



basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

**NATIONAL
SENIOR CERTIFICATE/
NASIONALE
SENIOR SERTIFIKAAT**

GRADE 12/GRAAD 12

MATHEMATICS P2/WISKUNDE V2

NOVEMBER 2025

MARKING GUIDELINES/NASIENRIGLYNE

MARKS/PUNTE: 150

**These marking guidelines consist of 26 pages./
Hierdie nasienriglyne bestaan uit 26 bladsye.**



SA EXAM PAPERS

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 Guidelines. 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 Nasienriglyne toegepas. Hou op nasien by die tweede berekeningsfout.*
- *Aanvaar van antwoorde/waardes om 'n probleem op te los, word NIE toegelaat nie.*

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



QUESTION/VRAAG 1

AGE OF CAR (IN YEARS)	SELLING PRICE OF CAR (IN RANDS)
2	293 000
3	265 000
3	256 000
4	219 000
4	241 000
4	246 000
6	226 000
6	176 000
7	154 000
7	180 000
8	148 000

1.1	$a = 331\,397,20$ $b = -22\,988,32$ $\hat{y} = 331\,397,20 - 22\,988,32x$	✓ $a = 331\,397,20$ ✓ $b = -22\,988,32$ ✓ equation (3)
1.2	$\hat{y} = 331\,397,20 - 22\,988,32(5)$ $= 216\,455,60$ OR/OF $\hat{y} = 216\,455,61$ (calculator)	✓ substitution ✓ answer (2) ✓✓ answer (2)
1.3	The strong correlation ($r = -0,95$) suggests that the data points lie close to the regression line. Therefore, the prediction will be valid./ <i>'n Sterk korrelasie ($r = -0,95$) dui aan dat die punte naby aan die regressielyn lê.</i> <i>Dus, die voorspelling is geldig.</i>	✓ strong correlation OR $r = -0,95$ ✓ answer (2)
1.4	The average decrease per year is R22 988,32. <i>Die gemiddelde afname per jaar is R 22 988,32.</i>	✓ answer (1)
		[8]



QUESTION/VRAAG 2

TIME, t (IN MINUTES)	CUMULATIVE FREQUENCY
$0 < t \leq 20$	16
$0 < t \leq 40$	40
$0 < t \leq 60$	59
$0 < t \leq 80$	67
$0 < t \leq 100$	70

2.1.1	70	✓ 70 (1)
2.1.2	No. of people = $67 - 40$ = 27	✓ $67 - 40$ ✓ 27 (2)
2.1.3	<p style="text-align: center;">Histogram</p>	<ul style="list-style-type: none"> ✓ two frequencies correct ✓ all frequencies correct ✓ no gaps between bars (3)
2.1.4	Skewed to the right OR positively skewed <i>Skeef na regs OF positief skeef</i>	✓ answer (1)



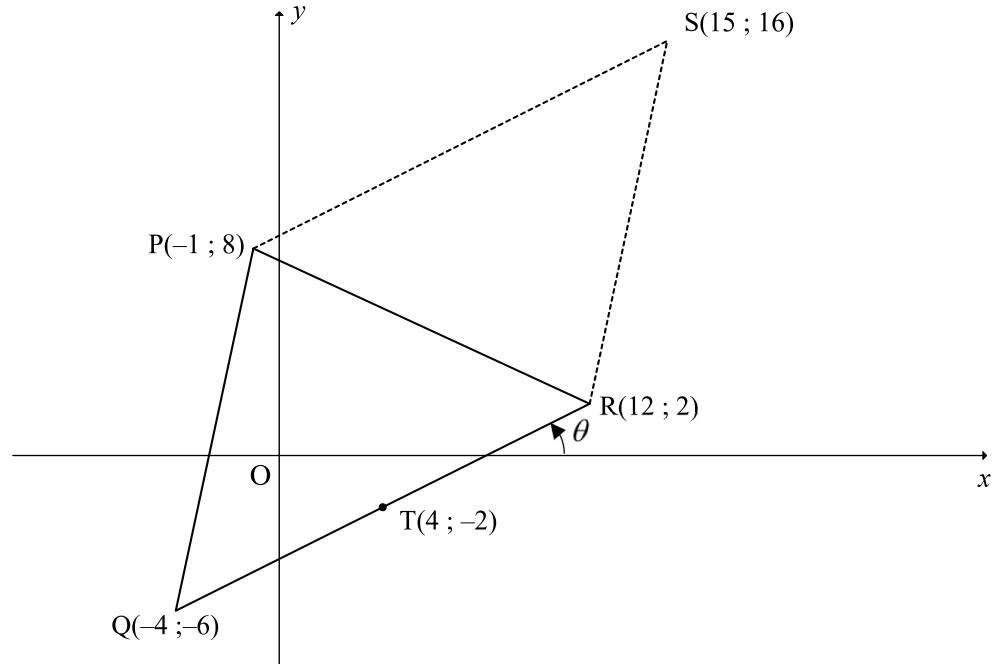
2.2

11	14	19	20	8	10	2	14
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$\frac{11+14+19+20+8+10+2+14+x}{9} = 12$ $x + 98 = 108$ $x = 10$ <p>The 9th player scored 10 points</p> $\sigma = 5,23 \quad (5,22812)$ $(\bar{x} - \sigma; \bar{x} + \sigma) = (12 - 5,23; 12 + 5,23)$ $= (6,77; 17,23)$ <p>3 players' points were outside one standard deviation of the mean. <i>3 spelers se punte aangeteken lê buite een standaardafwyking van die gemiddeld.</i></p>	<p>✓ equating using mean</p> <p>✓ answer</p> <p>✓ standard deviation</p> <p>✓ interval</p> <p>✓ answer</p>	(5)
		[12]



