basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

SENIOR CERTIFICATE/*SENIOR SERTIFIKAAT*
NATIONAL SENIOR CERTIFICATE/
NASIONALE SENIOR SERTIFIKAAT

GRADE/*GRAAD* 12

MATHEMATICS P2/*WISKUNDE V2*

NOVEMBER 2020

MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS/*PUNTE*: 150

These marking guidelines consist of 27 pages.
Hierdie nasienriglyne bestaan uit 27 bladsye.

NOTE:

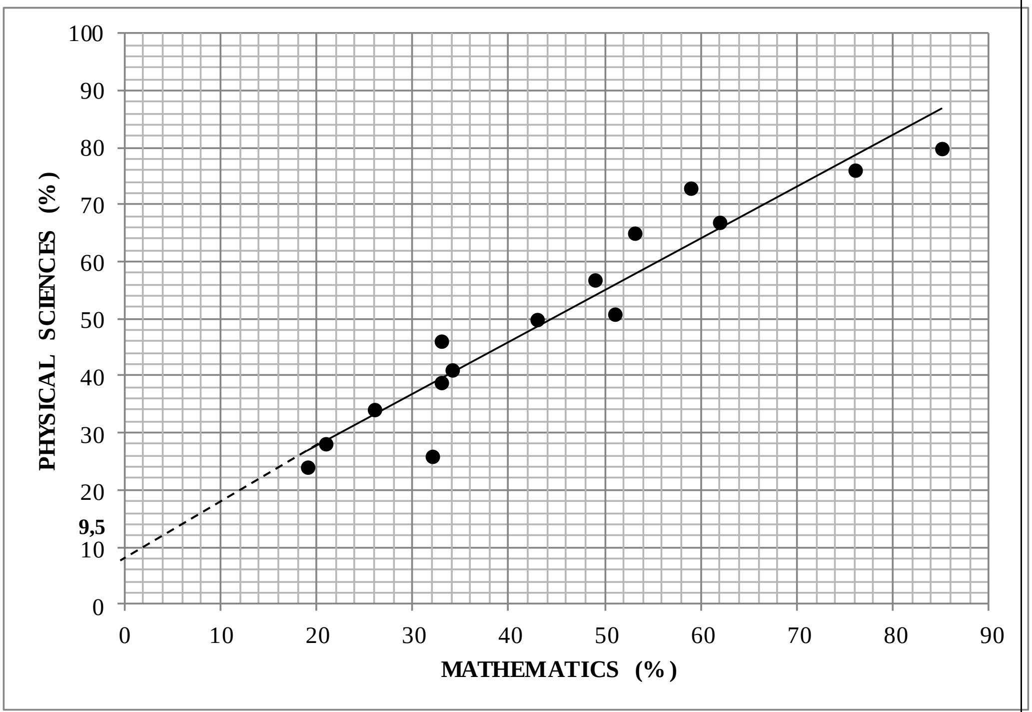
- If a candidate answers a question TWICE, only mark the FIRST attempt.
- If a candidate has crossed out an attempt of a question and not redone the question, mark the crossed out version.
- Consistent accuracy applies in ALL aspects of the marking memorandum. Stop marking at the second calculation error.
- Assuming answers/values in order to solve a problem is NOT acceptable.

LET WEL:

- *As 'n kandidaat 'n vraag TWEE KEER beantwoord, sien slegs die EERSTE poging na.*
- *As 'n kandidaat 'n antwoord van 'n vraag doodtrek en nie oordoen nie, sien die doodgetrekte poging na.*
- *Volgehoue akkuraatheid word in ALLE aspekte van die memorandum 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/*VRAAG* 1

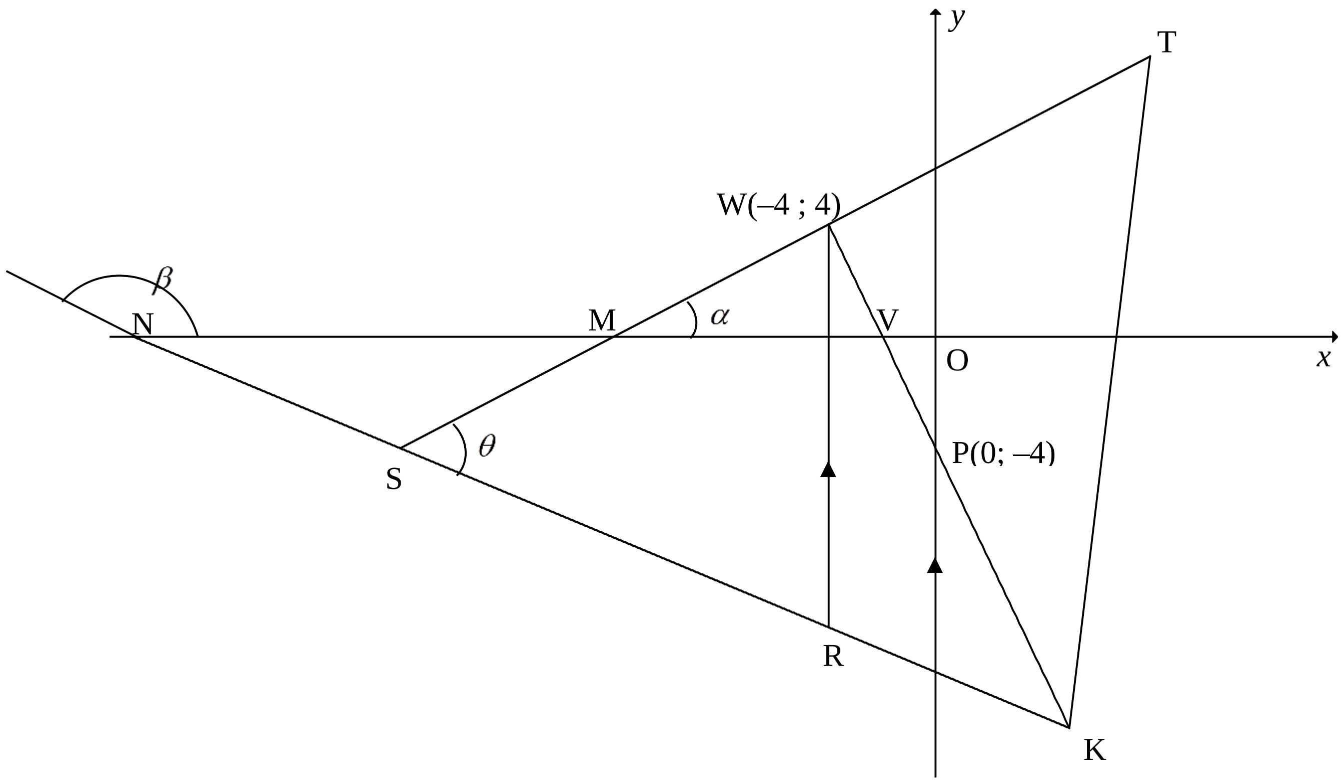
1.1	$a = 9{,}5$ $b = 0{,}909.. = 0{,}91$ $\hat{y} = 9{,}5 + 0{,}91x$	✓ $a = 9{,}5$ ✓ $b = 0{,}91$ ✓ equation (3)
1.2		✓✓ correct slope going through 2 points: (50 ; 55) or (40 ; 46) or (60 ; 64) or (0 ; 9,5) or (45 ; 50) (2)
1.3	Final exam mark $\approx$ 72,22% (calculator) **OR** $\hat{y} = 9{,}5 + 0{,}91(69)$ $\approx$ 72,29%	✓✓ answer (2) ✓ substitution ✓ answer (2)
1.4	*r* = 0,95	✓ answer(A) (1)
1.5	There is a **very strong positive** correlation between the Mathematics and Physical Sciences mark. *Daar is 'n baie sterk positiewe korrelasie tussen die Wiskunde en Fisiese Wetenskappunte.*	✓ **strong/ *sterk*** (1)
1.6	The teacher concludes that the higher the learners' Mathematics marks, the higher the learners' Physical Sciences marks. *Die onderwyser het waargeneem dat hoe hoër die wiskunde punte is, hoe hoër is die Fisiese Wetenskappunte.*	✓ answer (1)
		[10]

