Province of the
EASTERN CAPE
EDUCATION

NATIONAL SENIOR CERTIFICATE/*NASIONALE SENIOR SERTIFIKAAT*

GRADE/*GRAAD* 11

NOVEMBER 2022

TECHNICAL MATHEMATICS P2/*TEGNIESE WISKUNDE V2* MARKING GUIDELINE/*NASIENRIGLYN*

MARKS/*PUNTE*: 150

This marking guideline consists of 16 pages./
Hierdie nasienriglyn bestaan uit 16 bladsye.

NOTE:

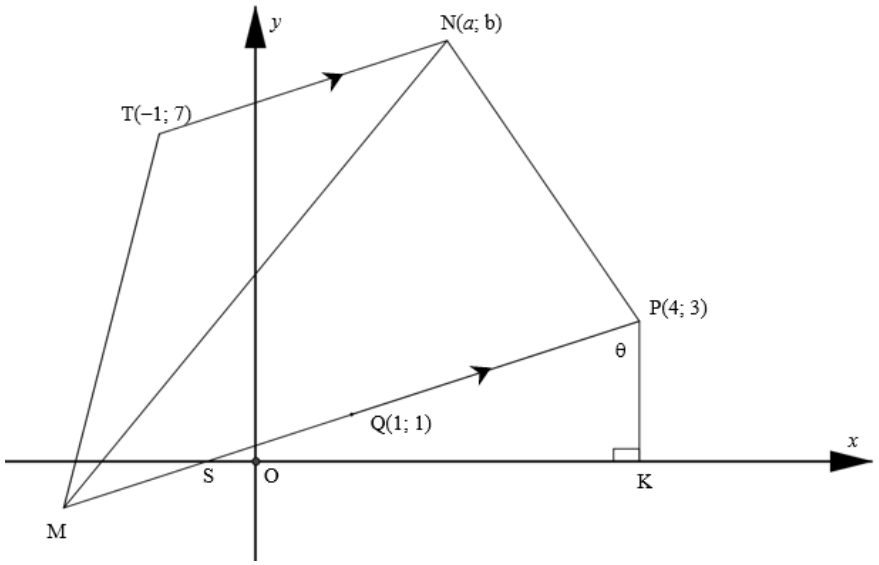
- Continuous accuracy (CA) applies only where indicated in this marking guideline.
- Assuming values/answers in order to solve a problem is unacceptable.

LET WEL:

- *Volgehoue akkuraatheid (CA) is slegs van toepassing soos in hierdie nasienriglyn aangedui.*
- *Aanvaarding van waardes/antwoorde om 'n probleem op te los, is onaanvaarbaar.*

MARKING CODES / *NASIENKODES*	
M	**Method / *Metode***
A	**Accuracy / *Akkuraatheid***
AO	**Answer only / *Slegs antwoord***
CA	**Consistent accuracy / *Deurlopende akkuraatheid***
F	**Formula / *Formule***
I	**Identity / *Identiteit***
R	**Rounding / *Afronding***
S	**Simplification / *Vereenvoudiging***
ST	**Statement / *Bewering***
RE	**Reason / *Rede***
ST RE	**Statement and correct reason / *Bewering en korrekte rede***
SF	**Substituting correctly in correct formula / *Korrekte vervanging in die korrekte formule***
NPU	**No penalty for omitting units / *Geen penalisering vir eenhede uitgelaat***