QUESTION/VRAAG 3



3.1	$QR = \sqrt{(-4-12)^2 + (-6-2)^2}$ $= \sqrt{320} = 8\sqrt{5} \text{ units}$	$\checkmark QR = \sqrt{(-4-12)^2 + (-6-2)^2}$ $\checkmark \text{ answer}$	(2)
3.2	$m_{QR} = \frac{-6-2}{-4-12} \quad \text{OR} \quad m_{QR} = \frac{2-(-6)}{12-(-4)}$ $m_{QR} = \frac{1}{2} \qquad m_{QR} = \frac{1}{2}$	$\checkmark \text{ correct substitution of } Q(-4; -6)$ $\text{ \& } R(12; 2) \text{ into gradient formula}$ $\checkmark \text{ answer}$	(2)
3.3	$m_{QR} = \frac{1}{2}$ $\tan \theta = \frac{1}{2}$ $\theta = 26,57^\circ$	$\checkmark \tan \theta = m_{QR}$ $\checkmark \text{ answer}$	(2)
3.4	$m_{QR} = \frac{1}{2}$ $-6 = \frac{1}{2}(-4) + c \quad \text{OR} \quad y - 2 = \frac{1}{2}(x - 12)$ $c = -4 \qquad y - 2 = \frac{1}{2}x - 6$ $y = \frac{1}{2}x - 4 \qquad y = \frac{1}{2}x - 4$	$\checkmark \text{ correct substitution of gradient and}$ $\text{ point } Q(-4; -6) \text{ or } R(12; 2)$ $\checkmark \text{ answer}$	(2)
3.5	$Q \rightarrow R : (x; y) \rightarrow (x + 16; y + 8)$ $\therefore S(15; 16)$	$\checkmark x_s = 15 \quad \checkmark y_s = 16$	(2)



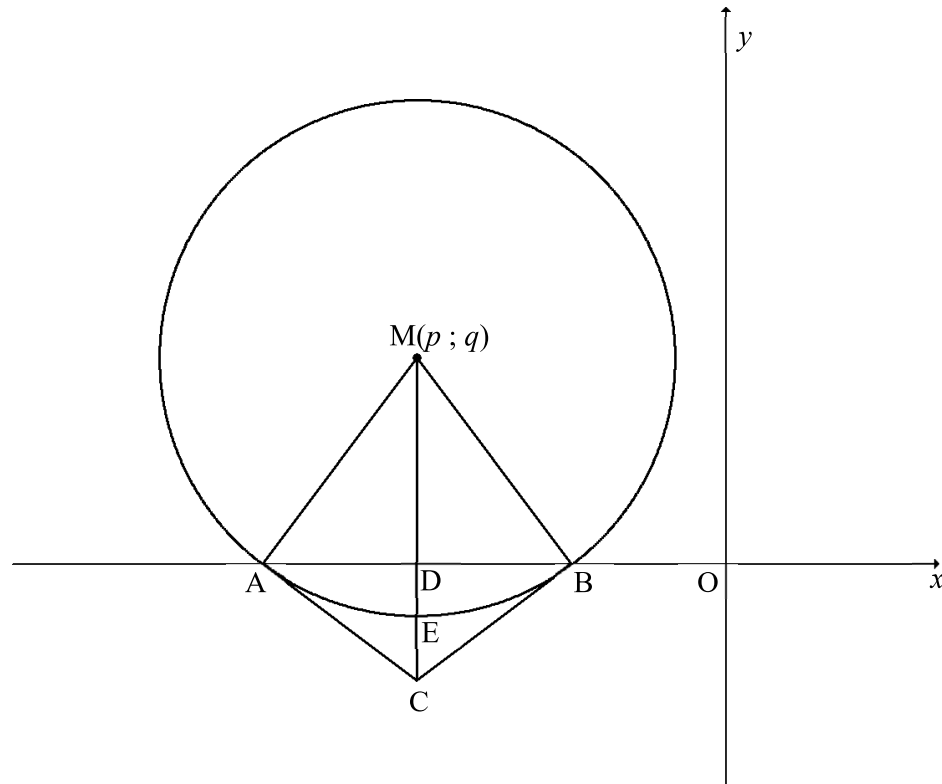
<p>3.6</p>	$m_{QR} = \frac{1}{2}$ $m_{PT} = -2$ <p>Equation of PT:</p> $y = -2x + c \qquad y - y_1 = -2(x - x_1)$ $8 = -2(-1) + c \quad \text{OR} \quad y - 8 = -2(x - (-1))$ $c = 6 \qquad y - 8 = -2x - 2$ $y = -2x + 6 \qquad y = -2x + 6$ $-2x + 6 = \frac{1}{2}x - 4$ $-4x + 12 = x - 8$ $5x = 20$ $x = 4$ $y = \frac{1}{2}(4) - 4$ $y = -2$ <p>T(4; -2)</p> <p>OR</p> $PQ = \sqrt{(-4 - (-1))^2 + (-6 - 8)^2} = \sqrt{205}$ $PR = \sqrt{(12 - (-1))^2 + (2 - 8)^2} = \sqrt{205}$ <p>∴ ΔPQR is isosceles / ΔPQR is 'n gelykbenige Δ</p> <p>∴ ⊥ height bisects the base QR / ⊥ hoogte halveer die basis QR</p> <p>∴ T is midpoint of QR / T is middelpunt van QR</p> <p>∴ T(4; -2)</p>	<p>✓ m_{PT}</p> <p>✓ equation of PT</p> <p>✓ equation QR = equation PT</p> <p>✓ simplification</p> <p>✓ T(x_T; y_T)</p> <p>(5)</p> <p>✓ $PQ = \sqrt{205}$</p> <p>✓ $PR = \sqrt{205}$</p> <p>✓ ΔPQR is isosceles</p> <p>✓ ⊥ height bisects the base QR</p> <p>✓ T(4; -2)</p> <p>(5)</p>
<p>3.7</p>	$PT = \sqrt{(4 - (-1))^2 + (-2 - 8)^2}$ $PT = \sqrt{125} = 5\sqrt{5} \text{ units} = 11,18 \text{ units}$ <p>Area of PQRS = QR.PT</p> $= (8\sqrt{5})(5\sqrt{5})$ $= 200 \text{ units}^2$ <p>OR</p>	<p>✓ length of PT</p> <p>✓ substitution of QR and PT</p> <p>✓ answer</p> <p>(3)</p>



	$PT = \sqrt{(4 - (-1))^2 + (-2 - 8)^2}$ $PT = \sqrt{125} = 5\sqrt{5} \text{ units} = 11,18 \text{ units}$ $\text{Area of } \Delta PQR = \frac{1}{2}(8\sqrt{5})(5\sqrt{5})$ $= 100 \text{ units}^2$ $\text{Area of PQRS} = 2 \times \text{Area of } \Delta PQR$ $= 200 \text{ units}^2$	<p>✓ length of PT</p> <p>✓ substitution of QR and PT</p> <p>✓ answer</p> <p style="text-align: right;">(3)</p>
		[18]



