180°\ ;\ 0°)$ (1) ✓ $-180° < x < 0°$ (1)
7.4.1	$g(x).f'(x) < 0$ $x \in (-90°\ ;\ 0°) \cup (0°\ ;\ 90°)$ **OR** $-90° < x < 0°$ or $0° < x < 90°$	✓ $(-90°\ ;\ 0)$ ✓ $(0°\ ;\ 90°)$ (2) ✓ $-90° < x < 0°$ ✓ $0° < x < 90°$ (2)

QUESTION/*VRAAG* 6

6.1	$\sin(x+60°)+2\cos x=0$ $\sin x\cos 60°+\cos x\sin 60°+2\cos x=0$ $\frac{1}{2}\sin x+\frac{\sqrt{3}}{2}\cos x+2\cos x=0$ $\frac{1}{2}\sin x=-2\cos x-\frac{\sqrt{3}}{2}\cos x$ $\sin x=-4\cos x-\sqrt{3}\cos x$ $\sin x=\cos x(-4-\sqrt{3})$ $\frac{\sin x}{\cos x}=\frac{\cos x(-4-\sqrt{3})}{\cos x}$ $\therefore \tan x=-4-\sqrt{3}$	✓expansion/*uitbreiding* ✓special angle values/ *spesiale ∠-waardes* ✓simpl/*vereenv* ✓ $\sin x=\cos x(-4-\sqrt{3})$ (4)
6.2	$\tan x=-4-\sqrt{3}$ $\tan x=-(4+\sqrt{3})$ *ref* $\angle=80{,}10°$ $x=-80{,}1°$ or/*of* $99{,}9°$	✓80,10° ✓99,90° ✓–80,1° (3)
6.3.1		✓(30° ; 1) ✓(–60° ; 0) ✓shape/*vorm* (3)
6.3.2	$\therefore \sin(x+60°)>-2\cos x$ $x\in(-80{,}10°\ ;\ 99{,}90°)$ **OR/*OF*** $-80{,}10°<x<99{,}90°$	✓✓critical values/ *kritiese waardes* ✓notation/*notasie* (3) **[13]**

QUESTION/*VRAAG* 8

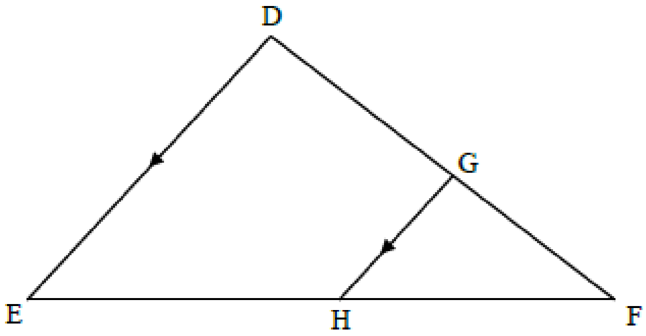


8.1	$\tan y = \frac{p}{AB}$ $AB = \frac{p}{\tan y}$	✓ correct trig ratio ✓ answer (2)
8.2	In ΔBAC: $\frac{\sin B\hat{A}C}{BC} = \frac{\sin A\hat{C}B}{AB}$ $\frac{\sin(180° - 2x)}{2p} = \frac{\sin x}{AB}$ $\frac{\sin 2x}{2p} = \sin x \times \left(\frac{\tan y}{p}\right)$ $\frac{2\sin x \cos x}{2p} = \sin x \times \left(\frac{\tan y}{p}\right)$ $2\cos x = \left(\frac{\tan y}{p}\right)(2p)$ $\cos x = \tan y$	✓ $\frac{\sin B\hat{A}C}{2p} = \frac{\sin A\hat{C}B}{AB}$ ✓ $B\hat{A}C = 180° - 2x$ ✓ substitute AB ✓ $2\sin x \cos x$ (4)
8.3	$\cos x = \tan y$ $\tan y = \cos 60°$ $\tan y = 0{,}5$ $y = 26{,}57°$	✓ substitution of 60° ✓ answer (2)
		[8]

