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# basic education

Department:  
Basic Education  
**REPUBLIC OF SOUTH AFRICA**

**NATIONAL  
SENIOR CERTIFICATE/  
NASIONALE  
SENIOR SERTIFIKAAT**

**GRADE 12/GRAAD 12**

**MATHEMATICS P2/WISKUNDE V2**

**NOVEMBER 2024**

**MARKING GUIDELINES/NASIENRIGLYNE**

**MARKS/PUNTE: 150**

**These marking guidelines consist of 25 pages./  
*Hierdie nasienriglyne bestaan uit 25 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 Guidelines. Stop marking at the second calculation error.
- Assuming answers/values in order to solve a problem is NOT acceptable.

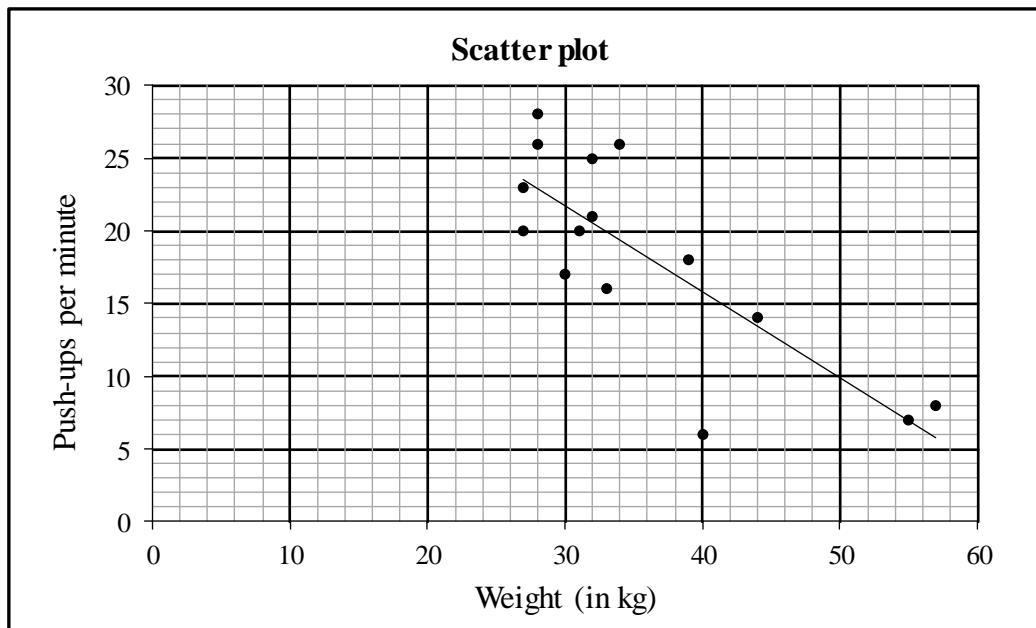
## LET WEL:

- *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

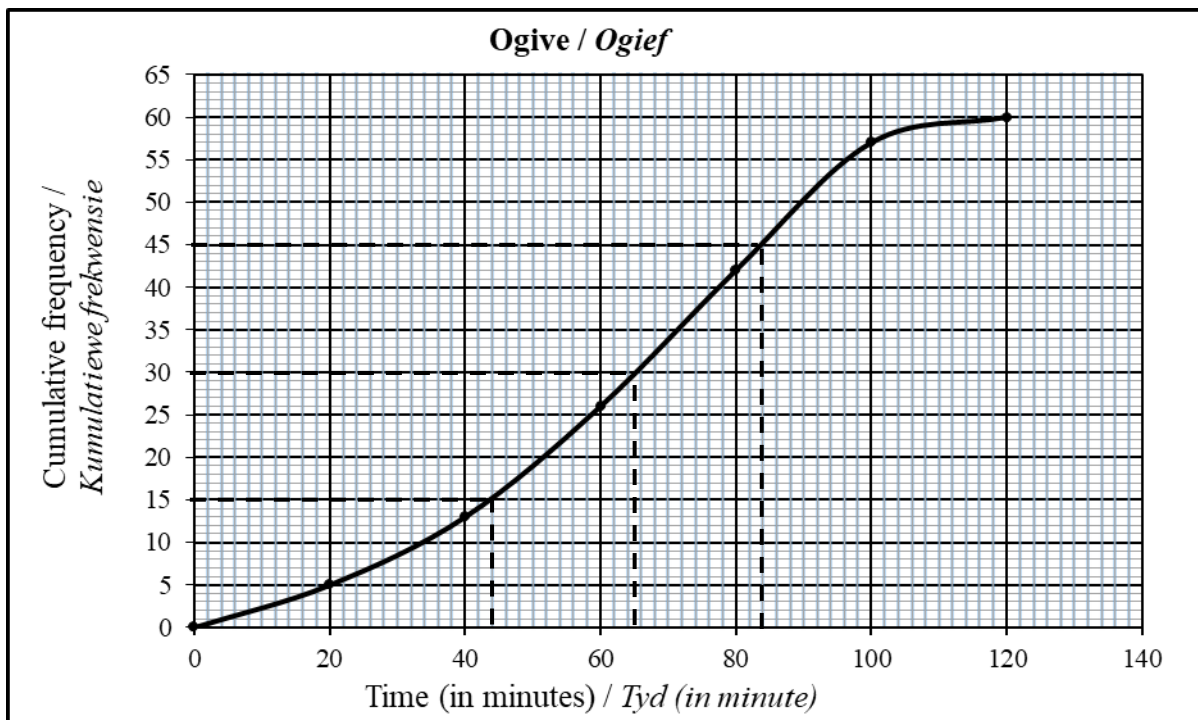
Weight (in kg) (x)	34	32	40	27	33	28	27	55	39	44	30	57	28	32	31
Number of push-ups per minute (y)	26	21	6	20	16	26	23	7	18	14	17	8	28	25	20



1.1	$a = 39,456001\dots$ $b = -0,590018\dots$ $\hat{y} = 39,46 - 0,59x$ <div style="border: 1px solid black; padding: 2px; display: inline-block;">CORRECT ANSWER ONLY: FULL MARKS</div>	✓ $a = 39,46$ ✓ $b = -0,59$ ✓ equation (3)
1.2	$r = -0,8$	✓ (A) $-0,8$ (1)
1.3	$y = 39,46 - 0,59(29)$ $y = 22,35$ <b>OR/OF</b> $y = 22,35$ (calculator)	✓ substitution ✓ answer (2) ✓✓ answer (2)
1.4	$\bar{y} = 18,33$	✓ (A) $18,33$ (1)
1.5	The increase in the number of push-ups will have <b>no influence</b> . The standard deviation <b>stays the same</b> .	✓ no influence <b>OR</b> standard deviation remains the same <i>geen verandering /</i> <i>bly dieselfde</i> (1)
1.6	6 is furthest y-value below the least squares regression line. An increase of 10 push-ups will get the team member to (40 ; 16), the minimum number of push-ups for a player weighing 40kg.	✓ 6 ✓ difference is 10 (2)
		<b>[10]</b>