QUESTION/VRAAG 4

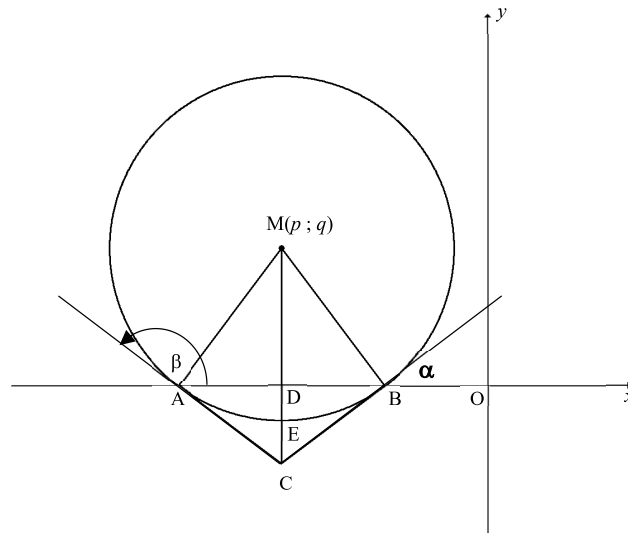


4.1	$p = -6$	✓ $p = -6$	(1)
4.2	$\widehat{M\hat{D}B} = 90^\circ$ [MC y-axis] $AM = ME = q + 1$ [radii] $MD = q$ $AM^2 = AD^2 + MD^2$ [Pythagoras] $(q + 1)^2 = (q - 1)^2 + q^2$ $q^2 + 2q + 1 = q^2 - 2q + 1 + q^2$ $q^2 - 4q = 0$ $q(q - 4) = 0$ $q \neq 0$ or $q = 4$	✓ $AM = q + 1$ ✓ $MD = q$ ✓ substitution into Pythagoras ✓ standard form	(4)
4.3	$AM = 5$ units $(x + 6)^2 + (y - 4)^2 = 25$	✓ LHS ✓ RHS	(2)
4.4	3 units	✓ answer	(1)



4.5	$(x+6)^2 + (0-4)^2 = 25$ $(x+6)^2 = 9$ $x+6 = 3 \quad \text{or} \quad x+6 = -3$ $x = -3 \quad \quad \quad x = -9$ <p>A(-9 ; 0) B(-3 ; 0)</p> <p>OR</p> $(x+6)^2 + (0-4)^2 = 25$ $x^2 + 12x + 36 + 16 - 25 = 0$ $x^2 + 12x + 27 = 0$ $(x+3)(x+9) = 0$ $x = -3 \quad \quad \quad \text{or} \quad x = -9$ <p>A(-9 ; 0) B(-3 ; 0)</p> <p>OR</p> $q - 1 = 3$ <p>DB = AD = 3 [line from centre \perp to chord/ lyn vanuit midpt \perp op koord]</p> <p>A(-9 ; 0) B(-3 ; 0)</p>	<p>✓ substituting $y = 0$ into equation of circle</p> <p>✓ coordinates of A ✓ coordinates of B (3)</p> <p>✓ substituting $y = 0$ into equation of circle</p> <p>✓ coordinates of A ✓ coordinates of B (3)</p> <p>✓ DB = 3 ✓ coordinates of A ✓ coordinates of B (3)</p>
4.6	$m_{MB} = \frac{4-0}{-6-(-3)}$ $= -\frac{4}{3}$ $m_{BC} = \frac{3}{4}$ $y = \frac{3}{4}x + c$ $0 = \frac{3}{4}(-3) + c$ $c = \frac{9}{4}$ $y = \frac{3}{4}x + \frac{9}{4}$ <p>OR</p> $y - y_1 = \frac{3}{4}(x - x_1)$ $y - 0 = \frac{3}{4}[x - (-3)]$ $y = \frac{3}{4}(x + 3)$ $y = \frac{3}{4}x + \frac{9}{4}$	<p>✓ m_{MB}</p> <p>✓ m_{BC}</p> <p>✓ substitution of gradient BC and coordinates of B</p> <p>✓ answer (4)</p>
4.7	$C\left(-6; -\frac{9}{4}\right)$	<p>✓ x_c ✓ y_c (2)</p>





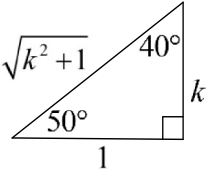
4.8	$\tan \alpha = \frac{3}{4}$ $\alpha = 36,87^\circ$ $m_{AC} = -\frac{3}{4}$ $\tan \beta = -\frac{3}{4}$ $\beta = 180^\circ - 36,87^\circ$ $\beta = 143,13^\circ$ $\therefore \hat{ACB} = 106,26^\circ$ OR $\tan \hat{MAB} = m_{MA} = \frac{4}{3}$ $\hat{MAB} = 53,13^\circ$ $\hat{AMD} = 90^\circ - 53,13^\circ$ $\hat{AMD} = 36,87^\circ$ $\hat{MAC} = 90^\circ \quad [\text{tangent} \perp \text{radius} / \text{raaklyn} \perp \text{radius}]$ $\hat{ACM} = 53,13^\circ$ $\therefore \hat{ACB} = 106,26^\circ \quad [\text{property of kite} / \text{eienskappe van vlieër}]$ OR $\tan \hat{ACD} = \frac{AD}{DC}$ $\tan \hat{ACD} = \frac{3}{\frac{9}{4}} = \frac{4}{3}$ $\hat{ACD} = 53,13^\circ$ $\therefore \hat{ACB} = 106,26^\circ \quad [\text{property of kite} / \text{eienskappe van vlieër}]$	$\checkmark \alpha = 36,87^\circ$ $\checkmark \tan \beta = m_{AC}$ $\checkmark \text{value of } \beta$ $\checkmark \text{answer} \quad (4)$ $\checkmark \hat{MAB}$ $\checkmark \hat{AMD}$ $\checkmark \hat{ACM}$ $\checkmark \text{answer} \quad (4)$ $\checkmark \text{trig ratio in } \triangle ACD \text{ or } \triangle BCD$ $\checkmark \tan \hat{ACD}$ $\checkmark \hat{ACD}$ $\checkmark \text{answer} \quad (4)$
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	<p>OR</p> <p>AB = 6 units AC = BC = $\frac{15}{4}$ units [tangent from same point/ <i>raaklyne vanuit dieselfde punt</i>] $(AB)^2 = (AC)^2 + (BC)^2 - 2(AC)(BC)\cos \hat{C}$ $(6)^2 = \left(\frac{15}{4}\right)^2 + \left(\frac{15}{4}\right)^2 - 2\left(\frac{15}{4}\right)\left(\frac{15}{4}\right)\cos \hat{C}$</p> <p>$\cos \hat{ACB} = -0,28$ $\hat{ACB} = 106,26^\circ$</p> <p>OR</p> <p>$\tan \hat{MAB} = m_{MA} = \frac{4}{3}$ $\hat{MAB} = 53,13^\circ$ AMBC is a cyclic quad/ AMBC is 'n kvh $\therefore \hat{MCB} = 53,13^\circ$ [\angles in the same seg/\anglee in dies segm] $\therefore \hat{ACB} = 106,26^\circ$ [property of kite/eienskappe v vlieër]</p>	<p>✓ AC = BC</p> <p>✓ substitution into cosine-rule</p> <p>✓ simplification</p> <p>✓ answer (4)</p> <p>✓ \hat{MAB}</p> <p>✓ AMBC is a cyclic quad/kvh</p> <p>✓ \hat{MCB}</p> <p>✓ answer (4)</p>
		[21]