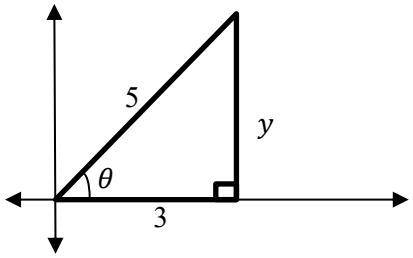
QUESTION/*VRAAG* 1

Q		M
		
1.1	$K(4;0)$	✓ 5 ✓ 0 (2)
1.2	$M_{PM} = \left(\frac{x_2 + x_1}{2}; \frac{y_2 + y_1}{2}\right)$ $M_{PM} = \left(\frac{x_M + 4}{2}; \frac{y_M + 3}{2}\right)$ $\therefore 1 = \frac{x_M + 4}{2}$ and/*en* $\therefore 1 = \frac{y_M + 3}{2}$ $2 = x_M + 4$ and/*en* $2 = y_M + 3$ $-2 = x_M$ and/*en* $-1 = y_M$ $\therefore$ M(-2;-1)	✓**F** ✓$1 = \frac{x_M + 4}{2}$ ✓$1 = \frac{y_M + 3}{2}$ ✓Simplification/Ver-eenvoudiging ✓ $-2 = x_M$ ✓$-1 = y_M$ (6)
1.3	$m_{PM} = \frac{y_2 - y_1}{x_2 - x_1}$ $m_{PM} = \frac{3+1}{4+2}$ **OR / OF** $m_{PM} = m_{QM} = \frac{3-1}{4-2}$ $m_{PM} = \frac{4}{6}$ $m_{PM} = \frac{2}{3}$ **OR /OF** $m_{PM} = m_{QM} = \frac{2}{3}$	✓**F** ✓**SF** ✓**CA** (3)
1.4	$tanP\hat{S}K = \frac{2}{3}$ $P\hat{S}K = tan^{-1}\left(\frac{2}{3}\right)$ $P\hat{S}K = 33{,}69\ldots°$ $\therefore S\hat{P}K = 180° - 90° - 33{,}69\ldots°$ $S\hat{P}K = 56{,}31°$ (Int. ∠'s of ΔSPK/*Binne ∠'e van ΔSPK*)	✓**M** ✓**CA** ✓**M** ✓**ST CA** ✓**R** (5)

1.5	$sinP\hat{S}K = \frac{PK}{PS}$	
	$\sin 33{,}69\ldots^\circ = \frac{3}{PS}$	✓**M CA** from/*van* 1.4
	$PS \times \sin 33{,}69\ldots^\circ = 3$	
	$PS = \frac{3}{sin33{,}69\ldots^\circ}$	✓$\frac{3}{sin33{,}69\ldots^\circ}$
	$PS = 5{,}41$ units/*eenhede*	✓**CA**
	OR/*OF*	
	$y = \frac{2}{3}x + c$	
	$3 = \frac{2}{3}(4) + c$ **or/of** $1 = \frac{2}{3}(1) + c$ **or/of** $-1 = \frac{2}{3}(-2) + c$	
	$3 = \frac{8}{3} + c$ **or/of** $1 = \frac{2}{3} + c$ **or/of** $-1 = \frac{-4}{3} + c$	
	$\frac{1}{3} = c$	
	$\therefore y = \frac{2}{3}x + \frac{1}{3}$	✓**M**
	$\therefore S(x;0): 0 = \frac{2}{3}x + \frac{1}{3}$	
	$-\frac{1}{3} = \frac{2}{3}x$	
	$-\frac{1}{2} = x$	✓**CA**
	$\therefore S\left(-\frac{1}{2}; 0\right)$	
	$\therefore PS = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$	
	$PS = \sqrt{\left(-\frac{1}{2} - 4\right)^2 + (0 - 3)^2}$	
	$PS = 5{,}41$ units/*eenhede*	✓Answer/antwoord **CA**
		(3)