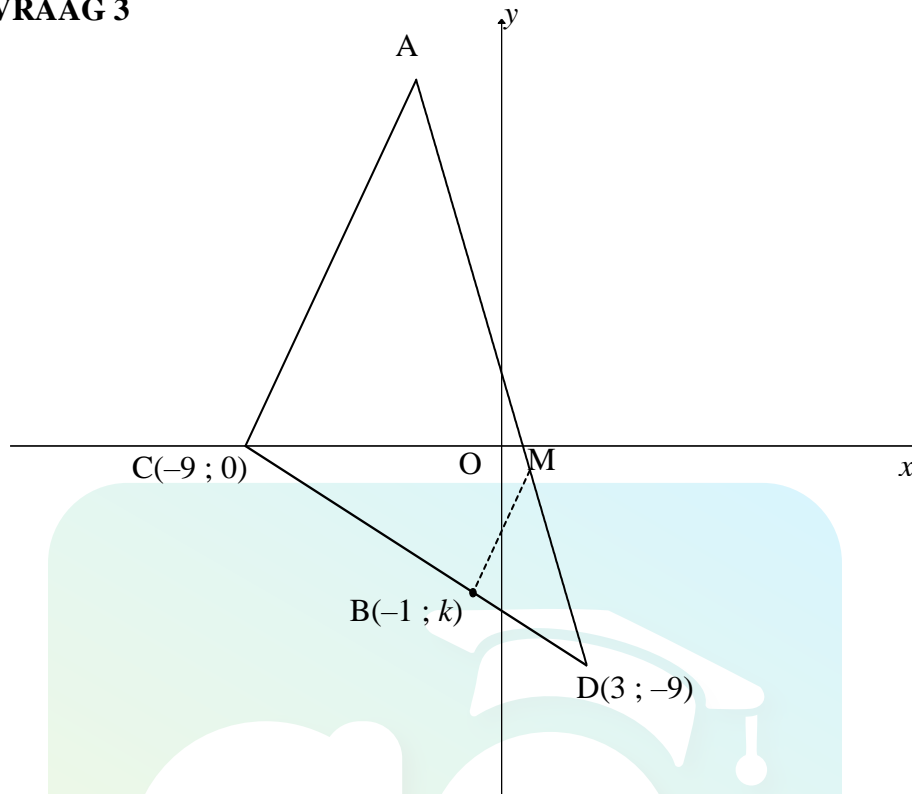


## QUESTION/VRAAG 2



2.1	Median = 65	✓ 65 (1)
2.2	$Q_1 = 44$	✓ 44 (1)
2.3	$IQR = 84 - 44$ $= 40$	✓ 84 ✓ IQR (2)
2.4		✓ box ✓ (A) whiskers ending at 5 & 120 (2)
2.5	Number of employees who qualify = 34 $\% \text{ of employees who qualify} = \frac{34}{60} \times 100$ $= 56,67\% \text{ of the employees}$ <b>OR/OF</b> Number of employees who qualify = 35 $\% \text{ of employees who qualify} = \frac{35}{60} \times 100$ $= 58,33\% \text{ of the employees}$	✓ 34  ✓ answer ✓ 35 ✓ answer (2)
2.6	Number of intervals = 3 Time allowed to work from home = 3(30 minutes) $= 90 \text{ minutes}$ <b>OR/OF</b> 1,5 hours	✓ 3 ✓ answer (2)
<b>[10]</b>		

## QUESTION / VRAAG 3

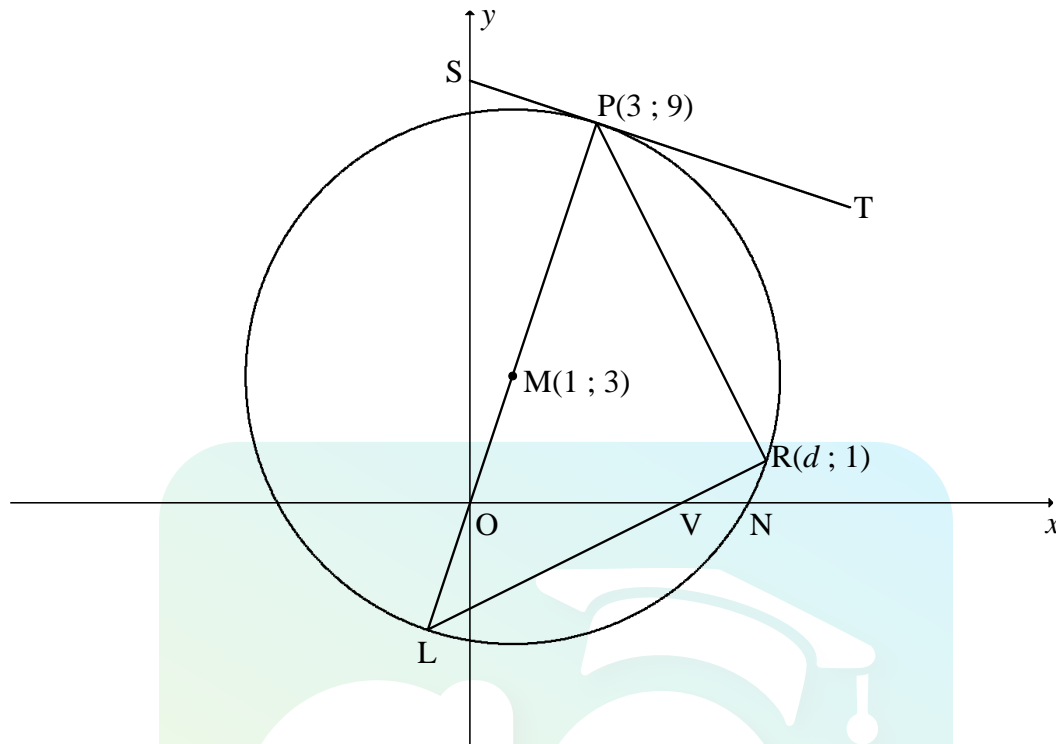


3.1	$m_{DC} = \frac{-9-0}{3-(-9)} \quad \text{OR/OF} \quad m_{DC} = \frac{0-(-9)}{-9-3}$ $m_{DC} = -\frac{3}{4} \quad \quad \quad m_{DC} = -\frac{3}{4}$	✓ correct substitution of D(3; -9) & C(-9; 0) into gradient formula ✓ answer (2)
3.2	Equation of DC: $0 = -\frac{3}{4}(-9) + c \quad \text{OR/OF} \quad y - 0 = -\frac{3}{4}(x - (-9))$ $c = \frac{-27}{4} \text{ or } -6\frac{3}{4} \quad \quad \quad y = -\frac{3}{4}(x + 9)$ $y = -\frac{3}{4}x - \frac{27}{4} \quad \quad \quad y = -\frac{3}{4}x - \frac{27}{4}$	✓ correct substitution of C(-9; 0) or D(3; -9) into equation of line ✓ answer (2)
3.3	$k = -\frac{3}{4}(-1) - \frac{27}{4} \quad \text{OR/OF} \quad \frac{k - (-9)}{-1 - 3} = \frac{-3}{4} \quad \text{OR/OF} \quad \frac{k - 0}{-1 - (-9)} = \frac{-3}{4}$ $k = \frac{3}{4} - \frac{27}{4} \quad \quad \text{OR/OF} \quad k + 9 = 3 \quad \quad \text{OR/OF} \quad k = -\frac{3}{4}(8)$ $k = -6 \quad \quad \quad k = -6 \quad \quad \quad k = -6$	✓ substitution of B(-1; k) (1)
3.4	$DC = \sqrt{(3+9)^2 + (-9-0)^2}$ $DC = 15 \text{ units}$	✓ correct substitution of D(3; -9) & C(-9; 0) into distance formula ✓ answer (2)