QUESTION/*VRAAG* 2

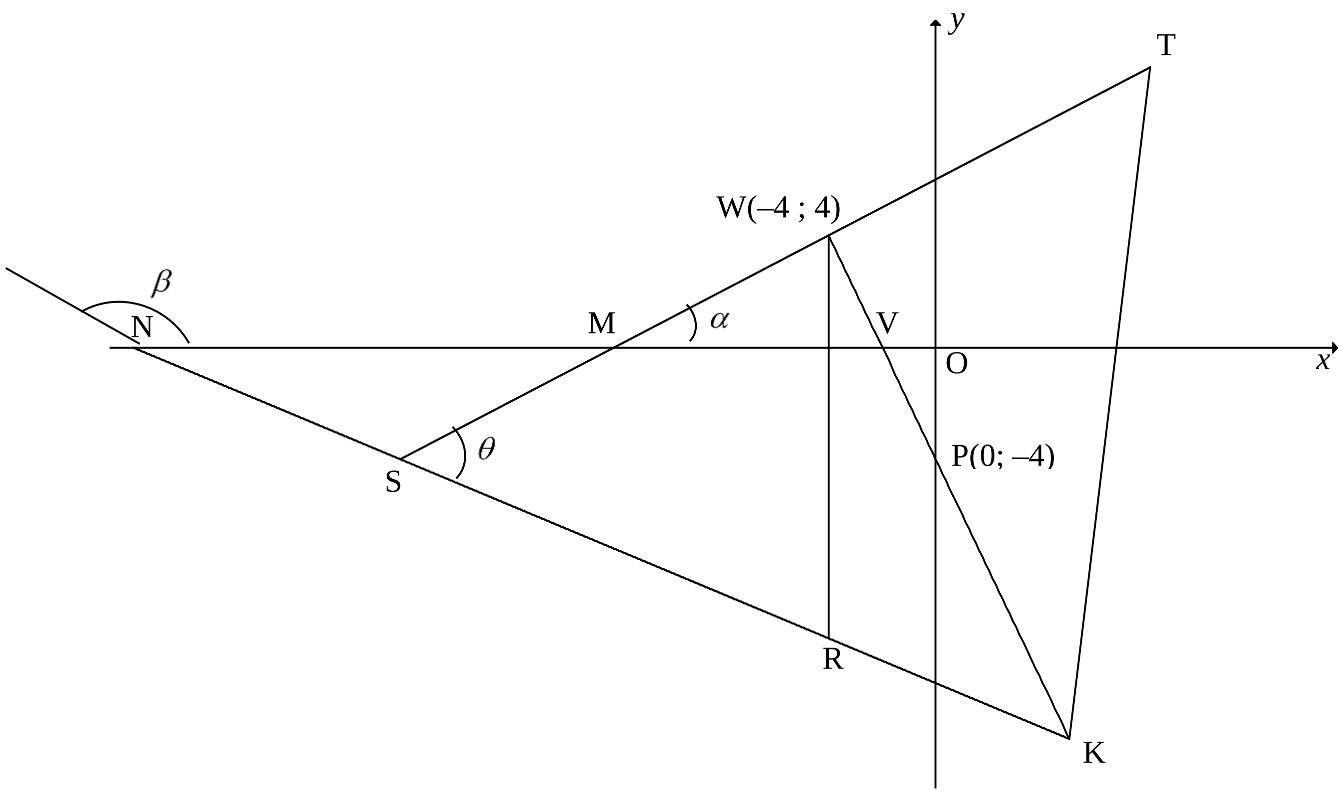
2 018	**2 175**	**2 182**	**2 215**	**2 254**	**2 263**	**2 267**	**2 271**	**2 293**	**2 323**	**2 334**	**2 346**

2.1	July / *Julie*	✓ answer (1)
2.2	$\bar{x} = \frac{26\,941}{12}$ Answer only: Full marks = 2 245,083.. ≈ 2 245,08 aircraft landings	✓ 26 941 ✓ answer (2)
2.3	Standard deviation for landings at the King Shaka International airport: $\sigma = 86{,}30$	✓✓ answer (2)
2.4	$(\bar{x}-\sigma\,;\bar{x}+\sigma)$ = (2 245,08 – 86,30 ; 2 245,08 + 86,30) limit = (2 158,78 ; 2 331,38) There were **9** months when the aircraft arrivals at the King Shaka International airport were within one standard deviation of the mean.	✓ $\bar{x}-\sigma$ ✓ $\bar{x}+\sigma$ ✓ answer (3)
2.5	The standard deviation of the number of landings at the Port Elizabeth Airport will be higher than the standard deviation of the number of arrivals at the King Shaka International Airport **OR C.**	✓ answer (1)
		[9]

QUESTION/*VRAAG* 3



3.1	$m_{\text{WP}} = \dfrac{4-(-4)}{-4-0} = \dfrac{8}{-4}$ $m_{\text{WP}} = -2$	✓ substitution of W and P ✓ m_{WP} (2)
3.2	$m_{\text{ST}} = \dfrac{1}{2}$ (given) $(m_{\text{WP}})(m_{\text{ST}}) = (-2)\left(\dfrac{1}{2}\right)$ $= -1$ $\therefore \text{ST} \perp \text{WP}$	✓ $(m_{\text{WP}})(m_{\text{ST}})$ ✓ $(m_{\text{WP}})(m_{\text{ST}}) = -1$ (2)
3.3	$5y + 2x + 60 = 0$ $\therefore y = -\dfrac{2}{5}x - 12$ $-\dfrac{2}{5}x - 12 = \dfrac{1}{2}x + 6$ $-4x - 120 = 5x + 60$ $9x = -180$ $x = -20$ $\therefore y = -\dfrac{2}{5}(-20) - 12$ $\therefore y = -4$ $\therefore$ S(–20; –4) **OR**	✓ equating ✓ x value ✓ substitution ✓ y value (4)