QUESTION/VRAAG 5

5.1.1	$r^2 = k^2 + 1^2 \quad [\text{Pythagoras}]$ $r = \sqrt{k^2 + 1}$ $\cos 40^\circ = \frac{k}{\sqrt{k^2 + 1}}$ 	✓ third side = $\sqrt{k^2 + 1}$ ✓ answer (2)
5.1.2	$\frac{2 \sin 25^\circ \cos 25^\circ}{-2 + 4 \sin^2 25^\circ}$ $= \frac{\sin 50^\circ}{-2(1 - 2 \sin^2 25^\circ)}$ $= \frac{\sin 50^\circ}{-2 \cos 50^\circ}$ $= \left(\frac{k}{\sqrt{k^2 + 1}} \right) \div \left(\frac{-2}{\sqrt{k^2 + 1}} \right) \quad \text{OR} = -\frac{1}{2} \tan 50^\circ$ $= -\frac{1}{2} k$	✓ $\sin 50^\circ$ ✓ $-2(1 - 2 \sin^2 25^\circ)$ ✓ double angle ✓ subst OR quotient identity ✓ answer (5)
5.1.3	$\sin 10^\circ = \sin(50^\circ - 40^\circ)$ $= \sin 50^\circ \cos 40^\circ - \cos 50^\circ \sin 40^\circ$ $= \left(\frac{k}{\sqrt{k^2 + 1}} \right) \left(\frac{k}{\sqrt{k^2 + 1}} \right) - \left(\frac{1}{\sqrt{k^2 + 1}} \right) \left(\frac{1}{\sqrt{k^2 + 1}} \right)$ $= \frac{k^2 - 1}{k^2 + 1}$ <p>OR</p> $\sin 10^\circ = \cos 80^\circ$ $= \cos 2(40^\circ)$ $= 2 \cos^2 40^\circ - 1$ $= 2 \left(\frac{k}{\sqrt{k^2 + 1}} \right)^2 - 1$ $= \frac{2k^2}{k^2 + 1} - 1$ $= \frac{k^2 - 1}{k^2 + 1}$ <p>OR</p>	✓ $\sin 10^\circ = \sin(50^\circ - 40^\circ)$ ✓ correct expansion ✓ first term ✓ second term ✓ $\sin 10^\circ = \cos 80^\circ$ ✓ correct expansion ✓✓ substitution (4)



	$\begin{aligned}\sin 10^\circ &= \sin(60^\circ - 50^\circ) \\ &= \sin 60^\circ \cos 50^\circ - \cos 60^\circ \sin 50^\circ \\ &= \left(\frac{\sqrt{3}}{2}\right)\left(\frac{1}{\sqrt{k^2+1}}\right) - \left(\frac{1}{2}\right)\left(\frac{k}{\sqrt{k^2+1}}\right) \\ &= \frac{\sqrt{3}-k}{2\sqrt{k^2+1}}\end{aligned}$	<ul style="list-style-type: none"> ✓ $\sin 10^\circ = \sin(60^\circ - 50^\circ)$ ✓ correct expansion ✓ first term ✓ second term 	(4)
5.2.1	$\begin{aligned}\frac{\sin(540^\circ + x) \cdot \cos(90^\circ + x)}{\sin(-x)} \\ &= \frac{(-\sin x)(-\sin x)}{(-\sin x)} \\ &= -\sin x\end{aligned}$	<ul style="list-style-type: none"> ✓ $\sin(540^\circ + x) = -\sin x$ ✓ $\cos(90^\circ + x) = -\sin x$ ✓ $\sin(-x) = -\sin x$ ✓ answer 	(4)
5.2.2	$x \in (180^\circ; 360^\circ)$ OR $180^\circ < x < 360^\circ$	<ul style="list-style-type: none"> ✓✓ $x \in (180^\circ; 360^\circ)$ ✓✓ $180^\circ < x < 360^\circ$ 	(2) (2)
			[17]