3.5	$DB = \sqrt{(3 - (-1))^2 + (-9 - (-6))^2}$ $DB = 5$ $\therefore \frac{DB}{DC} = \frac{5}{15} = \frac{1}{3}$	<p>✓ <math>DB = 5</math></p> <p>✓ answer</p> <p>(2)</p>
3.6	$\frac{DM}{DA} = \frac{DB}{DC} = \frac{1}{3}$ $\frac{\text{Area } \triangle MBD}{\text{Area } \triangle ACD} = \frac{\frac{1}{2}(DM)(DB)(\sin \hat{D})}{\frac{1}{2}(DA)(DC)(\sin \hat{D})}$ $= \frac{1}{3} \times \frac{1}{3}$ $= \frac{1}{9}$	<p>✓ <math>\frac{DM}{DA} = \frac{DB}{DC}</math></p> <p>✓ correct use of area rule</p> <p>✓ subst. for <math>\frac{BD}{DC}</math> and <math>\frac{DM}{DA}</math> into correct formula</p> <p>✓ answer</p> <p>(4)</p>
3.7	$y = -4x + c$ $m_{AD} = -4$ $-9 = -4(3) + c$ $c = 3$ $y = -4x + 3$ $(x-3)^2 + (y+9)^2 = 612$ $(x-3)^2 + (-4x+3+9)^2 = (\sqrt{612})^2$ $(x-3)^2 + (-4x+12)^2 = 612$ $x^2 - 6x + 9 + 16x^2 - 96x + 144 = 612$ $17x^2 - 102x - 459 = 0$ $x^2 - 6x - 27 = 0$ $(x-9)(x+3) = 0$ $x = 9 \text{ or } x = -3$ <p>N/A</p> $y = -4(-3) + 3$ $y = 15$ $A(-3; 15)$	<p>OR/OF</p> $\frac{y+9}{x-3} = -4$ $y+9 = -4x+12$ $y = -4x+3$ <p>✓ correct substitution of <math>m_{AD} = -4</math> and <math>D(3; -9)</math></p> <p>✓ <math>(x-3)^2 + (y+9)^2 = 612</math></p> <p>✓ substitution of equation AD into distance formula</p> <p>✓ standard form</p> <p>✓ x values with rejection</p> <p>✓ y coordinate</p> <p>(6)</p>

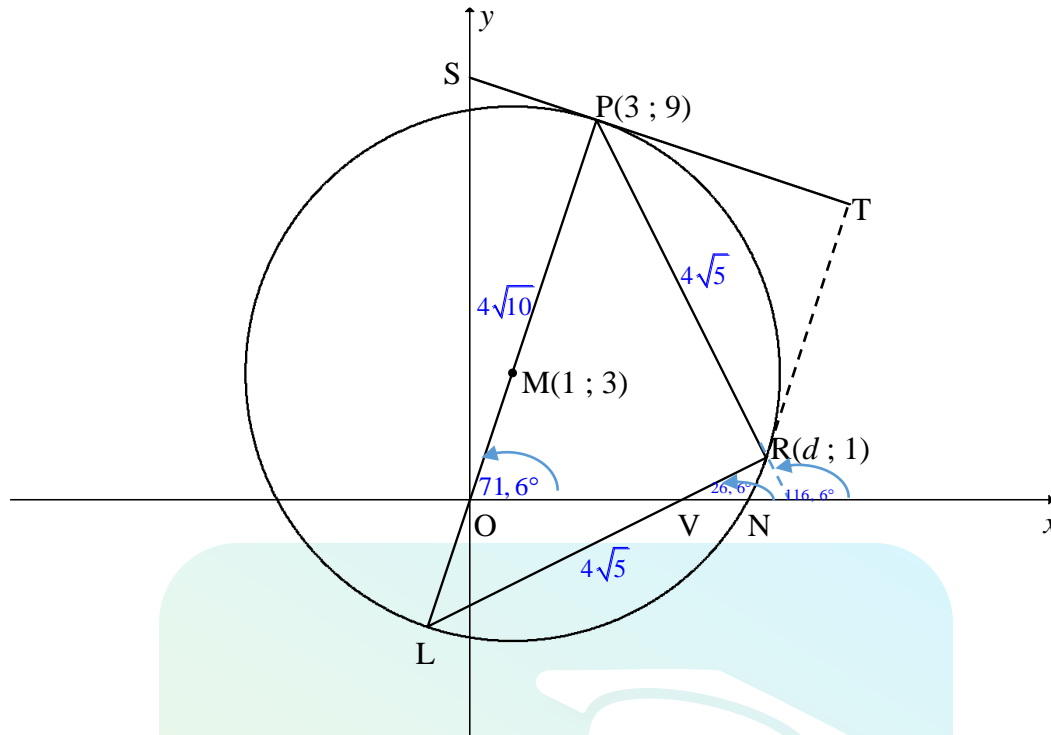
	<p><b>OR/OF</b></p> $-9 = -4(3) + c$ $c = 3$ $y = -4x + 3$ $N(0 ; 3)$ $ND = \sqrt{(3-0)^2 + (-9-3)^2}$ $= 3\sqrt{17}$ $AD = 6\sqrt{17}$ $ND = \frac{1}{2}AD$ <p>N is the midpoint of AD</p> $A(-3 ; 15)$	<p><b>OR/OF</b></p> <p>✓ correct substitution of <math>m_{AD} = -4</math> and <math>D(3 ; -9)</math></p> <p>✓ <math>N(0 ; 3)</math></p> <p>✓ substitution into distance formula to calculate ND</p> <p>✓ <math>ND = \frac{1}{2}AD</math></p> <p>✓ <math>x</math> – value    ✓ <math>y</math> – value</p> <p>(6)</p>
		<b>[19]</b>

## QUESTION/VRAAG 4



4.1	$L(-1; -3)$	$\checkmark x = -1 \quad \checkmark y = -3$ (2)
4.2	$m_{MP} = \frac{9-3}{3-1}$ $m_{MP} = 3$ $m_{ST} = -\frac{1}{3}$ $9 = -\frac{1}{3}(3) + c$ $c = 10$ $y = -\frac{1}{3}x + 10$	$\checkmark m_{MP} = 3$ $\checkmark m_{ST} = -\frac{1}{m_{MP}}$ $\checkmark$ substitution of $m_{ST}$ & $P(3; 9)$ into equation of a line $\checkmark$ equation of tangent ST (4)
4.3	$(x-1)^2 + (y-3)^2 = r^2$ $(3-1)^2 + (9-3)^2 = r^2$ $r^2 = 40$ $(x-1)^2 + (y-3)^2 = 40$ $x^2 - 2x + 1 + y^2 - 6y + 9 = 40$ $x^2 + y^2 - 2x - 6y - 30 = 0$	$\checkmark (3-1)^2 + (9-3)^2 = r^2$ $\checkmark$ value of $r^2$ $\checkmark$ LHS of equation of circle $\checkmark$ expanding LHS (4)

4.4	$d^2 + (1)^2 - 2d - 6(1) - 30 = 0$ $d^2 - 2d - 35 = 0$ $(d - 7)(d + 5) = 0$ $d = 7 \text{ or } d = -5$ $\therefore d = 7$ <p><b>OR/OF</b></p> $(x - 1)^2 + (y - 3)^2 = 40$ $(d - 1)^2 + (1 - 3)^2 = 40$ $(d - 1)^2 = 36$ $d - 1 = 6 \text{ or } d - 1 = -6$ $d = 7 \text{ or } d = -5$ $\therefore d = 7$ <p><b>OR/OF</b></p> $\hat{PRL} = 90^\circ \quad (\angle \text{ in semi-circle})$ $\frac{9 - 1}{3 - d} \times \frac{1 - (-3)}{d - (-1)} = -1$ $d^2 - 2d - 35 = 0$ $(d - 7)(d + 5) = 0$ $d = 7 \text{ or } d = -5$ $\therefore d = 7$	$\checkmark d^2 + (1)^2 - 2d - 6(1) - 30 = 0$ $\checkmark \text{ standard form}$ <p style="text-align: right;">(2)</p> <p><b>OR/OF</b></p> $\checkmark (d - 1)^2 + (1 - 3)^2 = 40$ $\checkmark \text{ standard form}$ <p style="text-align: right;">(2)</p> <p><b>OR/OF</b></p> $\checkmark m_{PR} \times m_{RL} = -1$ $\checkmark \text{ standard form}$ <p style="text-align: right;">(2)</p>
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4.5