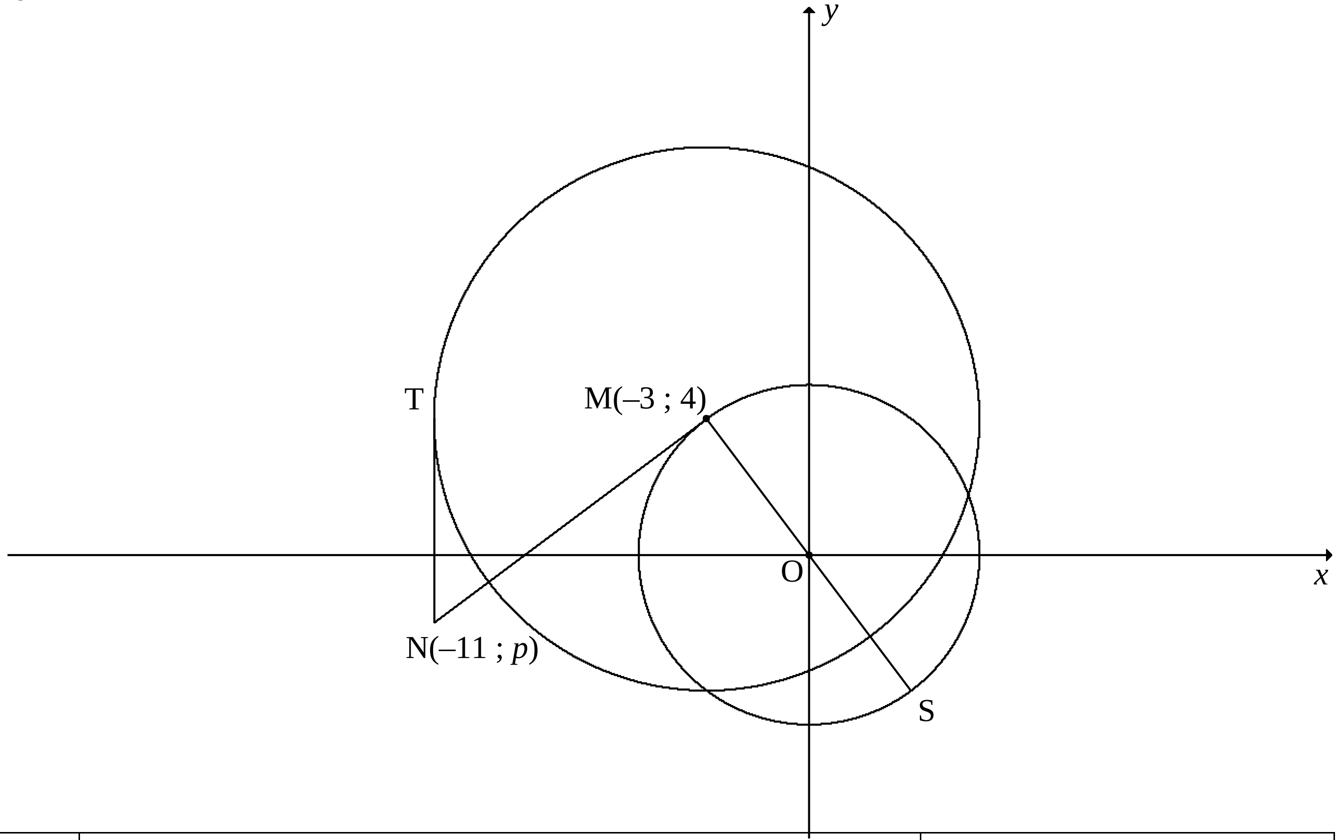


	$5y+2x+60=0$ $5\left(\frac{1}{2}x+6\right)+2x+60=0$ $\frac{5}{2}x+30+2x+60=0$ $\frac{9}{2}x=-90 \qquad \therefore x=-20$ $\therefore y=-\frac{2}{5}(-20)-12$ $\therefore y=-4$ $\therefore$ S(–20; –4) **OR** $5y+2x=-60$ ....(1) $2y-x=12$ ....(2) $(1)+2(2): 9y=-36$ $y=-4$ $2(-4) - x = 12$ $x=-20$	✓ substitution ✓ x value ✓ substitution ✓ y value (4) ✓ adding ✓ y value ✓ substitution ✓ x value (4)

3.4	$y=-\frac{2}{5}(-4)-12$ OR $5y+2(-4)+60=0$ $y=-\frac{52}{5}$ $\therefore \text{R}\left(-4;-\frac{52}{5}\right)$ OR R(–4 ; –10,4) $\therefore \text{WR}=4-\left(-\frac{52}{5}\right)$ OR $\text{WR}=\sqrt{(-4-(-4))^2+(4-\left(-\frac{52}{5}\right))^2}$ $\therefore \text{WR}=\frac{72}{5}$ units or $\text{WR}=14\frac{2}{5}$ units **OR** $\text{WR}=\text{ST}-\text{SK}$ $=\frac{1}{2}x+6-\left(-\frac{2}{5}x-12\right)$ $=\frac{9}{10}x+18$ $=\frac{9}{10}(-4)+18$ $=14{,}4$ units	✓ substitution ✓ y value ✓ method or subst into distance formula ✓ answer (4) ✓ substitution ✓ simplification ✓ subst x = –4 ✓ answer (4)
3.5	$m_{\text{SK}}=-\frac{2}{5}$ $\beta=158{,}19...°$ (Ref. $\angle$ =21, 801…°) $\text{M}\hat{\text{N}}\text{S}=21{,}80...°$ $m_{\text{ST}}=\frac{1}{2}$ $\text{N}\hat{\text{M}}\text{S}=26{,}56...°$ $\theta=21{,}80...°+26{,}56...°$ [ext $\angle$ of Δ] $\theta=48{,}366...°=48{,}37°$	✓ m_{SK} ✓ size of β ✓ size of $\text{N}\hat{\text{M}}\text{S}$ ✓ method ✓ answer (5)
3.6	In ΔSRW: $\perp h$ = –4 – (–20) $\perp h$ = 16units $\text{Area } \Delta\text{SRW}=\frac{1}{2}(\perp h)(\text{WR})$ $=\frac{1}{2}(16)\left(\frac{72}{5}\right)$ $=115{,}2$ square units Area SWRL = 2Area ΔSRW =2(115,2) = 230,4square units **OR**	✓ $\perp h$ ✓ substitution ✓ area Δ ✓ answer (4)

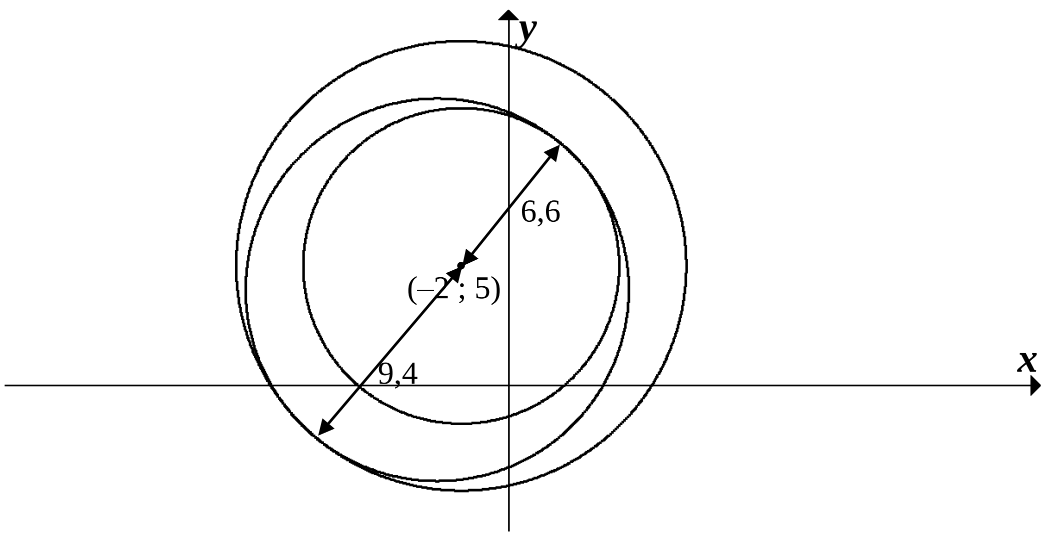
	In ΔSRW: $\perp h = -4 - (-20)$ $\perp h = 16$units Area SWRL $= 16 \times \dfrac{72}{5}$ $= 230,40$ square units	✓ $\perp h$ ✓ ✓ substitution ✓ answer (4)
	OR $\text{SW} = \sqrt{(-20+4)^2 + (-4-4)^2} = 8\sqrt{5} = 17,89$ $\text{SR} = \sqrt{(-20+4)^2 + \left(-4+10\dfrac{2}{5}\right)^2} = \dfrac{16\sqrt{29}}{5} = 17,23$ Area SWRL = $2 \times$ Area ΔSRW $= 2\left(\dfrac{1}{2}\text{SW} \times \text{SR} \sin\theta\right)$ $= 2\left(\dfrac{1}{2} 8\sqrt{5} \times \dfrac{16\sqrt{29}}{5} \sin 48,37°\right)$ $= 230,41$square units	✓SW $= 8\sqrt{5}$ ✓SR$= \dfrac{16\sqrt{29}}{5}$ ✓substitution ✓answer (4)
		[21]