1.6	*TN*: $m = \frac{2}{3}$ (TN ∥ MP)	✓**ST RE**
	$\therefore y = \frac{2}{3}x + c$	
	(-1;7): $7 = \frac{2}{3}(-1) + c$	
	$7 = \frac{-2}{3} + c$	
	$\frac{23}{3} = c$	✓$\frac{23}{3} = c$
	$\therefore y = \frac{2}{3}x + \frac{23}{3}$	✓ $y = \frac{2}{3}x + \frac{23}{3}$
	$\therefore$ *N* is a point of intersection/*is 'n snypunt*	
	$\therefore -3x + 15 = \frac{2}{3}x + \frac{23}{3}$	✓**M**
	$-3x - \frac{2}{3}x = \frac{23}{3} - 15$	✓$x = 2$
	$-\frac{11}{3}x = -\frac{22}{3}$	✓$y = 9$
	$x = 2$	✓*N*(2;9)
	$\therefore y = -3(2) + 15$	
	$y = 9$	
	$\therefore N(2;9)$	(7)
		[26]

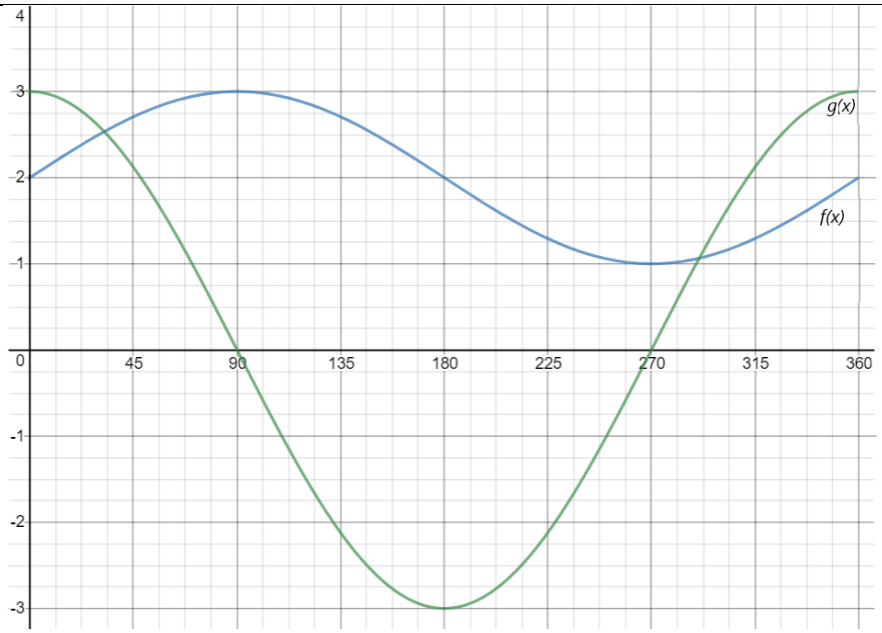
QUESTION/*VRAAG* 2

Ques			M
2.1.1	41,54		✓**A** (1)
2.1.2	8,68		✓✓**A** (2)
2.2.1	$5cos\theta = 3$ $cos\theta = \frac{3}{5}$ $\therefore sin\theta.sec\theta = \frac{4}{5} \times \frac{5}{3}$ $= \frac{4}{3}$	 $(5)^2 = (3)^2 + (y)^2$ $\therefore y = 4$	✓ $cos\theta = \frac{3}{5}$ ✓Diagram in correct quadrant/*diagram in korrekte kwadrant* ✓$y = 4$ ✓ $\frac{4}{5} \times \frac{5}{3}$ ✓**CA** (5)
2.2.2	$\frac{tan\theta}{cot\theta} = \frac{\frac{4}{3}}{\frac{3}{4}}$ $= \frac{4}{3} \times \frac{4}{3}$ $= \frac{16}{9}$		✓✓**SF CA** ✓**CA** (3)
2.2.3	$cos\theta = \frac{3}{5}$ $\theta = cos^{-1}\left(\frac{3}{5}\right)$ $\theta = 53{,}13°$		✓Using any correct ratio/*Maak gebruik van enige korrekte verhouding* ✓**M** ✓**CA** (3)
2.3	$3\sin\theta = -1{,}026$ $\sin\theta = -0{,}342$ Ref/*Verw* $\angle \approx 20°$ $\theta = 180° + 20°$ or/*of* $360° - 20°$ $\theta = 200°$ or/*of* $340°$		✓**S A** ✓Ref/*Verw* ∠ **CA** ✓180°+ **A** ✓360°− **A** ✓**S CA** (5)
			[19]