$$m_{PO} = 3$$

$$\therefore \tan \hat{POV} = 3$$

$$\hat{POV} = 71,565\dots^\circ$$

$$m_{RL} = \frac{1 - (-3)}{7 - (-1)}$$

$$= \frac{1}{2}$$

$$\therefore \tan \hat{RVN} = \frac{1}{2}$$

$$\hat{RVN} = 26,565\dots^\circ$$

$$\hat{L} = 71,565\dots^\circ - 26,565\dots^\circ \quad [\text{ext. } \angle \text{ of } \Delta / \text{ buite } \angle \text{ van } \Delta]$$

$$\hat{L} = 45^\circ$$

**OR/OF**

$$\hat{R} = 90^\circ \quad [\angle \text{ in semi-circle } / \angle \text{ in 'n halwe sirkel}]$$

$$PR^2 = (3-7)^2 + (9-1)^2$$

$$PR = \sqrt{80} = 4\sqrt{5} \text{ units}$$

$$PL^2 = (3-(-1))^2 + (9-(-3))^2 \quad \text{OR} \quad RL^2 = (7+1)^2 + (1+3)^2$$

$$PL = \sqrt{160} = 4\sqrt{10}$$

$$RL = \sqrt{80} = 4\sqrt{5}$$

$$\sin \hat{L} = \frac{4\sqrt{5}}{4\sqrt{10}} \quad \text{OR} \quad \cos \hat{L} = \frac{4\sqrt{5}}{4\sqrt{10}} \quad \text{OR} \quad \tan \hat{L} = \frac{4\sqrt{5}}{4\sqrt{5}}$$

$$\hat{L} = 45^\circ$$

$$\checkmark \tan \hat{POV} = m_{PO}$$

$$\checkmark \hat{POV}$$

$$\checkmark m_{RL} \text{ using } R(7; 1) \text{ \& } L$$

$$\checkmark \hat{RVN}$$

$$\checkmark \text{ answer}$$

(5)

**OR/OF**

$$\checkmark \hat{R} = 90^\circ$$

$$\checkmark PR = \sqrt{80} = 4\sqrt{5}$$

$$\checkmark \text{ length of PL OR RL}$$

$$\checkmark \text{ trig ratio of } \hat{L}$$

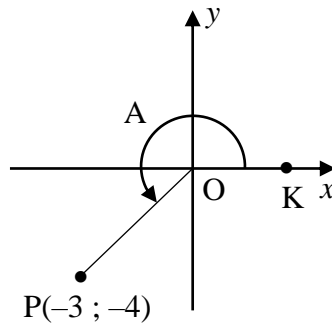
$$\checkmark \text{ answer}$$

(5)



	<p><b>OR/OF</b></p> $PL = \sqrt{(3+1)^2 + (9+3)^2} = \sqrt{160} = 4\sqrt{10}$ $PR = \sqrt{(7-3)^2 + (1-9)^2} = \sqrt{80} = 4\sqrt{5}$ $LR = \sqrt{(7+1)^2 + (1+3)^2} = \sqrt{80} = 4\sqrt{5}$ $\cos L = \frac{80+160-80}{2\sqrt{80} \times \sqrt{160}}$ $\cos L = \frac{\sqrt{2}}{2}$ $\hat{L} = 45^\circ$	<p><b>OR/OF</b></p> <p>✓ length of PL</p> <p>✓ <math>PR = \sqrt{80} = 4\sqrt{5}</math></p> <p>✓ length of LR</p> <p>✓ substitution into the cos rule</p> <p>✓ answer</p> <p style="text-align: right;">(5)</p>
4.6	$m_{RM} = \frac{1-3}{7-1}$ $= -\frac{1}{3}$ $m_{RT} = 3 \quad (\tan \perp \text{ rad})$ $m_{PT} = -\frac{1}{3}$ $m_{RT} \times m_{PT} = -1$ <p><math>PT \perp RT</math></p> <p><b>OR/OF</b></p> $m_{MR} = \frac{3-1}{1-7}$ $= -\frac{1}{3}$ $m_{PT} = -\frac{1}{3} \quad [\text{proved in Q4.2}]$ $m_{PT} = m_{MR}$ <p><math>\therefore PT \parallel MR</math></p> <p><math>\hat{MRT} = 90^\circ</math> [radius <math>\perp</math> tangent / raaklyn <math>\perp</math> radius]</p> <p><math>\hat{PTR} = 90^\circ</math> [co-int <math>\angle</math>s; <math>PT \parallel MR</math>/ooreenkomst. <math>\angle</math>e; <math>PT \parallel MR</math>]</p> <p><math>PT \perp RT</math></p> <p><b>OR/OF</b></p> <p><math>\hat{TPR} = \hat{L} = 45^\circ</math> [tan-chord theorem/ <math>\angle</math> tussen raaklyn en koord]</p> <p><math>TP = TR</math> [tans from common pt]</p> <p><math>\therefore \hat{TPR} = \hat{TRP} = 45^\circ</math> [<math>\angle</math>s opp equal sides/ <math>\angle</math>e teenoor gelyke sye]</p> <p><math>\therefore \hat{PTR} = 90^\circ</math> [sum of <math>\angle</math>s in <math>\Delta</math> / binne <math>\angle</math>e van <math>\Delta</math>]</p> <p><math>PT \perp RT</math></p>	<p>✓ <math>m_{RM}</math></p> <p>✓ <math>m_{RT}</math></p> <p>✓ <math>m_{RT} \times m_{PT} = -1</math></p> <p style="text-align: right;">(3)</p> <p><b>OR/OF</b></p> <p>✓ <math>PT \parallel MR</math></p> <p>✓ <math>\hat{MRT} = 90^\circ</math></p> <p>✓ <math>\hat{PTR} = 90^\circ</math></p> <p style="text-align: right;">(3)</p> <p><b>OR/OF</b></p> <p>✓ <math>\hat{TPR} = \hat{L}</math></p> <p>✓ <math>\hat{TPR} = \hat{TRP}</math></p> <p>✓ <math>\hat{PTR} = 90^\circ</math></p> <p style="text-align: right;">(3)</p>
		<b>[20]</b>

## QUESTION/VRAAG 5



5.1.1	$r = 5$ $\cos A = -\frac{3}{5}$	✓ $r = 5$ ✓ answer (2)
5.1.2	$\cos 2A = 2\cos^2 A - 1$ $= 2\left(-\frac{3}{5}\right)^2 - 1$ $= -\frac{7}{25}$ <b>OR/OF</b> $\cos 2A = \cos^2 A - \sin^2 A$ $= \left(-\frac{3}{5}\right)^2 - \left(-\frac{4}{5}\right)^2$ $= -\frac{7}{25}$ <b>OR/OF</b> $\cos 2A = 1 - 2\sin^2 A$ $= 1 - 2\left(-\frac{4}{5}\right)^2$ $= -\frac{7}{25}$	✓ substitution of $\cos A$ into double angle formula ✓ answer (2) ✓ substitution of $\cos A$ & $\sin A$ into double angle formula ✓ answer (2) ✓ substitution of $\sin A$ into double angle formula ✓ answer (2)
5.1.3	 $x = -3$ $\sin(A - B) = \sin A \cos B - \cos A \sin B$ $= \left(-\frac{4}{5}\right)\left(-\frac{3}{5}\right) - \left(-\frac{3}{5}\right)\left(\frac{4}{5}\right)$ $= \frac{12}{25} + \frac{12}{25}$ $= \frac{24}{25}$	✓ $x = -3$ ✓✓ substitution into the compound angle formula ✓ answer (4)