QUESTION/*VRAAG* 4

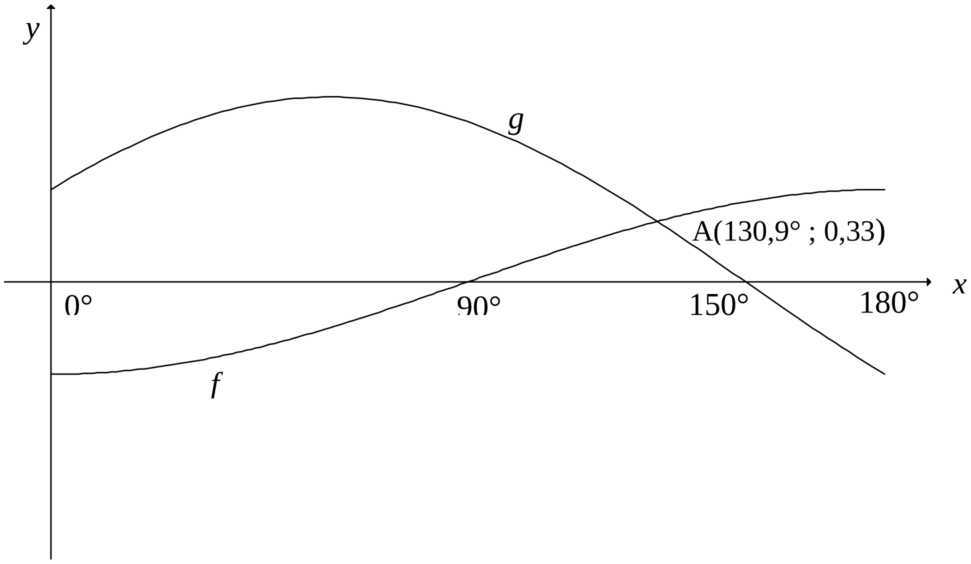


4.1	$x^2+y^2=r^2$ $\therefore r^2=(-3)^2+(4)^2=25$ $x^2+y^2=25$	✓ substitution ✓ answer (2)
4.2	TM ⊥ TN [tangent ⊥ radius] T(–11 ; 4) $r=-3-(-11)=8$ $(x+3)^2+(y-4)^2=64$	✓ $x_T=-11$ ✓ LHS ✓ RHS (3)
4.3	O (0 ; 0) and M(–3; 4) $m_{\text{OM}}=\frac{4-0}{-3-0}=-\frac{4}{3}$ OR $\frac{0-4}{0-(-3)}=-\frac{4}{3}$ $m_{\text{NM}}=\frac{3}{4}$ $y-4=\frac{3}{4}(x-(-3))$ **OR** $y=\frac{3}{4}x+c$ $y-4=\frac{3}{4}x+\frac{9}{4}$ $4=\frac{3}{4}(-3)+c$ $\therefore y=\frac{3}{4}x+\frac{25}{4}$ $c=\frac{25}{4}$ $y=\frac{3}{4}x+\frac{25}{4}$	✓ $m_{\text{OM}}=-\frac{4}{3}$ ✓ $m_{\text{NM}}=\frac{3}{4}$ ✓ substitution of m and M ✓ equation (4)

4.4	N(–11 ; p) $y=\frac{3}{4}x+\frac{25}{4}$ $p=\frac{3}{4}(-11)+\frac{25}{4}$ OR $\frac{4-p}{-3-(-11)}=\frac{3}{4}$ $p=-2$ $\therefore \text{N}(-11;-2)$ $\frac{-3+x_S}{2}=0$ and $\frac{4+y_S}{2}=0$ $\therefore \text{S}(3;-4)$ $\text{SN}=\sqrt{(-11-3)^2+(-2-(-4))^2}$ $=10\sqrt{2}$ units or 14,14 units	✓ subst x = –11 into eq or gradient ✓ $p=-2$ ✓ x_S ✓ y_S ✓ answer (CA) (5)
4.5	$\text{B}(-2;\,5)$ $\text{BM}=\sqrt{2}$ units Radius of circle centred at M = 8 units $k=8-\sqrt{2}$ or $k=8+\sqrt{2}$ = 6,59 units = 9,41 units = 6,6 units = 9,4 units	✓ $\sqrt{2}$ ✓✓ $k=6{,}6$ ✓✓ $k=9{,}4$ (5)
		[19]

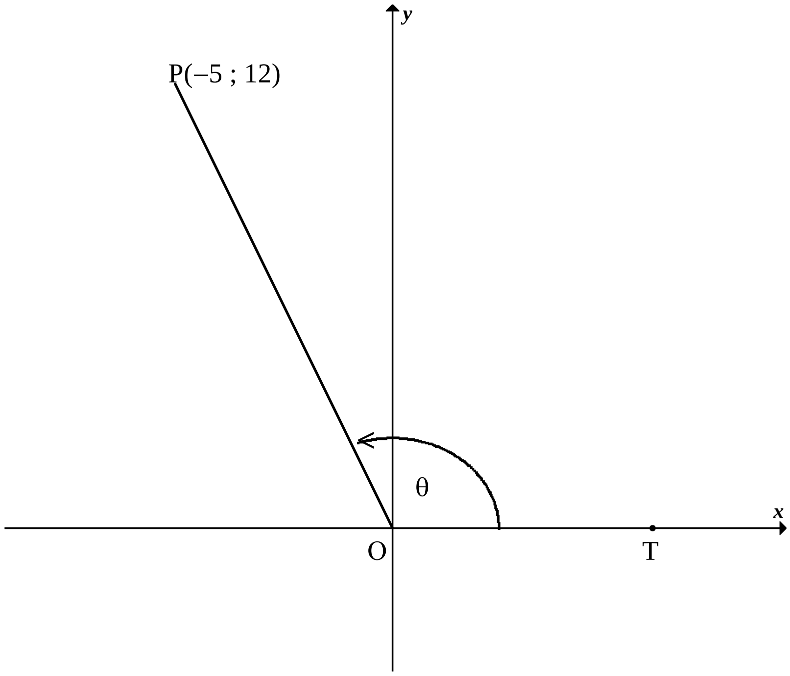


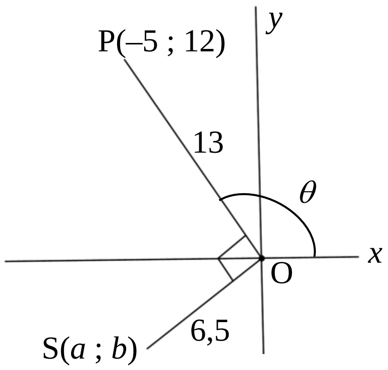
QUESTION/*VRAAG* 5



5.1	Period of g = 360°	✓ answer (1)
5.2	Amplitude of $f = \frac{1}{2}$	✓ answer (A) (1)
5.3	$f(180°) - g(180°)$ $= \frac{1}{2} - \left(-\frac{1}{2}\right)$ = 1	✓ 1 (1)
5.4.1	$x = 140{,}9°$	✓ $x = 140{,}9°$ (1)
5.4.2	$\sqrt{3}\sin x + \cos x \geq 1$ $\frac{\sqrt{3}}{2}\sin x + \frac{1}{2}\cos x \geq \frac{1}{2}$ $\sin x\cos 30° + \cos x\sin 30° \geq \frac{1}{2}$ $\sin(x+30°) \geq \frac{1}{2}$ $\sin(x+30°) = \frac{1}{2}$ at $x = 0°$ or $x = 120°$ $\therefore x \in [0°;120°]$ **OR** $0° \leq x \leq 120°$	✓ dividing by 2 ✓ $\cos 30°; \sin 30°$ ✓ $\sin(x+30°) \geq \frac{1}{2}$ ✓ interval (4)
		[8]