PROPORTIONALITY

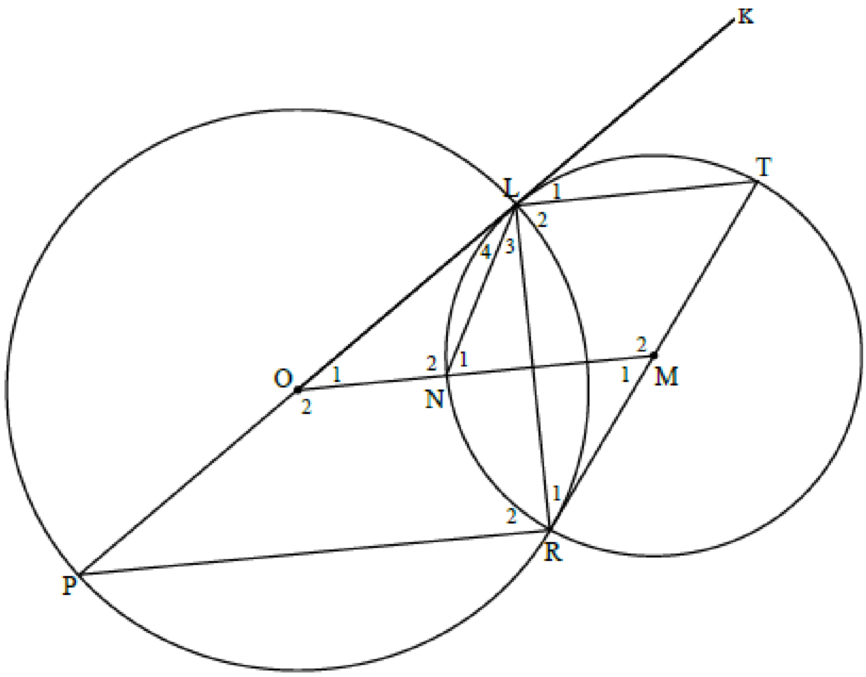
QUESTION/*VRAAG* 9

9.1



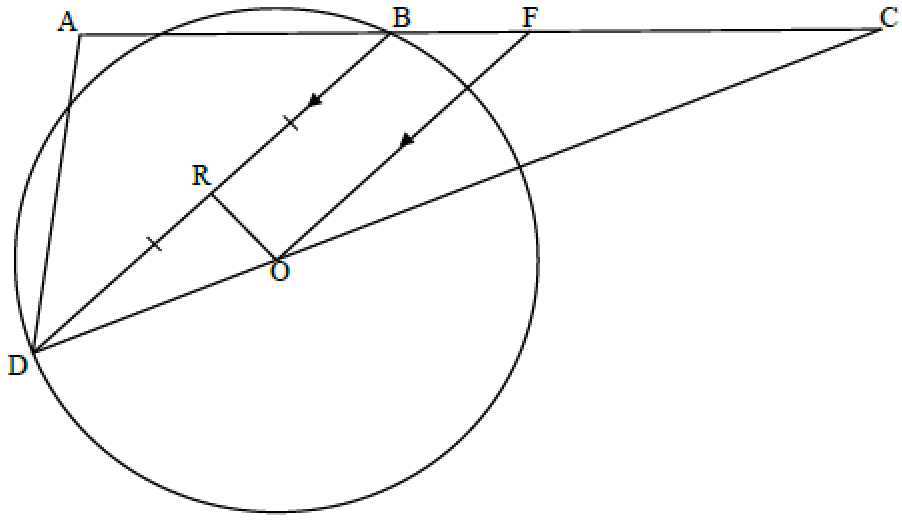
9.1.1	$\frac{HF}{EH}=\frac{GF}{DF}=\frac{2}{5}$	[line || to one side of Δ] **OR** [prop theorem; GH || DE]	✓ S ✓ R (2)
9.1.2	$\frac{EH}{EF}=\frac{DG}{DF}=\frac{5}{7}$ $\frac{EH}{21}=\frac{5}{7}$ $EH=15cm$	[line || to one side of Δ] **OR** [prop theorem; GH || DE]	✓ S ✓ answer (2)
9.1.3	ΔFGH ||| **ΔFDE**	[∠∠∠]	✓ S (1)
9.1.4	$\frac{GH}{DE}=\frac{FH}{FE}$ $\frac{GH}{DE}=\frac{2}{7}$	[|||Δ's]	✓ S ✓ S (2)