5.2	$\frac{\cos\left(\frac{\alpha}{2} - 45^\circ\right) \sin\left(\frac{\alpha}{2} - 45^\circ\right)}{2}$ $= \frac{2\cos\left(\frac{\alpha}{2} - 45^\circ\right) \sin\left(\frac{\alpha}{2} - 45^\circ\right)}{2 \cdot 2}$ $= \frac{\sin(\alpha - 90^\circ)}{4}$ $= \frac{-\cos \alpha}{4}$ $= \frac{-p}{4} \quad \text{OR/OF} \quad = -\frac{1}{4} p$ <p><b>OR/OF</b></p> $\frac{\cos\left(\frac{\alpha}{2} - 45^\circ\right) \sin\left(\frac{\alpha}{2} - 45^\circ\right)}{2}$ $= \frac{\left[\cos \frac{\alpha}{2} \cos 45^\circ + \sin \frac{\alpha}{2} \sin 45^\circ\right] \left[\sin \frac{\alpha}{2} \cos 45^\circ - \cos \frac{\alpha}{2} \sin 45^\circ\right]}{2}$ $= \frac{\left[\frac{\sqrt{2}}{2} \cos \frac{\alpha}{2} + \frac{\sqrt{2}}{2} \sin \frac{\alpha}{2}\right] \left[\frac{\sqrt{2}}{2} \sin \frac{\alpha}{2} - \frac{\sqrt{2}}{2} \cos \frac{\alpha}{2}\right]}{2}$ $= \frac{\frac{1}{2} \sin^2 \frac{\alpha}{2} - \frac{1}{2} \cos^2 \frac{\alpha}{2}}{2}$ $= \frac{-\frac{1}{2} \left(\cos^2 \frac{\alpha}{2} - \sin^2 \frac{\alpha}{2}\right)}{2}$ $= -\frac{\cos 2\left(\frac{\alpha}{2}\right)}{4}$ $= -\frac{\cos \alpha}{4}$ $= -\frac{1}{4} p$	<p>✓ multiply by <math>\frac{2}{2}</math></p> <p>✓ double angle</p> <p>✓ co function</p> <p>✓ answer</p> <p>(4)</p> <p><b>OR/OF</b></p> <p>✓ expansion</p> <p>✓ special angles</p> <p>✓ double angle</p> <p>✓ answer</p> <p>(4)</p>
		[12]

## QUESTION/VRAAG 6

6.1.1	$\cos(x + y) = \cos(x - (-y))$ $= \cos x \cos(-y) + \sin x \sin(-y)$ $= \cos x \cos y - \sin x \sin y$	<p>✓ <math>(x + y) = (x - (-y))</math></p> <p>✓ correct expansion</p> <p style="text-align: right;">(2)</p>
6.1.2	$\text{LHS} = \frac{\cos(90^\circ - x)\cos y + \sin(-y)\cos(180^\circ + x)}{\cos x \cos(360^\circ + y) + \sin(360^\circ - x)\sin y}$ $= \frac{(\sin x)\cos y + (-\sin y)(-\cos x)}{\cos x(\cos y) + (-\sin x)\sin y}$ $= \frac{\sin x \cos y + \cos x \sin y}{\cos x \cos y - \sin x \sin y}$ $= \frac{\sin(x + y)}{\cos(x + y)}$ $= \tan(x + y)$ $= \text{RHS}$	<p>✓ <math>\cos(90^\circ - x) = \sin x</math></p> <p>✓ <math>\sin(-y) = -\sin y</math></p> <p>✓ <math>\cos(180^\circ + x) = -\cos x</math></p> <p>✓ <math>\cos(360^\circ + y) = \cos y</math></p> <p>✓ <math>\sin(360^\circ - x) = -\sin x</math></p> <p>✓ compound angle formulae</p> <p style="text-align: right;">(6)</p>
6.2	$\sqrt{6\sin^2 x - 11\cos(90^\circ + x) + 7} = 2$ $6\sin^2 x - 11\cos(90^\circ + x) + 7 = 4$ $6\sin^2 x - 11(-\sin x) + 7 = 4$ $6\sin^2 x + 11\sin x + 3 = 0$ $(3\sin x + 1)(2\sin x + 3) = 0$ $\sin x = -\frac{1}{3} \quad \text{OR/OR} \quad \sin x = -\frac{3}{2}$ $\text{ref } \angle = 19,47^\circ \quad \text{no solution}$ $x = 199,47^\circ \text{ or } x = 340,53^\circ$	<p>✓ squaring both sides</p> <p>✓ <math>\cos(90^\circ + x) = -\sin x</math></p> <p>✓ factors</p> <p>✓ both equations</p> <p>✓✓ answers</p> <p style="text-align: right;">(6)</p>
6.3.1	$g(x) = \frac{4 - 8\sin^2 x}{3}$ $= \frac{4(1 - 2\sin^2 x)}{3}$ $= \frac{4\cos 2x}{3}$ <p>Maximum value of <math>\cos 2x</math> is 1</p> <p><math>\therefore</math> maximum value of <math>g(x) = \frac{4}{3}</math></p>	<p>✓ factors</p> <p>✓ <math>\frac{4\cos 2x}{3}</math></p> <p>✓ answer</p> <p style="text-align: right;">(3)</p>

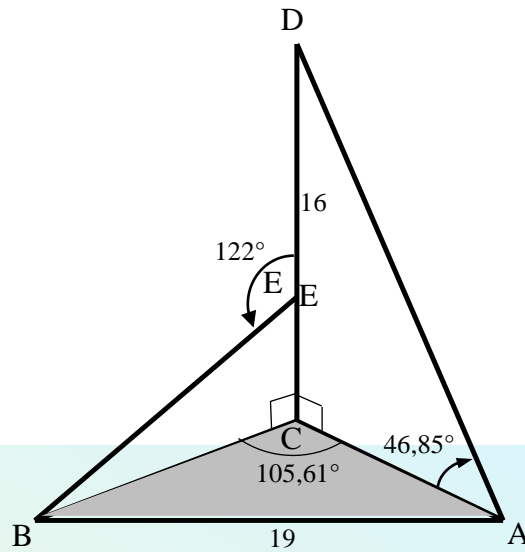
	<p><b>OR/OF</b></p> <p><math>4 - 8\sin^2 x</math> is a maximum when <math>\sin^2 x</math> is a minimum</p> <p>Minimum value of <math>\sin^2 x</math> is 0</p> <p><math>\therefore</math> max. value of <math>g(x) = \frac{4-8(0)}{3}</math></p> $g(x) = \frac{4}{3}$ <p><b>OR/OF</b></p> <p><math>\sin x = \frac{-(0)}{2\left(-\frac{8}{3}\right)}</math></p> <p><math>\sin x = 0</math></p> <p><math>\therefore</math> max. value of <math>g(x) = \frac{4-8(0)}{3}</math></p> $g(x) = \frac{4}{3}$	<p><b>OR/OF</b></p> <p>✓ min of <math>\sin^2 x = 0</math></p> <p>✓ <math>g(x) = \frac{4-8(0)}{3}</math></p> <p>✓ answer</p> <p>(3)</p> <p><b>OR/OF</b></p> <p>✓ <math>\sin x = \frac{-(0)}{2\left(-\frac{8}{3}\right)}</math></p> <p>✓ <math>\sin x = 0</math></p> <p>✓ answer</p> <p>(3)</p>
6.3.2	$x = 180^\circ$	<p>✓ <math>180^\circ</math></p> <p>(1)</p>
<b>[18]</b>		