QUESTION/*VRAAG* 6

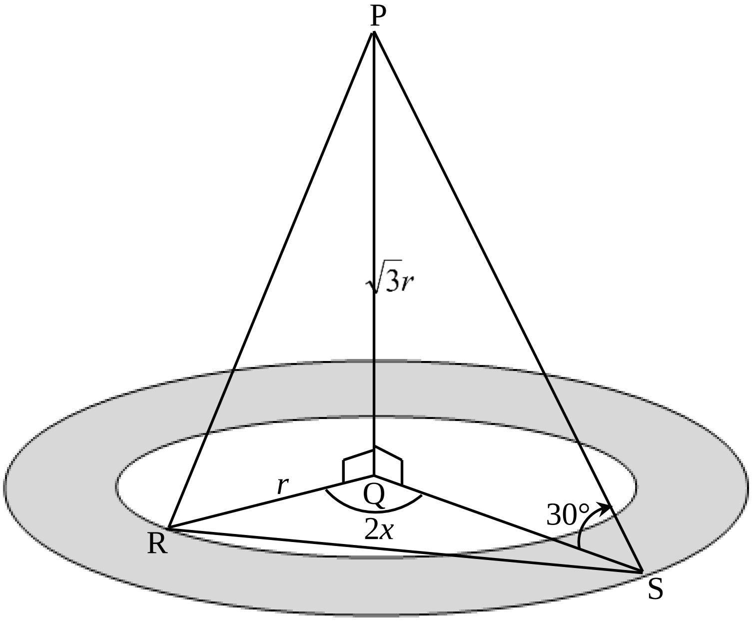


6.1.1	$\tan\theta = -\frac{12}{5}$ or $-2\frac{2}{5}$	✓answer (1)
6.1.2	$(\text{OP})^2 = (-5)^2 + (12)^2$ $\text{OP} = 13$ $\cos\theta = -\frac{5}{13}$	✓ Pythagoras ✓ OP ✓ answer (3)
6.1.3	$\sin(\theta + 90°) = \frac{b}{6{,}5}$ $\cos\theta = \frac{b}{6{,}5}$ $\frac{-5}{13} = \frac{b}{6{,}5}$ $b = -\frac{5}{2}$  **OR** $\cos(90° + \theta) = \frac{a}{6{,}5}$ $-\sin\theta = \frac{a}{6{,}5}$ $-\frac{12}{13} = \frac{a}{6{,}5}$ $\therefore a = -6$ $b = \sqrt{(6{,}5)^2 - (-6)^2} = -\frac{5}{2}$	✓ $\sin(\theta + 90°) = \frac{b}{6{,}5}$ ✓ $\cos\theta$ ✓ $\frac{-5}{13} = \frac{b}{6{,}5}$ ✓ value of b (4) ✓ $\cos(\theta + 90°) = \frac{a}{6{,}5}$ ✓ $-\sin\theta$ ✓ value of a ✓ value of b (4)

6.2	$\dfrac{\sin 2x.\cos(-x)+\cos 2x.\sin(360°-x)}{\sin(180°+x)}$ $=\dfrac{\sin 2x\ \cos x\ +\ \cos 2x(-\sin x)}{-\sin x}$ $=\dfrac{\sin(2x-x)}{-\sin x}$ $=\dfrac{\sin x}{-\sin x}$ $=-1$	✓ $\cos(-x)=\cos x$ ✓ $\sin(360°-x)=-\sin x$ ✓ $\sin(180°+x)=-\sin x$ ✓ numerator = $\sin x$ ✓ answer (5)
6.3	$6\sin^2 x+7\cos x-3=0$ $6(1-\cos^2 x)+7\cos x-3=0$ $6-6\cos^2 x+7\cos x-3=0$ $6\cos^2 x-7\cos x-3=0$ $(3\cos x+1)(2\cos x-3)=0$ $\cos x=-\dfrac{1}{3}$ or $\cos x=\dfrac{3}{2}$ (N/A) $\therefore\ x=109{,}47°+k.360°;\ k\in Z$ or $x=250{,}53°+k.360°;\ k\in Z$	✓ identity ✓ standard form ✓ factors ✓ both solutions of $\cos x$ ✓ $x=109{,}47°\ \&\ 250{,}53°$ ✓ $+k.360°;\ k\in Z$ (6)
6.4	$x+\dfrac{1}{x}=3\cos A$ $(3\cos A)^2=\left(x+\dfrac{1}{x}\right)^2$ $9\cos^2 A=x^2+\dfrac{1}{x^2}+2$ $9\cos^2 A=2+2$ $\cos^2 A=\dfrac{4}{9}$ $\cos 2A=2\cos^2 A-1$ $=2\left(\dfrac{4}{9}\right)-1$ $=-\dfrac{1}{9}$ **OR**	✓squaring both sides ✓ $9\cos^2 A=x^2+\dfrac{1}{x^2}+2$ ✓ $\cos^2 A=\dfrac{4}{9}$ ✓ $\cos 2A=2\cos^2 A-1$ ✓ answer (5)

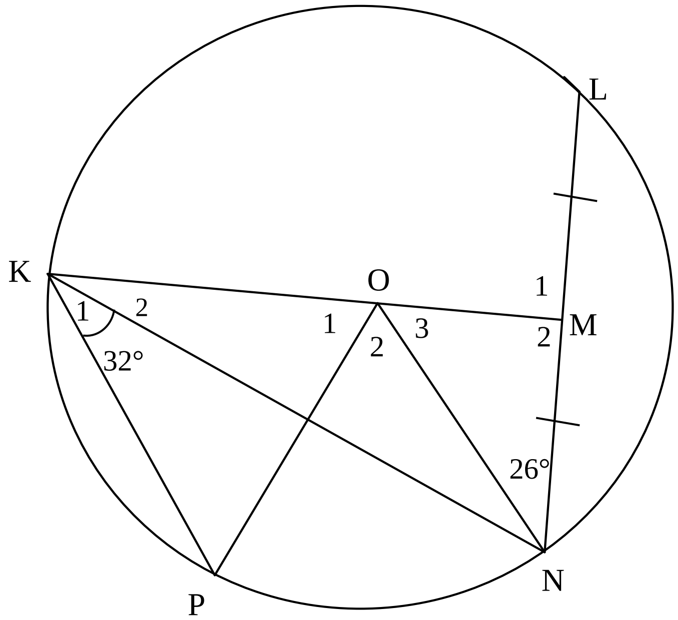
	$x^2 - 2 + \frac{1}{x^2} = 0$ $\left(x - \frac{1}{x}\right)^2 = 0$ $x^2 = 1$ $x = \pm 1$ $3\cos A = 2$ or $3\cos A = -2$ $\cos A = \frac{2}{3}$ or $\cos A = -\frac{2}{3}$ $\cos 2A = 2\cos^2 A - 1$ $= 2\left(\pm\frac{2}{3}\right)^2 - 1$ $= -\frac{1}{9}$	✓ $x = \pm 1$ ✓ $\cos A = \frac{2}{3}$ ✓ $\cos A = -\frac{2}{3}$ ✓double angle identity ✓ answer (5)
		[24]

QUESTION/*VRAAG* 7



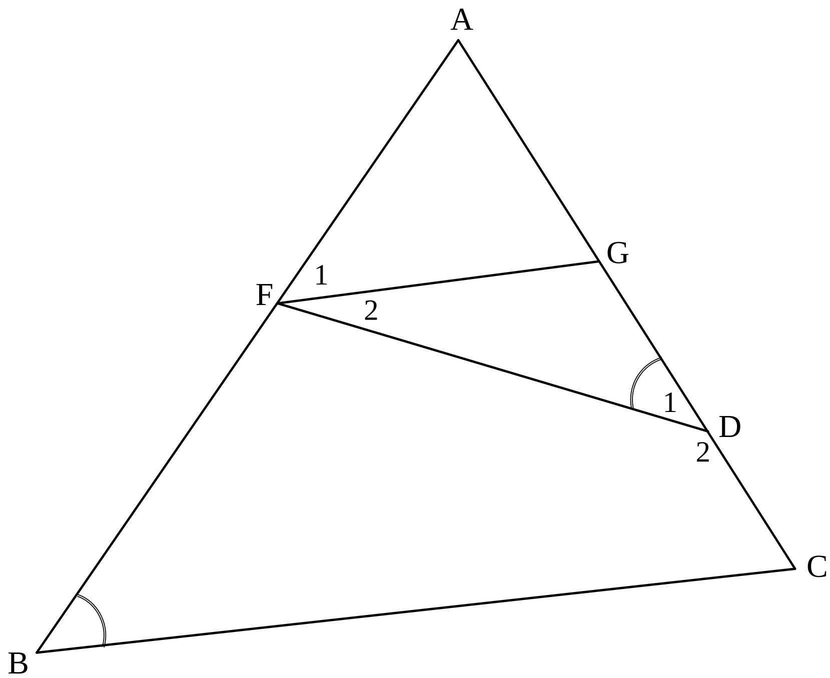
7.1	$\tan 30° = \frac{\sqrt{3}r}{QS}$ **OR** $\tan 60° = \frac{QS}{\sqrt{3}r}$ $QS = \frac{\sqrt{3}r}{\tan 30°}$ $\sqrt{3} = \frac{QS}{\sqrt{3}r}$ $= \frac{\sqrt{3}r}{\frac{1}{\sqrt{3}}}$ *or* $\frac{\sqrt{3}r}{\frac{\sqrt{3}}{3}}$ $QS = 3r$ $= 3r$	✓✓ trig ratio ✓ QS subject (3)
7.2	$\text{Area of flower garden} = \pi(3r)^2 - \pi r^2$ $= 9\pi r^2 - \pi r^2$ $= 8\pi r^2$	✓ substitution into difference of areas ✓ answer (2)
7.3	$RS^2 = r^2 + (3r)^2 - 2(r)(3r)\cos 2x$ $= r^2 + 9r^2 - 6r^2 \cos 2x$ $= 10r^2 - 6r^2 \cos 2x$ $= r^2(10 - 6\cos 2x)$ $RS = r\sqrt{10 - 6\cos 2x}$	✓substitution into cosine rule correctly ✓ $10r^2 - 6r^2 \cos 2x$ ✓ $r^2(10 - 6\cos 2x)$ (3)
7.4	$RS = 10\sqrt{10 - 6\cos 2(56)}$ $= 34{,}9966...$ ≈ 35 m	✓substitution ✓ answer (2)
		[10]