9.2



9.2.1	$\hat{L}_2 = 90°$ [∠ in semi-circle] **OR** $\hat{L}_1 = \hat{R}_1$ [tan chord theorem] $\hat{R}_2 = 90°$ [∠ in semi-circle] $\hat{R}_1 = \hat{P}$ [tan chord theorem] $\therefore \hat{L}_2 = \hat{R}_2$ $\therefore \hat{L}_1 = \hat{P}$ $\therefore$ LT || PR [alt ∠s =] $\therefore$ LT || PR [corresp. ∠s =]	✓ S ✓ R ✓ S/R ✓ R (4)
9.2.2	$\hat{L}_1 = \hat{R}_1$ [tan chord theorem] $\hat{L}_1 = \hat{O}_1$ [corresp. ∠s; LT || PR] $\therefore \hat{R}_1 = \hat{O}_1$ $\therefore$ L, O, R and M are concyclic. $\therefore$ LORM is a cyclic quadrilateral [converse ∠s in the same seg]	✓ S ✓ R ✓ S/R ✓ S ✓ R (5)
9.2.3	$O\hat{L}R = \hat{M}_1$ [∠s in the same seg] $2\hat{L}_3 = \hat{M}_1$ [∠ at centre = 2 × ∠ at circumference] $\therefore O\hat{L}R = 2\hat{L}_3$ $\therefore \hat{L}_3 = \frac{1}{2} O\hat{L}R$ $\therefore \hat{L}_4 = \hat{L}_3$ $\therefore$ LN bisects $O\hat{L}R$	✓ S/R ✓ S ✓ R ✓ S (4)
		[20]