## QUESTION/VRAAG 7

7.1	$x = 90^\circ$	✓ $x = 90^\circ$ (1)
7.2	$x = -180^\circ$ or $x \in (-90^\circ ; 0^\circ]$  <b>OR/OF</b>  $x = -180^\circ$ or $-90^\circ < x \leq 0^\circ$	✓✓ answer (2)  ✓✓ answer (2)
7.3.1	$180^\circ$	✓ answer (1)
7.3.2		✓ turning points on x-axis: $x = -90^\circ ; 90^\circ$  ✓ shape  ✓ turning point on y-axis at $(0 ; 2)$  (3)
7.4	$2\cos^3 x - \sin x = 0$ $2\cos^3 x = \sin x$ $2\cos^2 x = \frac{\sin x}{\cos x}$ $2\cos^2 x = \tan x$ $2\cos^2 x - 1 = \tan x - 1$ $\cos 2x + 1 = \tan x$ $x = 45^\circ + k \cdot 180^\circ; k \in \mathbb{Z}$  <b>OR/OF</b> $2\cos^3 x - \sin x = 0$ $\cos x(2\cos^2 x - \tan x) = 0$ $\cos x = 0$ or $2\cos^2 x = \tan x$ not valid $2\cos^2 x - 1 + 1 = \tan x$ $\cos 2x + 1 = \tan x$ $x = 45^\circ + k \cdot 180^\circ; k \in \mathbb{Z}$	✓ $2\cos^2 x = \tan x$ ✓ $2\cos^2 x - 1 = \tan x - 1$ ✓ $\cos 2x + 1 = \tan x$ ✓ answer (4)  <b>OR/OF</b>  ✓ $2\cos^2 x = \tan x$ ✓ $2\cos^2 x - 1 + 1 = \tan x$ ✓ $\cos 2x + 1 = \tan x$ ✓ answer (4)

[11]

## QUESTION/VRAAG 8

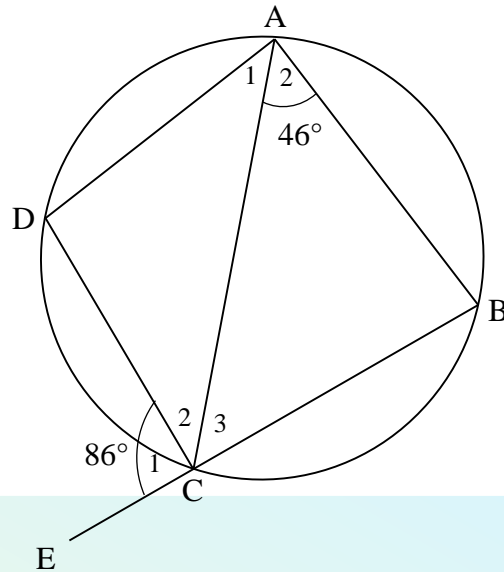


8.1	$\tan \hat{DAC} = \frac{DC}{AC}$ $AC = \frac{16}{\tan 46,85^\circ}$ $AC = 15 \text{ m}$	<ul style="list-style-type: none"> <li>✓ correct subs into trig ratio</li> <li>✓ answer</li> </ul> <p>(2)</p>
8.2	$(AB)^2 = (BC)^2 + (AC)^2 - 2(BC)(AC)\cos \hat{BCA}$ $(19)^2 = x^2 + (15)^2 - 2x(15)\cos 105,61^\circ$ $x^2 + 8,07x - 136 = 0$ $x = \frac{-8,07 \pm \sqrt{(8,07)^2 - 4(1)(-136)}}{2(1)}$ $x = 8,30 \text{ m or } x \neq -16,38 \text{ m}$ $\hat{BEC} = 58^\circ \quad \text{OR/OF} \quad \hat{EBC} = 32^\circ$ $\tan \hat{BEC} = \frac{BC}{EC}$ $EC = \frac{8,3}{\tan 58^\circ}$ $EC = 5,19 \text{ m}$ $DE = 10,81 \text{ m}$	<ul style="list-style-type: none"> <li>✓ correct subst. into cosine rule</li> <li>✓ quadratic equation in std form</li> <li>✓ correct subst. into quadratic formula</li> <li>✓ length of BC</li> <li>✓ size of <math>\hat{BEC}</math> OR/OF <math>\hat{EBC}</math></li> <li>✓ length of EC</li> <li>✓ answer</li> </ul> <p>(7)</p>



	<p><b>OR/OF</b></p> $\frac{\sin 105,61^\circ}{19} = \frac{\sin \hat{C}BA}{15}$ $\hat{C}BA = 49,5^\circ$ $\hat{B}AC = 24,89^\circ$ $\frac{BC}{\sin 24,89^\circ} = \frac{19}{\sin 105,61^\circ}$ $BC = 8,3 \text{ m}$ $\hat{B}EC = 58^\circ$ $\tan \hat{B}EC = \frac{BC}{EC}$ $EC = \frac{8,3}{\tan 58^\circ}$ $EC = 5,19 \text{ m}$ $DE = 10,81 \text{ m}$	<p><b>OR/OF</b></p> <p>✓ correct subst. into sine rule</p> <p>✓ <math>\hat{B}AC</math></p> <p>✓ correct subst. into sine formula</p> <p>✓ length of BC</p> <p>✓ size of <math>\hat{B}EC</math> <b>OR/OF</b> <math>\hat{E}BC</math></p> <p>✓ length of EC</p> <p>✓ answer</p> <p>(7)</p>
[9]		