6.2	$\sin^2 x ; \cos^2 x ; \frac{1}{2} \sin 2x$ $\cos^2 x - \sin^2 x = \frac{1}{2} \sin 2x - \cos^2 x$ $\cos^2 x - \sin^2 x = \frac{1}{2} (2 \sin x \cos x) - \cos^2 x$ $\cos^2 x - \sin^2 x = \sin x \cos x - \cos^2 x$ $2 \cos^2 x - \sin x \cos x - \sin^2 x = 0$ $(2 \cos x + \sin x)(\cos x - \sin x) = 0$ $2 \cos x = -\sin x \quad \text{or} \quad \cos x = \sin x$ $\tan x = -2 \quad \text{or} \quad \tan x = 1$ $\text{ref } \angle = 63,43^\circ \quad \text{or} \quad \text{ref } \angle = 45^\circ$ $x = 116,57^\circ + k \cdot 180^\circ \quad \text{or} \quad x = 45^\circ + k \cdot 180^\circ; k \in \mathbb{Z}$ <p>OR</p> $\sin^2 x ; \cos^2 x ; \frac{1}{2} \sin 2x$ $\cos^2 x - \sin^2 x = \frac{1}{2} \sin 2x - \cos^2 x$ $\cos^2 x - \sin^2 x = \frac{1}{2} (2 \sin x \cos x) - \cos^2 x$ $\cos^2 x - \sin^2 x = \sin x \cos x - \cos^2 x$ $\cos^2 x - \sin^2 x - \sin x \cos x + \cos^2 x = 0$ $(\cos x - \sin x)(\cos x + \sin x) + \cos x(\cos x - \sin x) = 0$ $(\cos x - \sin x)(\cos x + \sin x + \cos x) = 0$ $\cos x = \sin x \quad \text{or} \quad 2 \cos x = -\sin x$ $\tan x = 1 \quad \text{or} \quad \tan x = -2$ $\text{ref } \angle = 45^\circ \quad \text{or} \quad \text{ref } \angle = 63,43^\circ$ $x = 45^\circ + k \cdot 180^\circ; k \in \mathbb{Z} \quad \text{or} \quad x = 116,57^\circ + k \cdot 180^\circ$	$\checkmark \cos^2 x - \sin^2 x = \frac{1}{2} \sin 2x - \cos^2 x$ $\checkmark \sin 2x = 2 \sin x \cos x$ $\checkmark \text{ standard form}$ $\checkmark \text{ factors}$ $\checkmark \text{ both equations}$ $\checkmark x = 116,57^\circ$ $\checkmark 116,57^\circ + k \cdot 180^\circ; k \in \mathbb{Z}$ <p style="text-align: right;">(7)</p> $\checkmark \cos^2 x - \sin^2 x = \frac{1}{2} \sin 2x - \cos^2 x$ $\checkmark \sin 2x = 2 \sin x \cos x$ $\checkmark \text{ factors}$ $\checkmark \text{ factors}$ $\checkmark \text{ both equations}$ $\checkmark x = 116,57^\circ$ $\checkmark 116,57^\circ + k \cdot 180^\circ; k \in \mathbb{Z}$ <p style="text-align: right;">(7)</p>
[13]		

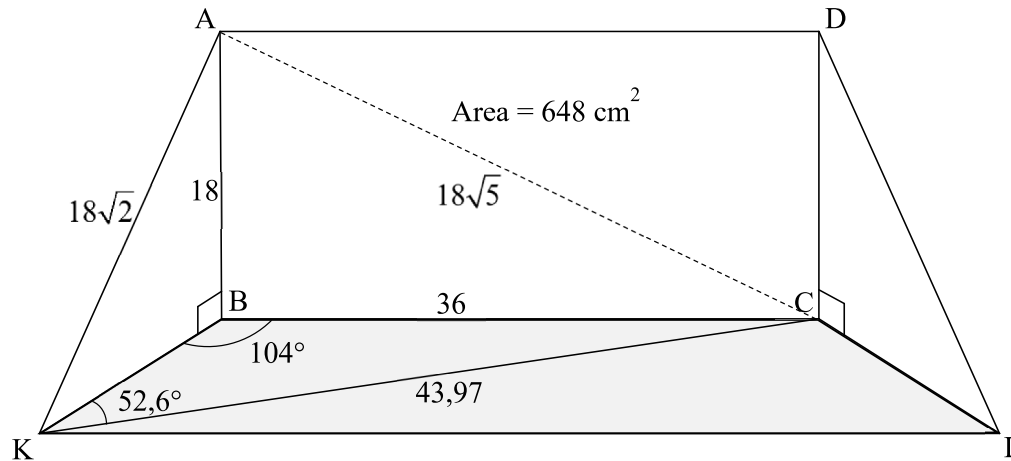


QUESTION/VRAAG 7

7.1	180°	✓ answer (1)
7.2		✓ asymptotes ✓ shape ✓ intercepts with axes (3)
7.3	$f(x) = \cos 2x$ $h(x) = \cos 2(x + 45^\circ)$ $= \cos(2x + 90^\circ)$ $= -\sin 2x$	✓ answer (1)
7.4	$y \in [-1; 1]$ OR $-1 \leq y \leq 1$	✓ $y \in [-1; 1]$ (1) ✓ $-1 \leq y \leq 1$ (1)
7.5	$\tan 2x - 1 = 0$ $\tan 2x = 1$ $2x = 45^\circ$ $x = 22,5^\circ$ $(1 - \tan 2x)(\cos 2x) \geq 0$ $-(\tan 2x - 1)(\cos 2x) \geq 0$ $(\tan 2x - 1)(\cos 2x) \leq 0$ $x \in [0^\circ; 22,5^\circ] \cup [112,5^\circ; 135^\circ)$ OR $0^\circ \leq x \leq 22,5^\circ$ or $112,5^\circ \leq x < 135^\circ$	✓ $x = 22,5^\circ$ ✓ $(\tan 2x - 1)(\cos 2x) \leq 0$ ✓ first interval ✓ second interval (4)
		[10]