QUESTION/*VRAAG* 8



8.1.1(a)	$\hat{O}_2 = 64°$ [$\angle$ at centre = 2 ×$\angle$ at circumference/ *Middelpts* $\angle$ = 2 ×$\angle$ *omtreks*$\angle$]	✓ S ✓ R (2)
8.1.1(b)	$\hat{M}_2 = 90°$ [Line from centre to midpt of chord/*lyn v midpt na midpt v koord*] $K\hat{O}N = 90° + 26° = 116°$ [ext $\angle$ of Δ/*buite* $\angle$ *van* Δ] $\hat{O}_1 = 116° - 64° = 52°$ **OR** $\hat{M}_2 = 90°$ [Line from centre to midpt of chord/*lyn v midpt na midpt v koord*] $\hat{O}_3 = 64°$ [sum of $\angle$s in Δ] $\hat{O}_1 = 52°$ [$\angle$s on straight line/*op 'n reguitlyn*]	✓ S ✓ R ✓ S ✓ answer (4) ✓ S ✓ R ✓ S ✓ answer (4)
8.1.2	$P\hat{K}O + \hat{P} = 128°$ [sum of $\angle$s in Δ/*som* $\angle$*e van* Δ] $P\hat{K}O = \hat{P}$ [$\angle$s opp = sides/$\angle$*e teenoor = sye*] $= 64°$ $\therefore \hat{K}_2 = 32°$ *or* $\hat{K}_2 = \hat{K}_1$ $\therefore$ KN bisects/*halveer* $O\hat{K}P$ **OR** $\hat{K}_2 = K\hat{N}O$ [$\angle$s opp = sides/$\angle$*e teenoor = sye*] $\hat{K}_2 + K\hat{N}O = 64°$ [sum of $\angle$s in Δ/*som* $\angle$*e van* Δ] $\therefore \hat{K}_2 = 32°$ *or* $\hat{K}_2 = \hat{K}_1$ $\therefore$ KN bisects/*halveer* $O\hat{K}P$	✓ S ✓ S ✓ S (3) ✓ S ✓ S ✓ S (3)

8.2

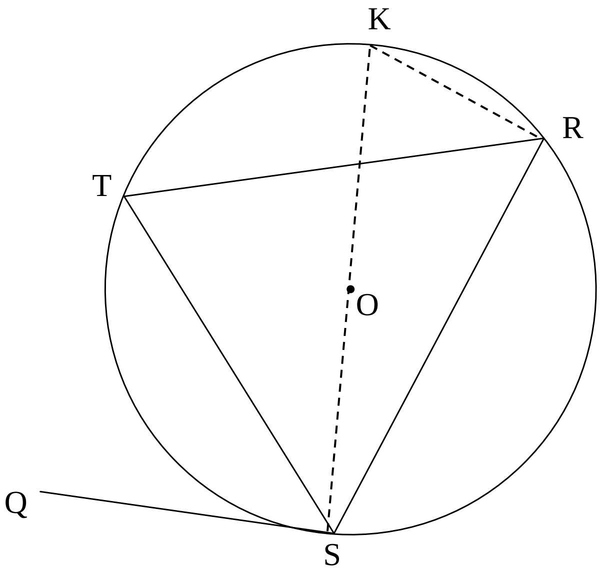


8.2.1	$\hat{F}_1 = \hat{D}_1$ [tan chord theorem/*raaklyn koordst*] $\hat{D}_1 = \hat{B}$ [Given/*Gegee*] $\therefore \hat{F}_1 = \hat{B}$ $\therefore FG \parallel BC$ [corresp ∠s =/*Ooreenkomstige∠e* =]	✓ S ✓ R ✓ $\hat{F}_1 = \hat{B}$ ✓ R (4)
8.2.2	$\frac{GC}{AC} = \frac{FB}{AB}$ [line ‖ one side of Δ/*lyn* ‖ *een sy v Δ*] $\frac{x+9}{2x-6} = \frac{5}{7}$ $7x + 63 = 10x - 30$ $3x = 93$ $x = 31$ **OR** $AG = 2x - 6 - (x+9) = x - 15$ $\frac{AG}{GC} = \frac{AF}{FB}$ [line ‖ one side of Δ/*lyn* ‖ *een sy v Δ*] $\frac{x-15}{x+9} = \frac{2}{5}$ $5x - 75 = 2x + 18$ $3x = 93$ $x = 31$ **OR**	✓ S ✓ R ✓ substitution ✓ answer (4) ✓ S ✓ R ✓ substitution ✓ answer (4)

	$\frac{AF}{AB}=\frac{AG}{AC}$ [line ∥ one side of Δ /lyn ∥ een sy v Δ] $\frac{2}{7}=\frac{x-15}{2x-6}$ $7x-105=4x-12$ $3x=93$ $x=31$	✓ S ✓ R ✓ substitution ✓ answer (4)
		[17]

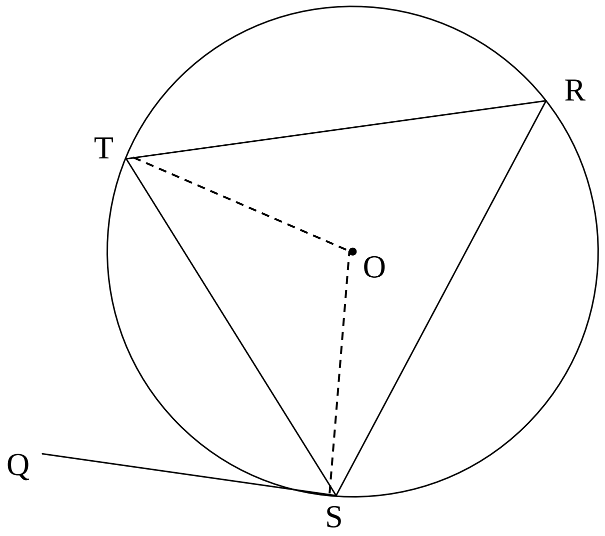
QUESTION/*VRAAG* 9

9.1



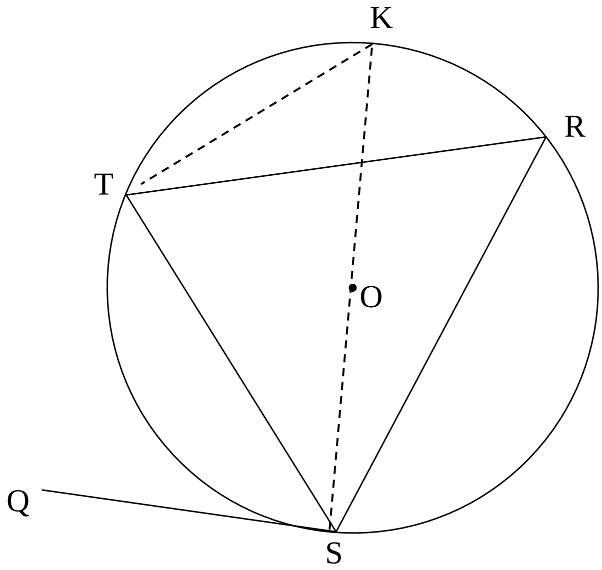
9.1	Construction: Draw diameter KS and draw KR *Konstruksie: Trek middellyn KS en verbind KR* $Q\hat{S}T = 90° - T\hat{S}K$ [radius ⊥ tangent/*raaklyn*] $S\hat{R}K = 90°$ [∠ in semi circle/*halfsirkel*] $\therefore S\hat{R}T = 90° - K\hat{R}T$ $T\hat{S}K = T\hat{R}K$ [∠s same segment/*∠e dieselfde segment*] $\therefore Q\hat{S}T = \hat{R}$	✓ construction ✓ S/R ✓ S/R ✓ S ✓ S/R (5)