## QUESTION/VRAAG 9

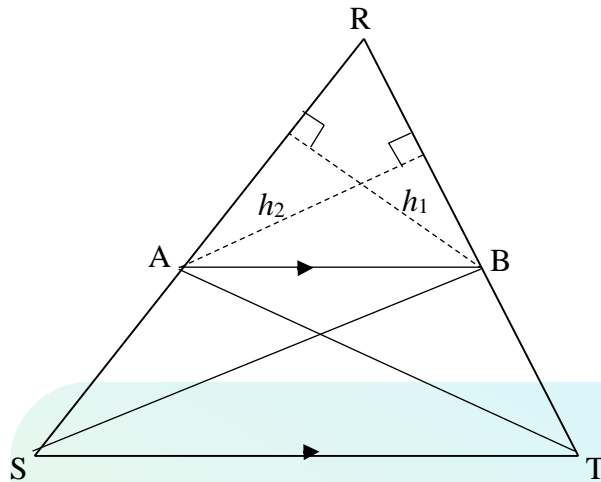


9.1	$\hat{A}_1 = 40^\circ$ [ext. $\angle$ of a cyclic quad / buite $\angle$ van kvh]	✓ S ✓ R (2)
9.2	$\hat{B} = 80^\circ$ $\left[ \hat{A}_1 = \frac{1}{2} \hat{B} \right]$ $\hat{D} = 100^\circ$ [opp $\angle$ s of cyclic quad / teenoorst. $\angle$ e van kvh] $\therefore \hat{C}_2 = 40^\circ$ [sum of $\angle$ s in $\Delta$ / binne $\angle$ e van $\Delta$ ] $\therefore \hat{C}_2 = \hat{A}_1 = 40^\circ$ $\therefore AD = DC$ [sides opp = $\angle$ s / sye teenoor gelyke $\angle$ ] <b>OR/OF</b> $\hat{B} = 80^\circ$ $\left[ \hat{A}_1 = \frac{1}{2} \hat{B} \right]$ $\angle ACE = \hat{A}_2 + \hat{B}$ [ext $\angle$ of $\Delta$ / buite $\angle$ van $\Delta$ ] $\therefore \hat{C}_2 = 40^\circ$ $\therefore \hat{C}_2 = \hat{A}_1 = 40^\circ$ $\therefore AD = DC$ [sides opp = $\angle$ s / sye teenoor gelyke $\angle$ ] <b>OR/OF</b> $\hat{B} = 80^\circ$ $\left[ \hat{A}_1 = \frac{1}{2} \hat{B} \right]$ $\therefore \hat{C}_3 = 180^\circ - 46^\circ - 80^\circ$ [sum of $\angle$ s in $\Delta$ / binne $\angle$ e van $\Delta$ ] $\therefore \hat{C}_3 = 54^\circ$ $\therefore \hat{C}_2 = 180^\circ - 86^\circ - 54^\circ$ [ $\angle$ s on a str. line / $\angle$ e op 'n reguitlyn] $\therefore \hat{C}_2 = 40^\circ$ $\therefore \hat{C}_2 = \hat{A}_1 = 40^\circ$ $\therefore AD = DC$ [sides opp = $\angle$ s / sye teenoor gelyke $\angle$ ] 	✓ S ✓ S/R ✓ S ✓ R (4) ✓ S ✓ S/R ✓ S ✓ R (4) ✓ S ✓ S/R ✓ S ✓ R (4)

[6]

## QUESTION/VRAAG 10

10.1

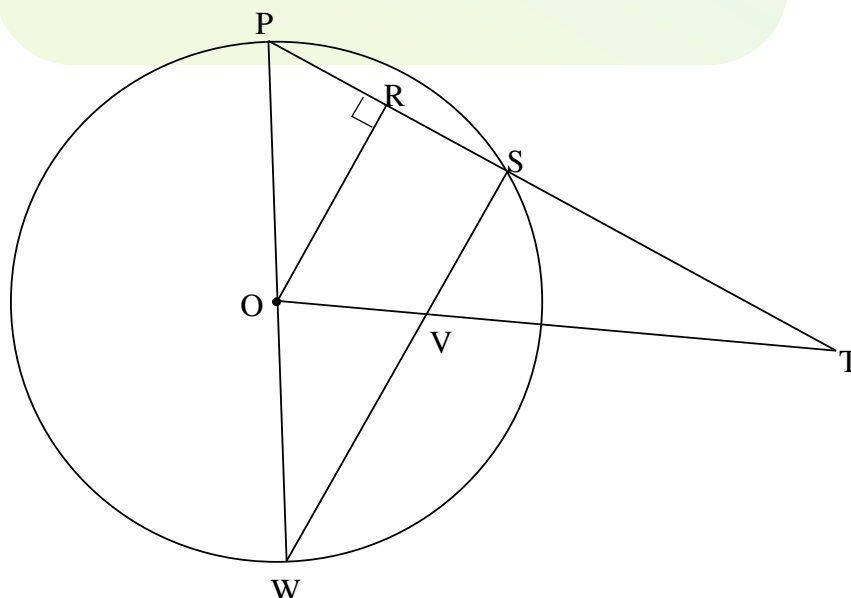


10.1	<p>Construction: Join SB and TA and draw <math>h_1</math> from B <math>\perp</math> AR and <math>h_2</math> from A <math>\perp</math> RB</p> <p><i>Konstruksie: Verbind SB en TA en trek <math>h_1</math> vanaf B <math>\perp</math> AR en <math>h_2</math> vanaf A <math>\perp</math> RB</i></p> <p>Proof/Bewys:</p> $\frac{\text{area } \triangle RAB}{\text{area } \triangle ASB} = \frac{\frac{1}{2} RA \times h_1}{\frac{1}{2} AS \times h_1} = \frac{RA}{AS}$ $\frac{\text{area } \triangle RAB}{\text{area } \triangle ABT} = \frac{\frac{1}{2} RB \times h_2}{\frac{1}{2} BT \times h_2} = \frac{RB}{BT}$ <p>area <math>\triangle RAB</math> = area <math>\triangle RAB</math> [common/gemeenskaplik]          But area <math>\triangle ASB</math> = area <math>\triangle ABT</math> [same base &amp; height; AB <math>\parallel</math> ST/          dies. basis &amp; hoogte; AB <math>\parallel</math> ST]</p> $\therefore \frac{\text{area } \triangle RAB}{\text{area } \triangle ASB} = \frac{\text{area } \triangle RAB}{\text{area } \triangle ABT}$ $\therefore \frac{RA}{AS} = \frac{RB}{BT}$	<p>✓ construction</p> $\checkmark \frac{\text{area } \triangle RAB}{\text{area } \triangle ASB} = \frac{\frac{1}{2} RA \times h_1}{\frac{1}{2} AS \times h_1}$ $\checkmark \frac{RA}{AS}$ $\checkmark \frac{\text{area } \triangle RAB}{\text{area } \triangle ABT} = \frac{RB}{BT}$ <p>✓ S ✓ R</p> <p>(6)</p>
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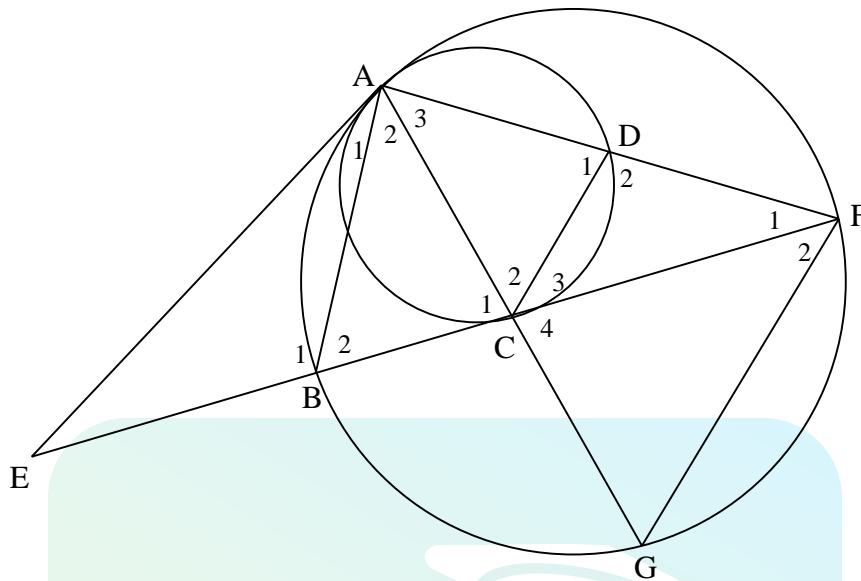


	<p><b>OR/OF</b></p> <p><math>\triangle PRO</math> and <math>\triangle PSW</math>  <math>\hat{P}SW = 90^\circ</math> [∠ in semi circle/∠ in halwe sirkel]  <math>\hat{P}RO = 90^\circ</math> [given]  <math>\therefore \hat{P}RO = \hat{P}SW</math>  <math>\hat{P}</math> is common  <math>\hat{P}OR = \hat{P}WS</math> [sum of ∠s in Δ/ som van ∠e in Δ]  <math>\therefore \triangle PRO \parallel \triangle PSW</math> [∠∠∠]  <math>\therefore \frac{PO}{PW} = \frac{RO}{SW}</math> [∥ Δs / ∥ Δe]    but <math>PW = 2 PO</math> [diameter = 2 radius/middellyn = 2 radius]  <math>\therefore \frac{RO}{SW} = \frac{PO}{2PO}</math>  <math>= \frac{1}{2}</math>  <math>\therefore OR : WS = 1 : 2</math></p>	<p>✓ S ✓ R  ✓ S    ✓ S  ✓ S</p> <p>(5)</p>
10.2.2	<p><math>\frac{OV}{VT} = \frac{RS}{ST} = \frac{1}{3}</math> [prop theorem; <math>RO \parallel SW</math>/  lyn    een sy van Δ]    <math>\frac{RS}{15} = \frac{1}{3}</math>  <math>RS = 5</math> units  <math>PR = RS = 5</math> units [line from centre ⊥ to chord /  lyn vanuit midpt. sirkel ⊥ op koord]    <math>\therefore PT = 25</math> units</p>	<p>✓ S / R    ✓ S  ✓ S    ✓ answer</p> <p>(4)</p>
<b>[15]</b>		