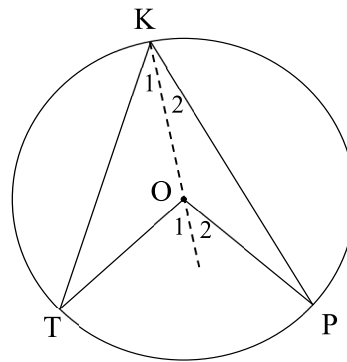
QUESTION/VRAAG 8



8.1	$\text{Area of } ABCD = BC \times AB$ $648 = 2AB \times AB$ $AB^2 = 324$ $AB = 18 \text{ cm}$	<ul style="list-style-type: none"> ✓ $BC = 2AB$ ✓ substitution into area of rectangle 	(2)
8.2	$AC^2 = AB^2 + BC^2 \quad [\text{Pythagoras}]$ $= 18^2 + 36^2$ $AC = \sqrt{1620} = 18\sqrt{5} = 40,25 \text{ cm}$	<ul style="list-style-type: none"> ✓ $AC^2 = 18^2 + 36^2$ ✓ answer 	(2)
8.3	$\frac{KC}{\sin \hat{K}BC} = \frac{BC}{\sin \hat{B}KC}$ $\frac{KC}{\sin 104^\circ} = \frac{36}{\sin 52,6^\circ}$ $KC = \frac{36 \sin 104^\circ}{\sin 52,6^\circ}$ $KC = 43,97 \text{ cm}$	<ul style="list-style-type: none"> ✓ substitution into sine rule ✓ answer 	(2)
8.4	$AK^2 = AB^2 + BK^2 \quad [\text{Pythagoras}]$ $= 18^2 + 18^2$ $AK = \sqrt{648} = 18\sqrt{2} \text{ cm} = 25,46 \text{ cm}$ $KC^2 = AK^2 + AC^2 - 2AK \cdot AC \cos \hat{K}AC$ $(43,97)^2 = (18\sqrt{2})^2 + (18\sqrt{5})^2 - 2(18\sqrt{2})(18\sqrt{5})(\cos \hat{K}AC)$ $\cos \hat{K}AC = 0,16\dots$ $\hat{K}AC = 80,60^\circ$	<ul style="list-style-type: none"> ✓ length of AK ✓ substitution into cosine rule ✓ simplification ✓ answer 	(4)
			[10]

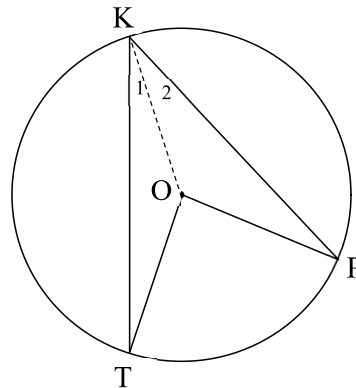


QUESTION/VRAAG 9



9.1	<p>Construction: Draw KO produced</p> $\hat{O}_1 = \hat{K}_1 + \hat{T} \quad [\text{ext } \angle \text{ of } \Delta / \text{buite } \angle \text{ van } \Delta]$ <p>But $\hat{K}_1 = \hat{T}$ [\angles opp equal sides/ \anglee teenoor gelyke sye]</p> $\therefore \hat{O}_1 = 2\hat{K}_1$ $\hat{O}_2 = \hat{K}_2 + P \quad [\text{ext } \angle \text{ of } \Delta / \text{buite } \angle \text{ van } \Delta]$ <p>But $\hat{K}_2 = P$ [\angles opp equal sides/ \anglee teenoor gelyke sye]</p> $\therefore \hat{O}_2 = 2\hat{K}_2$ $\therefore \hat{O}_1 + \hat{O}_2 = 2\hat{K}_1 + 2\hat{K}_2$ $= 2(\hat{K}_1 + \hat{K}_2)$ $\therefore \hat{T} \hat{O} \hat{P} = 2 \hat{T} \hat{K} \hat{P}$	<p>✓ construction</p> <p>✓ S / R</p> <p>✓ S</p> <p>✓ S</p> <p>✓ S</p> <p>✓ S</p> <p>(5)</p>
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OR

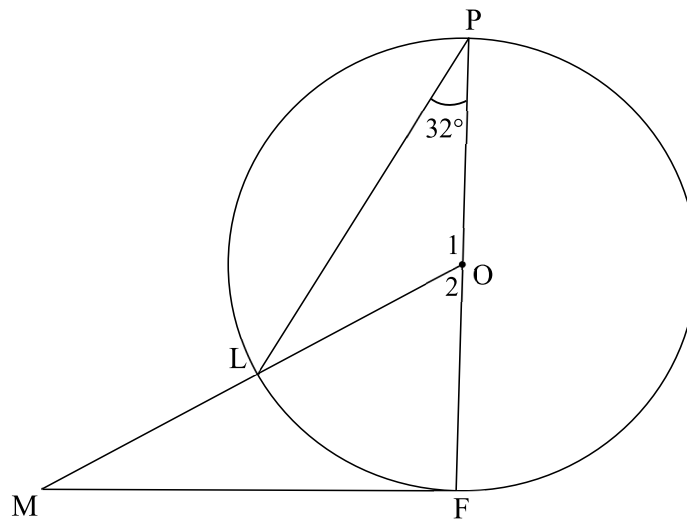


9.1	<p>Construction: Draw KO</p> $\hat{T} = \hat{K}_1 \quad [\angle \text{ s opp. equal sides/ } \angle \text{e teenoor gelyke sye}]$ $\therefore \hat{K} \hat{O} \hat{T} = 180^\circ - 2\hat{K}_1 \quad [\text{sum of } \angle \text{ s of } \Delta / \text{binne } \angle \text{e van } \Delta]$ $\hat{P} = \hat{K}_2 \quad [\angle \text{ s opp. equal sides/ } \angle \text{e teenoor gelyke sye}]$ $\therefore \hat{K} \hat{O} \hat{P} = 180^\circ - 2\hat{K}_2 \quad [\text{sum of } \angle \text{ s of } \Delta / \text{binne } \angle \text{e van } \Delta]$ $\hat{T} \hat{O} \hat{P} = 360^\circ - (\hat{K} \hat{O} \hat{T} + \hat{K} \hat{O} \hat{P}) \quad [\angle \text{ s around a point/ } \angle \text{e om 'n punt}]$ $= 360^\circ - (180^\circ - 2\hat{K}_1 + 180^\circ - 2\hat{K}_2)$ $= 2\hat{K}_1 + 2\hat{K}_2$ $= 2(\hat{K}_1 + \hat{K}_2)$	<p>✓ construction</p> <p>✓ S / R</p> <p>✓ S</p> <p>✓ S</p> <p>✓ S</p> <p>(5)</p>
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$$\therefore \hat{T}OP = 2 \hat{T}KP$$