OR



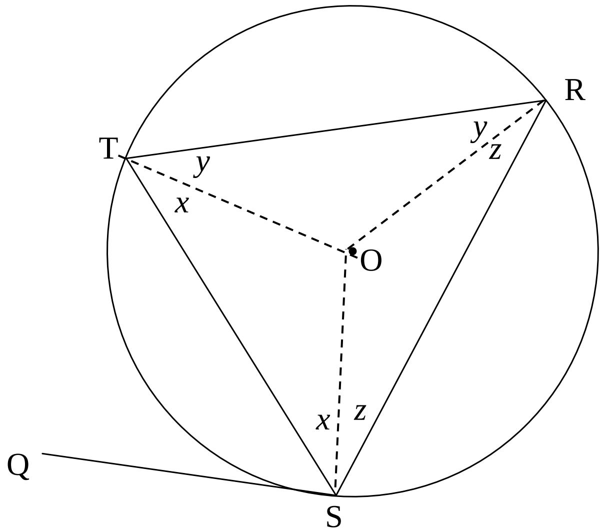
9.1	Construction: Draw radii OS and OT *Konstruksie: Trek radii OS en OT* $Q\hat{S}T = 90° - O\hat{S}T$ [radius ⊥ tangent/*raaklyn*] $O\hat{S}T = S\hat{T}O$ [∠s opp = sides/∠*e teenoor = sye*] $\therefore S\hat{O}T = 180° - 2O\hat{S}T$ [∠s of Δ/∠*e van Δ*] $\hat{R} = 90° - O\hat{S}T$ [∠ at centre = 2×∠ circumf/ *midpts∠ = 2× omtreks∠*] $\therefore Q\hat{S}T = \hat{R}$	✓ construction ✓ S/R ✓ S/R ✓ S ✓ S/R (5)

OR



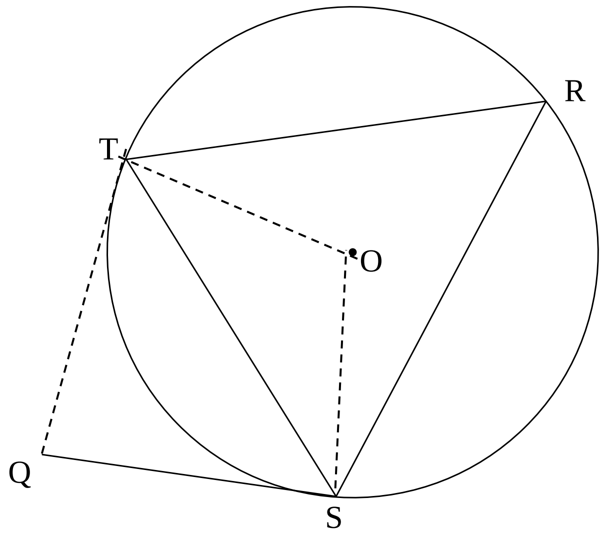
9.1	Construction: Draw diameter KS and join K to T. *Konstruksie: Trek middellyn KS en verbind K tot T* $Q\hat{S}T = 90° - T\hat{S}K$ [radius ⊥ tangent/*raaklyn*] $S\hat{T}K = 90°$ [∠ in semi circle/*halfsirkel*] $\therefore \hat{K} = 90° - T\hat{S}K$ $\therefore Q\hat{S}T = \hat{K}$ but $\hat{R} = \hat{K}$ [∠s same segment/∠*e dieselfde segment*] $\therefore Q\hat{S}T = \hat{R}$	✓ construction ✓ S/R ✓ S/R ✓ S ✓ S/R (5)

OR



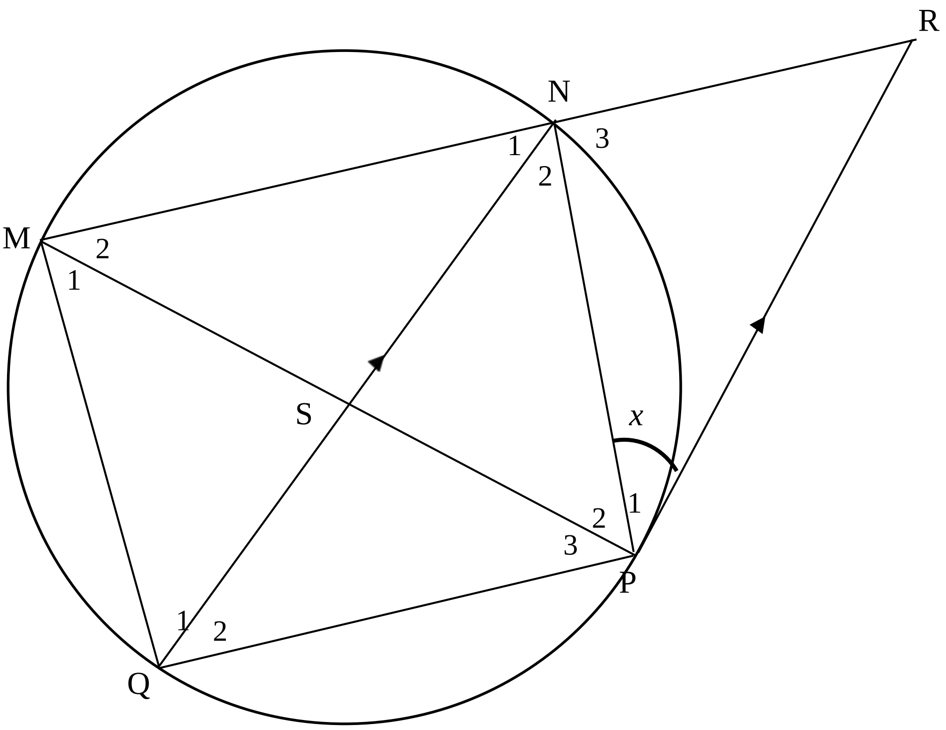
9.1	Construction: Draw radii OT, OR and OS *Konstruksie: Trek radiuse OT, OR en OS* $\text{O}\hat{\text{S}}\text{T} = \text{O}\hat{\text{T}}\text{S}$ [∠s opp = radii/∠*e teenoor = radiuse*] Also: $\text{O}\hat{\text{T}}\text{R} = \text{O}\hat{\text{R}}\text{T}$ and $\text{O}\hat{\text{R}}\text{S} = \text{O}\hat{\text{S}}\text{R}$ $2x + 2y + 2z = 180°$ [∠s of Δ] $x + y + z = 90°$ $y + z = 90° - x$ $\text{O}\hat{\text{S}}\text{Q} = 90°$ [radius ⊥ tangent/*raaklyn*] $\therefore\ \text{T}\hat{\text{S}}\text{Q} = 90° - x$ $\therefore\ \text{T}\hat{\text{S}}\text{Q} = y + z = \hat{\text{R}}$	✓ construction ✓ S/R ✓ S ✓ S/R ✓ S (5)