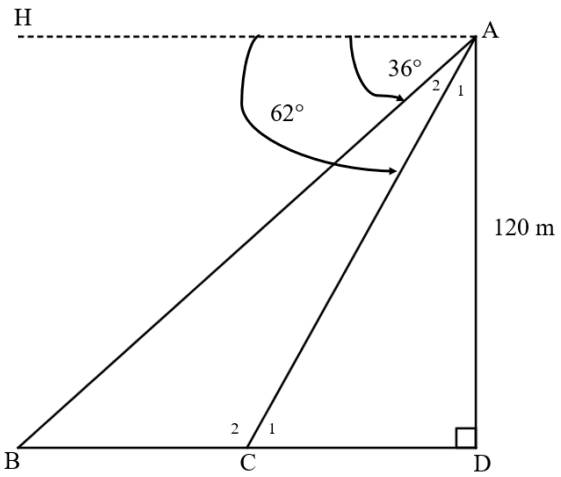
QUESTION/*VRAAG* 3

Ques		M
3.1.1	$1-\sin^2 x=\cos^2 x$	✓ $\cos^2 x$ (1)
3.1.2	$\sec^2 x-\tan^2 x=1$	✓1 (1)
3.2	$\frac{\sin(\pi-\theta).tan\theta.sin270°}{\cos(2\pi-\theta).\tan(\pi-\theta)}=\frac{(\sin\theta)(tan\theta).(-1)}{(cos\theta)(-\tan\theta)}$ $=tan\theta$	✓$\sin\theta$ **A** ✓-1 **A** ✓$\cos\theta$ **A** ✓$-tan\theta$ **A** ✓$tan\theta$ **CA** (5)
3.3	LHS/*LK* $=\sin x+\cot x.\cos x$ $=\sin x+\frac{\cos x}{\sin x}.\cos x$ $=\frac{\sin^2 x+\cos^2}{\sin x}$ $=\frac{1}{\sin x}$ $=\text{cosec } x$ = RHS/*RK*	✓$\frac{\cos x}{\sin x}$ **I A** ✓$\frac{\sin^2 x+\cos^2 x}{\sin x}$ ✓1 **I A** ✓$\frac{1}{\sin x}=\text{cosec } x$ (4)
		[11]