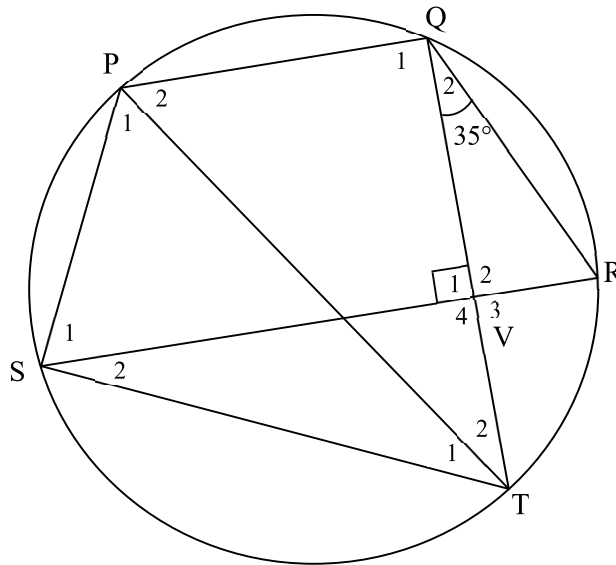
9.2



9.2.1	$\hat{O}_2 = 64^\circ$ OR $\hat{P}LO = \hat{P} = 32^\circ$ $\hat{O}_2 = 64^\circ$	[\angle at centre = $2 \times \angle$ at circumference/ <i>Midpts $\angle = 2 \times$ Omtreks \angle]</i> [\angle s opp equal radii/ <i>\anglee teenoor gelyke radiusse]</i> [ext \angle of Δ / buite \angle van Δ]	✓ S ✓ R (2)
9.2.2	$\hat{P}FM = 90^\circ$ $\hat{M} = 26^\circ$	[tan \perp diameter/raaklyn \perp middellyn] [sum of \angle s of Δ /binne \angle e van Δ]	✓ S ✓ R ✓ S (3)
			[10]



QUESTION/VRAAG 10



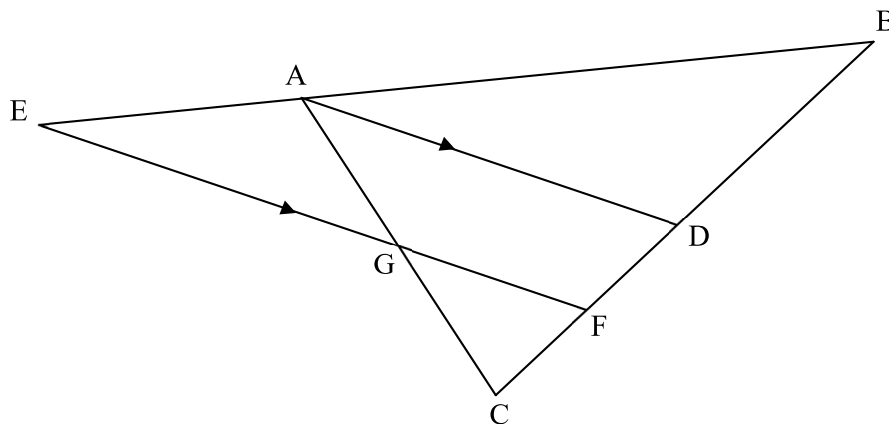
10.1	$\hat{R} = 55^\circ$ [sum of \angle s in Δ /binne \angle e van Δ] $\therefore \hat{QTS} = 55^\circ$ [\angle s in the same seg/ \angle e in dieselfde segment] OR $\hat{S}_2 = 35^\circ$ [\angle s in the same seg/ \angle e in dieselfde segment] $\therefore \hat{QTS} = 55^\circ$ [sum of \angle s in Δ /binne \angle e van Δ]	✓ S ✓ S ✓ R (3)
10.2	$\hat{SPQ} = 125^\circ$ [opp \angle s of cyclic quad/teenoorst. \angle e van kvh] $\hat{S}_1 = \hat{R} = 55^\circ$ [given/gegee] $\hat{SPQ} + \hat{S}_1 = 180^\circ$ $\therefore PQ \parallel SR$ [co-int \angle s supp/ko-binne \angle e suppl] OR $\hat{S}_1 = \hat{R} = 55^\circ$ [given/gegee] $\hat{PQR} = 125^\circ$ [opp \angle s of cyclic quad/teenoorst. \angle e van kvh] $\therefore \hat{Q}_1 = 125^\circ - 35^\circ = 90^\circ$ $\therefore \hat{Q}_1 + \hat{V}_1 = 180^\circ$ $\therefore PQ \parallel SR$ [co-int \angle s supp/ko-binne \angle e suppl]	✓ S ✓ R ✓ R (3) ✓ S ✓ R ✓ R (3)



10.3	$\hat{Q}_1 = 90^\circ$ [co-int \angle s; $PQ \parallel SR$ / <i>ko-binne \anglee; $PQ \parallel SR$</i> \therefore PT is a diameter [converse \angle in semi-circle/ chord subtends $90^\circ \angle$ <i>omgekeerde \angle in halwe sirkel / koord onderspan $90^\circ \angle$</i> OR $\hat{S}_2 = 35^\circ$ [ext \angle of ΔSVT or sum of \angle s in Δ <i>buite \angle v Δ of binne \anglee van Δ] $\hat{PST} = 90^\circ$ \therefore PT is a diameter [converse \angle in semi-circle/ chord subtends $90^\circ \angle$ <i>omgekeerde \angle in halwe sirkel / koord onderspan $90^\circ \angle$</i> </i>	✓ S ✓ R ✓ S ✓ R (2) (2)
[8]		