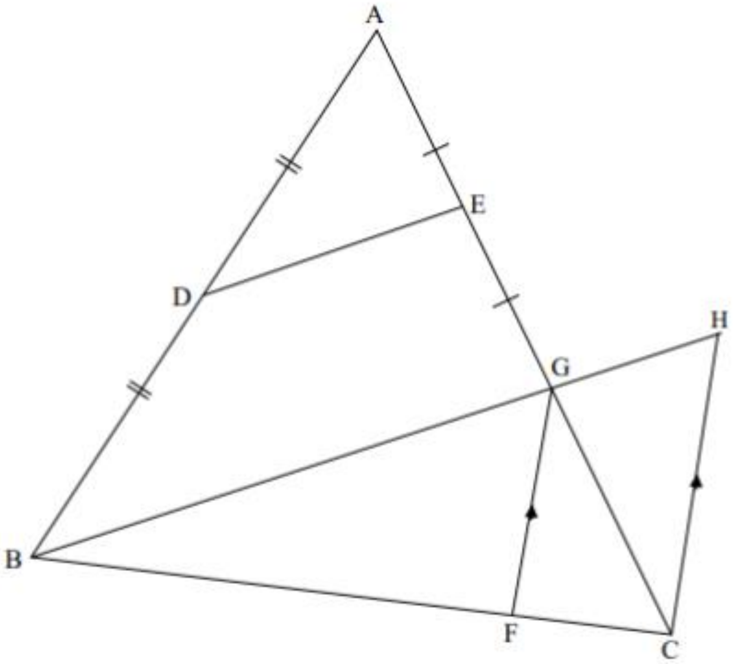
10.2



10.2.1	In ΔCFO and ΔCBD		
	$\hat{C}=\hat{C}$	[common]	✓ S
	$C\hat{F}O = C\hat{B}D$	[corresp ∠s; BD ∥ FO]	✓ S/ R
	$C\hat{O}F = C\hat{D}B$	[sum of ∠s in Δ] **OR** [corresp ∠s; AB ∥ CD]	✓ S **OR** R
	$\Delta CFO \;\|\|\| \;\Delta CBD$	[∠∠∠]	(3)
10.2.2	$\frac{FO}{BD} = \frac{CO}{CD}$	[||| Δs]	✓ S/R
	$FO.CD = CO.BD$		
	But $R\hat{D}O = F\hat{C}O$	[given]	
	$\therefore BD = BC$	[sides opp equal ∠s]	✓ S/R
	$\therefore\ FO.CD = CO.BC$		(2)

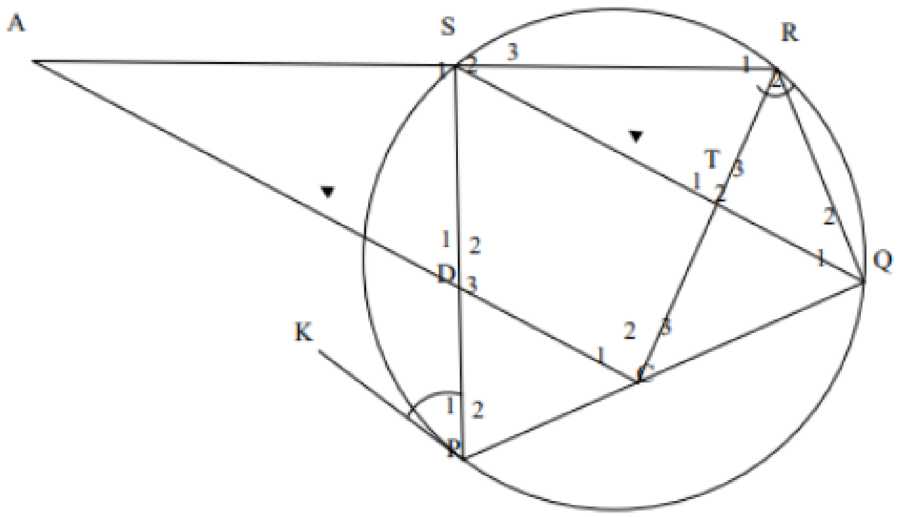
10.2.3	BD = BC = 12 units [sides opp equal ∠s] RD = 6 units [DR = RB] $\frac{RO}{RD}=\frac{3}{4}$ $\therefore RO=\frac{3}{4}(6)$ RO = 4,5 units OR ⊥ BD [line from centre to midpt of chord] $\therefore DO=\sqrt{6^2+4{,}5^2}$ [Pythagoras] DO = 7,5 units $\frac{BF}{BC}=\frac{DO}{DC}$ [line ‖ to one side of Δ] **OR**/***OF*** [prop theorem BD ‖ FO] $\therefore \frac{BF}{12}=\frac{7{,}5}{19{,}2}$ $BF=\frac{7{,}5\times 12}{19{,}2}$ $BF=\frac{75}{16}$ units	✓ S ✓ S ✓ S/R ✓ S ✓ S/R ✓ S (6)
10.2.4	$\tan R\hat{D}O=\frac{RO}{RD}=\frac{3}{4}$ $R\hat{D}O=36{,}87°$ $F\hat{C}O=R\hat{D}O=36{,}87°$ [given] $\therefore A\hat{B}D=73{,}74°$ [ext ∠ of Δ]	✓ S ✓ S ✓ answer (3)
		[20]