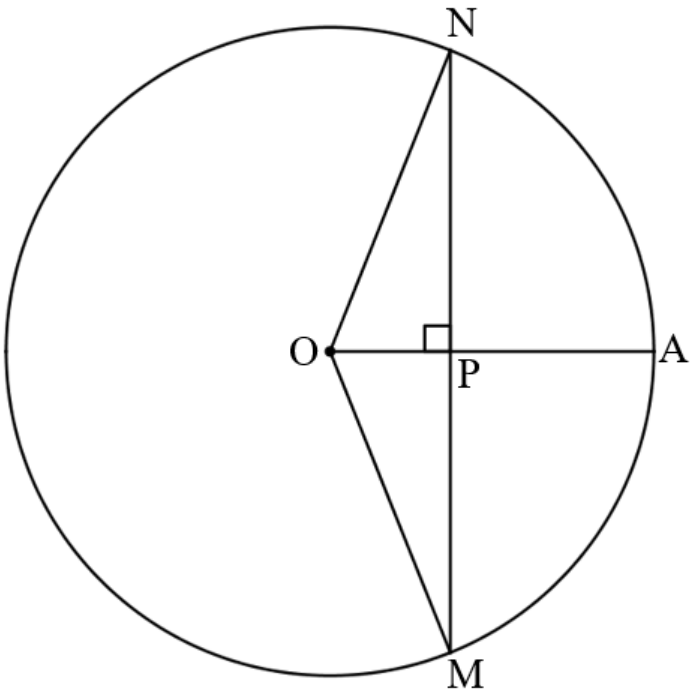
QUESTION/VRAAG 4

Ques		M
4.1	 Learners can use any interval / *Leerder kan enige interval gebruik.*	*g*: ✓ cos start and end point/*cos begin- en eindpunte* **A** ✓ cos turningpoints/*cos draaipunte* **A** ✓ cos *x*-intercepts/*cos x-afsnitte* **A** *f*: ✓ sin start and end point/*sin begin- en eindpunte* **A** ✓ sin turningpoints/*sin draaipunte* **A** ✓ sin *x*-intercepts/*sin x-afsnitte* **A** (6)
4.2.1	3	✓**A** (1)
4.2.2	$90° \leq x \leq 270°$	✓$90° \leq$ **CA** ✓$\leq 270°$ **CA** (2)
		[9]

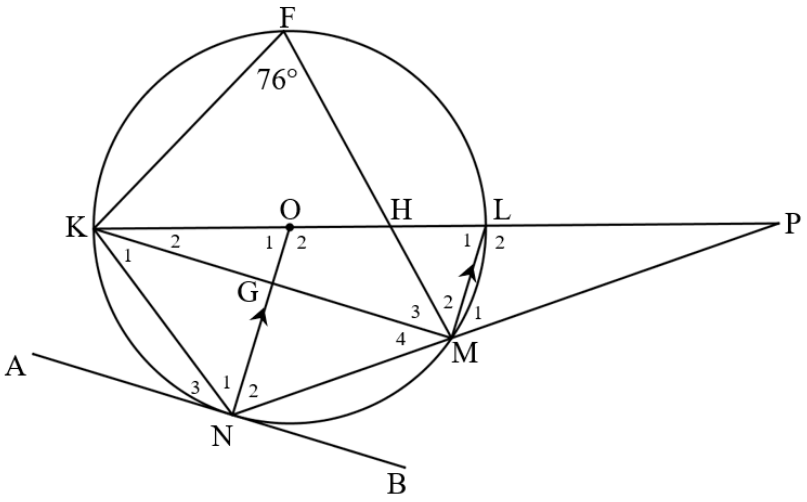
QUESTION/*VRAAG* 5

Ques		M
		
5.1	$\hat{B} = 36°$ (alt. <'s = /*verw.* <*'e* =;HA ∥ BD)	✓**ST** ✓**RE** (2)
5.2	$\hat{C}_1 = 62°$ (alt. <'s = /*verw.* <*'e* =;HA ∥ BD)	✓**ST RE** (1)
5.3	$\frac{AC}{120} = \text{cosec } 62°$ $AC = \frac{120}{\sin 62°}$ $\approx 135,91 \text{ m}$	✓**M** ✓**S** ✓**CA** (3)
5.4	$\frac{BC}{\sin A_2} = \frac{AC}{\sin B}$ $\frac{BC}{\sin 26°} = \frac{135,91}{\sin 36°}$ $BC = \frac{135,91 \sin 26°}{\sin 36°}$ $\approx 101,36 \text{ m}$	✓**F** ✓**SF CA** ✓ $\hat{A}_2 = 26°$ **A** ✓**S** ✓**CA** (5)
5.5	Area of $\Delta ABC = \frac{1}{2} BC.AC \sin C_2$ $= \frac{1}{2} \times 101,36 \times 135,91 \sin 118°$ $= 6081,67 \text{ m}^2$	✓**F** ✓**SF CA** ✓**CA** (3)
		[14]