QUESTION/VRAAG 11



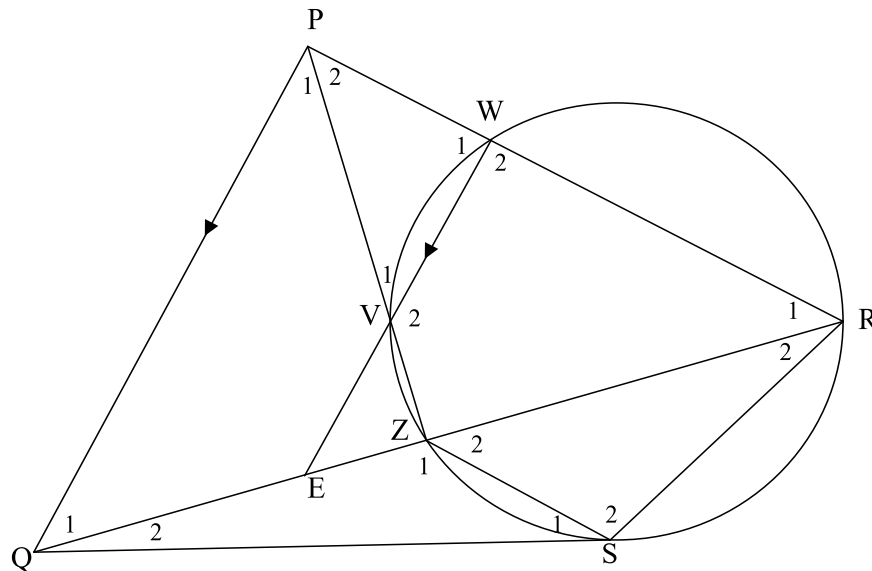
11.1.1	$\frac{FD}{CF} = \frac{GA}{CG}$ <p>[prop theorem; $AD \parallel EF$/line \parallel one side of Δ/ <i>eweredigheidst.; $AD \parallel EF$ / lyn \parallel een sy v Δ</i>]</p> $\frac{FD}{CF} = \frac{2}{3}$	<p>✓ S</p> <p>✓ answer</p> <p>(2)</p>
11.1.2	$FD = \frac{2}{3}CF$ $FD = \frac{2}{3}(2x) = \frac{4}{3}x$ $\frac{BA}{EA} = \frac{BD}{FD}$ <p>[prop theorem; $AD \parallel EF$/line \parallel one side of Δ/ <i>eweredigheidst.; $AD \parallel EF$ / lyn \parallel een sy v Δ</i>]</p> $\frac{BA}{EA} = \frac{5x - \frac{4}{3}x}{\frac{4}{3}x}$ $= \frac{11}{3} \times \frac{3}{4}$ $= \frac{11}{4}$	<p>✓ $\frac{4}{3}x$</p> <p>✓ S</p> <p>✓ substitution</p> <p>✓ answer</p> <p>(4)</p>



11.1.3	$\frac{\text{Area of } \Delta \text{GCF}}{\text{Area of GFDA}} = \frac{\text{Area } \Delta \text{GCF}}{\text{Area } \Delta \text{CDA} - \text{Area } \Delta \text{GCF}}$ $= \frac{\frac{1}{2} \text{GC} \cdot \text{CF} \sin \hat{\text{C}}}{\frac{1}{2} \text{AC} \cdot \text{CD} \sin \hat{\text{C}} - \frac{1}{2} \text{GC} \cdot \text{CF} \sin \hat{\text{C}}}$ $= \frac{\frac{1}{2} (3k)(3p)(\sin \hat{\text{C}})}{\frac{1}{2} (5k)(5p)(\sin \hat{\text{C}}) - \frac{1}{2} (3k)(3p)(\sin \hat{\text{C}})}$ $= \frac{\frac{1}{2} (9kp)(\sin \hat{\text{C}})}{\frac{1}{2} \sin \hat{\text{C}} (25kp - 9kp)}$ $= \frac{9}{16}$	<p>✓ GFDA = ΔCDA – ΔCGF</p> <p>✓ $\frac{1}{2}(\text{GC})(\text{FC}) \sin \hat{\text{C}}$</p> <p>✓ $\frac{1}{2} \text{AC} \cdot \text{CD} \sin \hat{\text{C}} - \frac{1}{2} \text{GC} \cdot \text{CF} \sin \hat{\text{C}}$</p> <p>✓ answer</p> <p style="text-align: right;">(4)</p>
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11.2



11.2.1	$\frac{QE}{QR} = \frac{PW}{PR}$ <p>[prop theorem; $PQ \parallel WE$/line \parallel one side of Δ / eweredigheidsst.; $PQ \parallel WE$ / lyn \parallel een sy v Δ]</p> $PR = \frac{PW \cdot QR}{QE}$	<p>✓ S ✓ R</p> <p>(2)</p>
11.2.2	$\frac{PQ}{RQ} = \frac{QZ}{QP}$ <p>[$\Delta PQZ \parallel \Delta RQP$]</p> $\therefore PQ^2 = RQ \cdot QZ$	<p>✓ $\frac{PQ}{RQ} = \frac{QZ}{QP}$</p> <p>(1)</p>
11.2.3	<p>In ΔQSZ and ΔQRS</p> $\hat{Q}_2 = \hat{Q}_2$ [common \angle / gemeenskaplike \angle] $\hat{S}_1 = \hat{R}_2$ [tan chord theorem/raaklyn koord stelling] $\hat{Z}_1 = \hat{Q}_2$ [3 rd \angle of Δ] $\therefore \Delta QSZ \parallel \Delta QRS$ [$\angle \angle \angle$]	<p>✓ S</p> <p>✓ S/R</p> <p>✓ S OR R</p> <p>(3)</p>
11.2.4	$\frac{QS}{QR} = \frac{QZ}{QS}$ <p>[$\Delta QSZ \parallel \Delta QRS$]</p> $\therefore QS^2 = QZ \cdot QR$ <p>But $PQ^2 = RQ \cdot QZ$ [proved in 11.2.2]</p> $\therefore PQ = QS$	<p>✓ S / R</p> <p>✓ S</p> <p>✓ S</p> <p>(3)</p>



11.2.5	$\frac{PQ}{RQ} = \frac{PZ}{PR} \quad [\Delta PQZ \parallel \Delta RQP]$ $PR = \frac{QR \cdot PZ}{PQ}$ $PR = \frac{PW \cdot QR}{QE} \quad [\text{proved in 11.2.1}]$ $\therefore \frac{PW \cdot QR}{QE} = \frac{QR \cdot PZ}{PQ}$ $PW = \frac{QE \cdot PZ}{PQ}$ <p>But $PQ^2 = RQ \cdot QZ$ [proved in 11.2.2]</p> $\therefore PQ = \sqrt{RQ \cdot QZ}$ $\therefore PW = \frac{QE \cdot PZ}{\sqrt{RQ \cdot QZ}}$	<p>✓ $PR = \frac{QR \cdot PZ}{PQ}$</p> <p>✓ S</p> <p>✓ $PW = \frac{QE \cdot PZ}{PQ}$</p> <p>✓ $PQ = \sqrt{RQ \cdot QZ}$</p> <p style="text-align: right;">(4)</p>
[23]		

TOTAL/TOTAAL: 150