8.2



8.2.1	Midpt theorem/*Midpt. Stelling* **OR/*OF*** Converse prop intercept theorem	✓R (1) ✓R (1)
8.2.2	BG = 2DE or $6x-2$ [Midpt theorem/*Midpt. stelling*] BG = $6x-2$ $\frac{GH}{BG}=\frac{FC}{BF}$ [line ∥ one side of Δ **OR** prop theorem; FG ∥ CH / *lyn ∥ een sy v.* Δ] $\frac{x+1}{6x-2}=\frac{1}{4}$ $4x+4=6x-2$ $2x=6$ $x=3$ **OR/*OF***	✓S ✓R ✓S ✓R ✓ equation into x ✓ answer (6)

QUESTION/*VRAAG* 10



10.1	$\hat{P}_1 = \hat{Q}_1$ [tan-chord theorem/$\angle$ *tussen raaklyn en koord*] $\hat{S}_1 = \hat{Q}_1 + \hat{Q}_2$ [ext $\angle$ of cyclic quad/*buite* $\angle$ *v. kvh*] $\therefore \hat{S}_1 = \hat{P}_1 + \hat{Q}_2$ $\hat{T}_2 = \hat{R}_2 + \hat{Q}_2$ [ext $\angle$ of Δ/*buite* $\angle$ *v.* Δ] but $\hat{P}_1 = \hat{R}_2$ [given/*gegee*] $\hat{T}_2 = \hat{P}_1 + \hat{Q}_2$ $\therefore \hat{S}_1 = \hat{T}_2 = \hat{P}_1 + \hat{Q}_2$	✓ S ✓ S / R ✓ S ✓ S (4)
10.2	In Δ ASD and ΔACR $\hat{A} = \hat{A}$ [common $\angle$/*gemeenskaplike* $\angle$] $\hat{S}_1 = \hat{T}_2$ [proven/*reeds bewys*] $\hat{T}_2 = \hat{C}_2$ [alt $\angle$s; QS || CA/verw. $\angle$*e*; QS || CA] $\therefore \hat{S}_1 = \hat{C}_2$ $\hat{D}_1 = \hat{R}_1$ [sum of $\angle$s in Δ/$\angle$*e v.* Δ] ΔASD ||| ΔACR $\therefore \frac{AD}{AR} = \frac{AS}{AC}$ [corresponding sides in proportion/ *ooreenstemmende sy in dies. verhouding*] **OR/*OF***	✓ identifying Δ's ✓ S ✓ S / R ✓ S ✓ S (5)

	In Δ ASD and ΔACR $\hat{A} = \hat{A}$ [common ∠/*gemeenskaplike* ∠] $\hat{S}_1 = \hat{T}_2$ [proven/*gegee*] $\hat{T}_2 = \hat{C}_2$ [alt ∠s; QS ∥ CA/verw. ∠*e*; QS ∥ CA] $\therefore \hat{S}_1 = \hat{C}_2$ ΔASD ∥∥ ΔACR [∠;∠;∠] $\therefore \frac{AD}{AR} = \frac{AS}{AC}$ [corresponding sides in proportion/ *ooreenstemmende sy in dies. verhouding*]	✓ identifying Δ's ✓ S ✓ S/R ✓ S ✓ R (5)
10.3	$\frac{AS}{AC} = \frac{SD}{CR}$ [ΔASD ∥∥ ΔACR] $\therefore AS = \frac{AC \times SD}{CR}$ $\frac{AS}{AR} = \frac{CT}{CR}$ [line ∥ one side of Δ OR prop theorem; TS ∥ CA/*lyn* ∥ *een sy v.* Δ] $\therefore AS = \frac{AR \times CT}{CR}$ $\therefore \frac{AC \times SD}{CR} = \frac{AR \times CT}{CR}$ $\therefore AC \times SD = AR \times CT$	✓ S ✓ S ✓ R ✓ equating (4)
		[13]