OR



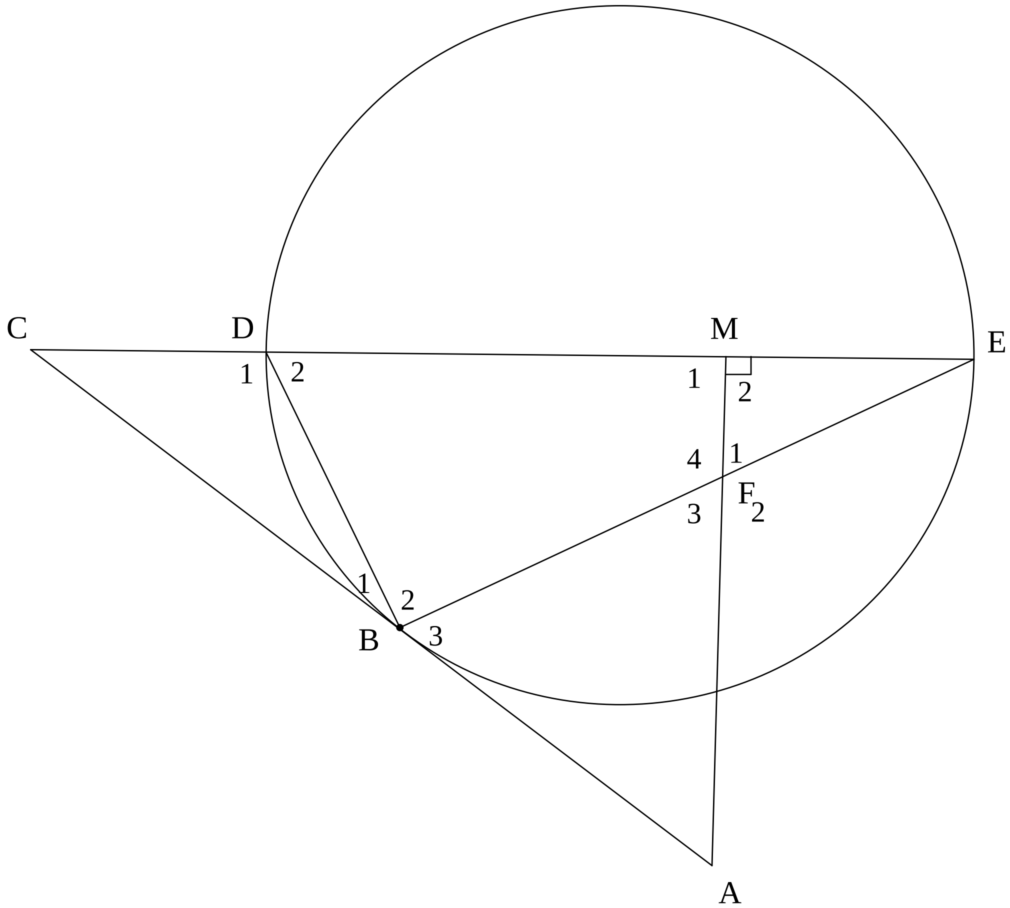
9.1	Construction: Draw radii OT and OS, tangent QT *Konstruksie: Trek radiuse OT en OS, raaklyn QT* $\text{O}\hat{\text{S}}\text{Q} = 90°$ [radius ⊥ tangent/*raaklyn*] $\therefore\ \text{T}\hat{\text{S}}\text{Q} = 90° - \text{T}\hat{\text{S}}\text{O}$ $\therefore\ \text{T}\hat{\text{S}}\text{O} = \text{S}\hat{\text{T}}\text{O}$ [∠s opp = radii/*∠e teenoor = radiuse*] $\text{T}\hat{\text{O}}\text{S} = 180° - 2\text{T}\hat{\text{S}}\text{O}$ [∠s of Δ] $\hat{\text{R}} = 90° - \text{T}\hat{\text{S}}\text{O}$ [∠ at centre = 2×∠ circumf/ *midpts∠ = 2× omtreks∠*] $\therefore\ \text{T}\hat{\text{S}}\text{Q} = \hat{\text{R}}$	✓ construction ✓ S/R ✓ S ✓ S ✓ S/R (5)

9.2



9.2.1(a)	$\hat{N}_2 = x$	[alt ∠s; PR ∥ NQ/*verw. ∠e;* PR ∥ NQ]	✓ S ✓ R (2)
9.2.1(b)	$\hat{Q}_2 = x$ OR $M_2 = x$ $\hat{Q}_2 = x$	[tan chord theorem/*raaklyn koordstelling*] [tan chord theorem/*raaklyn koordstelling*] [∠s in same segment/*∠e in dieselfde segm*]	✓ S ✓ R (2) ✓ S/R ✓ S/R (2)
9.2.2	$\frac{MN}{NR} = \frac{MS}{SP}$ $\hat{N}_1 = \hat{N}_2 = x$ $\hat{P}_3 = x$ $\hat{P}_3 = \hat{Q}_2$ SQ = PS $\frac{MN}{NR} = \frac{MS}{SQ}$	[QN ∥ PR; Prop Th] [given] [∠s in same segment/*∠e in dieselfde segm*] [= *x*] [sides opp = ∠/*sye teenoor = ∠e*]	✓ S ✓ R ✓ S ✓ S ✓ R ✓ R (6)
			[15]

QUESTION/*VRAAG* 10



10.1.1	$D\hat{B}E = 90°$ [$\angle$ in semi-circle/$\angle$ *in halfsirkel*] $\therefore D\hat{M}A = 90°$ [$AM \perp DE$] $\therefore$ FBDM is a cyclic quadrilateral/*koordevh* [converse opp $\angle$s cyclic quad/*omgek teenoorst* $\angle$*e kvh*] **OR** $D\hat{B}E = 90°$ [$\angle$ in semi-circle/$\angle$ *in halfsirkel*] $\hat{M}_2 = D\hat{B}E = 90°$ $\therefore$ FBDM is a cyclic quadrilateral/*koordevh* [converse ext$\angle$ of cyclic quad/*omgek buite*$\angle$ *van kvh*]	✓ S ✓ R ✓ R (3) ✓ S ✓ R ✓ R (3)

10.1.2	$\hat{B}_3 = \hat{D}_2$ [tangent chord th/*raaklyn koordst*] $\hat{F}_1 = \hat{D}_2$ [ext $\angle$ cyc quad/*buite* $\angle$ *koordevh*] $\therefore \hat{B}_3 = \hat{F}_1$ **OR** $\hat{B}_1 = \hat{E} = x$ [tangent chord th/*raaklyn koordst*] $\hat{F}_1 = 90° - x$ [$\angle$ sum in Δ/$\angle$ *van* Δ] $\hat{D}_2 = 90° - x$ [$\angle$ sum in Δ/$\angle$ *van* Δ] $\therefore \hat{F}_1 = D_2$ $\hat{B}_3 = \hat{D}_2$ [tangent chord th/*raaklyn koordst*] $\therefore \hat{B}_3 = \hat{F}_1$ **OR** $\hat{B}_1 = \hat{E} = x$ [tangent chord th/*raaklyn koordst*] $\hat{B}_3 = 90° - x$ [straight line/*reguitlyn*] $\hat{F}_1 = 90° - x$ [sum of $\angle$s Δ/ *som van* $\angle$*e van* Δ] $\therefore \hat{B}_3 = \hat{F}_1$	✓ S ✓ R ✓ S ✓ R (4) ✓ S ✓ R ✓ $\hat{F}_1 = 90° - x = \hat{D}_2$ ✓ R (4) ✓ S ✓ R ✓ S ✓ S (4)
10.1.3	In ΔCDB and ΔCBE $\hat{C} = \hat{C}$ [common $\angle$/*gemeenskaplike* $\angle$] $C\hat{B}D = C\hat{E}B$ [tangent chord th/*raaklyn koordst*] $C\hat{D}B = C\hat{B}E$ [$\angle$ sum in Δ/$\angle$ *van* Δ] ΔCDB ||| ΔCBE **OR** In ΔCDB and ΔCBE $C\hat{B}D = C\hat{E}B$ [tangent chord th/*raaklyn koordst*] $\hat{C} = \hat{C}$ [common $\angle$/*gemeenskaplike* $\angle$] ΔCDB ||| ΔCBE [$\angle$, $\angle$, $\angle$]	✓ S ✓ S/R ✓ R (3) ✓ S/R ✓ S ✓ R (3)
10.2.1	$\frac{BC}{EC} = \frac{DC}{BC}$ [||| Δs] $BC^2 = EC \times DC$ $= 8 \times 2$ $= 16$ $BC = 4$	✓ ratio ✓ substitution ✓answer (3)

10.2.2	$\frac{BC}{EC}=\frac{DB}{BE}$ [$\parallel$ Δs] $\frac{DB}{BE}=\frac{4}{8}=\frac{1}{2}$ $BE = 2DB$ $DB^2+BE^2=DE^2$ [Pyth theorem] $DB^2+(2DB)^2=36$ $5DB^2=36$ $DB^2=\frac{36}{5}$ $DB=\frac{6}{\sqrt{5}}=2{,}68$ units	✓ BE = 2DB ✓ substitution into Pyth theorem ✓ $DB^2=\frac{36}{5}$ ✓answer (4)
		[17]

TOTAL/*TOTAAL*: 150