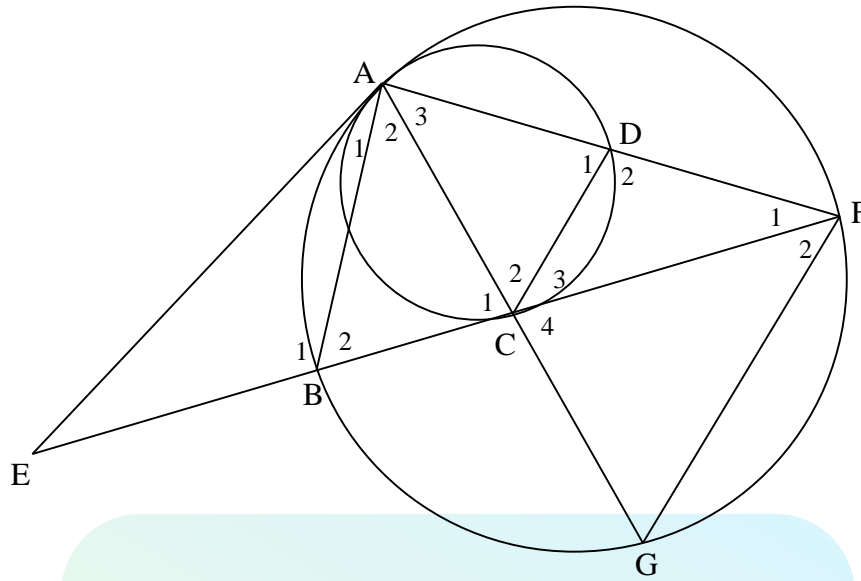
10.2



## QUESTION/VRAAG 11



11.1	$\hat{D}_1 = \hat{E}\hat{A}G = x$	[tan-chord theorem/ $\angle$ tussen raaklyn en koord]	✓ S ✓ R	(6)
	$\hat{C}_1 = \hat{D}_1 = x$	[tan-chord theorem/ $\angle$ tussen raaklyn en koord]	✓ S ✓ R	
	$\hat{C}_4 = \hat{C}_1 = x$	[vert opp $\angle$ s = / regoorst. $\angle$ e]	✓ S/R	
	$\hat{A}\hat{F}G = \hat{E}\hat{A}G = x$	[tan-chord theorem/ $\angle$ tussen raaklyn en koord]	✓ S	
	<b>OR/OF</b>			
	$EA = EC$	[tans from common pt/ raaklyne vanuit dies. punt]	✓ S/R	
	$\hat{C}_1 = \hat{E}\hat{A}G = x$	[ $\angle$ s opp equal sides/ $\angle$ e teenoor gelyke sye]	✓ S	
	$\hat{C}_4 = \hat{C}_1 = x$	[vert opp $\angle$ s = / regoorst. $\angle$ e]	✓ S/R	
	$\hat{D}_1 = \hat{E}\hat{A}G = x$	[tan-chord theorem/ $\angle$ tussen raaklyn en koord]	✓ S ✓ R	
	$\hat{A}\hat{F}G = \hat{E}\hat{A}G = x$	[tan-chord theorem $\angle$ tussen raaklyn en koord]	✓ S	



11.2	$\hat{D}_1 = \hat{A}FG = x$ $\therefore DC \parallel FG$ [corresp $\angle$ s = / ooreenk $\angle$ e = ] $\frac{AG}{AC} = \frac{AF}{AD}$ [prop theorem; $DC \parallel FG$ / lyn // een sy van $\Delta$ ] $\therefore AG \cdot AD = AC \cdot AF$  <b>OR/OF</b>  In $\Delta ACD$ and $\Delta AGF$ $\hat{A}_3$ is common $\hat{A}FG = \hat{D}_1 = x$ [proved in 11.1 / reeds bewys] $\hat{C}_2 = \hat{A}GF = x$ [sum $\angle$ s/binne $\angle$ e $\Delta$ ] $\Delta ACD \parallel \Delta AGF$ [ $\angle \angle \angle$ ] $\frac{AC}{AG} = \frac{AD}{AF}$ [ $\parallel \angle$ s $\therefore$ sides in proportion / $\parallel \angle$ e $\therefore$ sye in dieselfde verhouding] $\therefore AG \cdot AD = AC \cdot AF$	✓ S ✓ S/R ✓ S ✓ R  (4)      ✓ S ✓ S ✓ S/R ✓ S  (4)
11.3	In $\Delta AGF$ and $\Delta ABC$ $\hat{G} = \hat{B}_2$ [ $\angle$ s in the same seg / $\angle$ e in dies. segment] $\hat{A}FG = \hat{C}_1 = x$ [proved in 11.1 / reeds bewys] $\hat{A}_3 = \hat{A}_2$ [sum of $\angle$ s in $\Delta$ /binne $\angle$ e van $\Delta$ ] $\Delta AGF \parallel \Delta ABC$ [ $\angle \angle \angle$ ]	✓ S ✓ R ✓ S ✓ S <b>OR/OF</b> R (4)



11.4	$\frac{GF}{BC} = \frac{AF}{AC} \quad [\Delta AGF \parallel \Delta ABC]$ $\therefore GF = \frac{BC \cdot AF}{AC}$ $\Delta ACD \parallel \Delta FGC \quad [\angle \angle \angle]$ $\therefore \frac{AC}{GF} = \frac{AD}{FC}$ $\therefore AC = \frac{AD \cdot FG}{FC}$ $\therefore GF = BC \cdot AF \div \frac{AD \cdot FG}{FC}$ $GF = BC \cdot AF \times \frac{FC}{AD \cdot FG}$ $\therefore GF^2 = \frac{BC \cdot FC \cdot AF}{AD}$ <p><b>OR/OF</b></p> $\Delta AGF \parallel \Delta ABC \quad [\angle \angle \angle]$ $\frac{GF}{BC} = \frac{AF}{AC}$ $GF = \frac{AF \cdot BC}{AC}$ $\Delta ACD \parallel \Delta AGF \quad [\angle \angle \angle]$ $\frac{AD}{AF} = \frac{CD}{GF}$ $GF = \frac{AF \cdot CD}{AD}$ $GF \times GF = \frac{AF \cdot BC}{AC} \cdot \frac{AF \cdot CD}{AD}$ $\Delta FCD \parallel \Delta FAC \quad [\angle \angle \angle]$ $\frac{FC}{FA} = \frac{CD}{AC} \quad \text{from } \parallel \Delta \text{'s}$ $FC = \frac{CD \cdot AF}{AC}$ $GF^2 = \frac{AF \cdot FC \cdot BC}{AD}$	<p>✓ S / R</p> <p>✓ S</p> <p>✓ S</p> <p>✓ S</p> <p>✓ S</p> <p>✓ S</p> <p>✓ S</p> <p><b>OR/OF</b></p> <p>✓ S</p> <p>✓ S</p> <p>✓ S</p> <p>✓ S</p> <p>✓ S</p> <p>✓ S</p> <p>✓ S</p> <p>(6)</p> <p>(6)</p>
		[20]

**TOTAL/TOTAAL: 150**