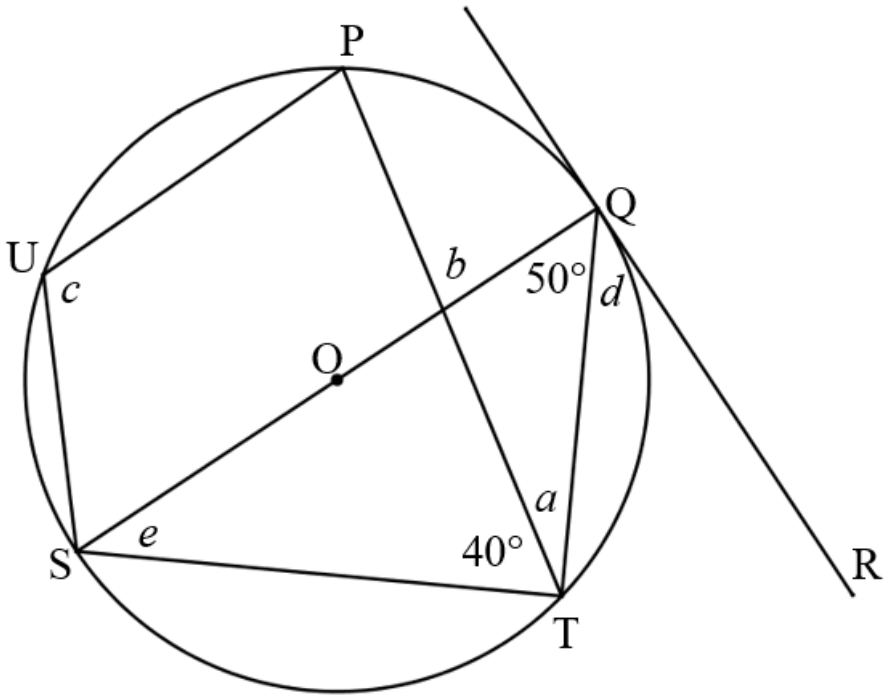
QUESTION/*VRAAG* 6

Ques		M
6.1	**Bisects** the chord/***halveer*** *die koord.*	✓**A** (1)
6.2		
	$MP = PN = \frac{48}{2} = 24$ units/*eenhede* (line from centre ⊥ to chord / *loodlyn uit midpt ʘ na koord)* $ON = OM = OA$ (radii) $\therefore ON^2 = OP^2 + PN^2$ (Pyth) $ON^2 = (7)^2 + (24)^2$ $ON^2 = 625$ $ON = \pm\sqrt{625}$ $ON = \pm 25$ $\therefore ON = 25$ units/*eenhede* $\therefore PA = OA - OP$ $PA = 25 - 7$ $PA = 18$ units/*eenhede*	✓**ST** ✓ **RE** ✓ **ST RE** ✓ **M** ✓**CA** ✓**M** ✓**CA** (7)
		[8]

QUESTION/*VRAAG* 7

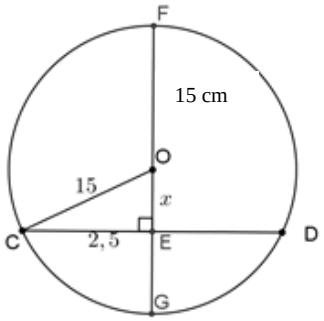
Ques		**M**
7.1	90°	✓**A** (1)
7.2		
7.2.1	$\hat{L}_1 = 76°$ (∠'s in same segment/*∠'e in dieselfde segment*)	✓**ST** ✓ **RE** (2)
7.2.2	$\widehat{O}_2 = 76°$ (corresp. ∠'s/*ooreenkomstige ∠'e*; ON ∥ LM)	✓**ST** ✓ **RE** (2)
7.2.3	$\widehat{M}_4 = 38°$ (∠ at centre = 2 x ∠ at circumf./*midpts ∠ = 2* x *omtreks ∠*)	✓**ST** ✓ **RE** (2)
7.2.4	$\widehat{N}_3 = 38°$ (tan chord/*raaklyn koord*)	✓**ST** ✓ **RE** (2)
7.2.5	$\widehat{N}_1 + \widehat{N}_2 = 104°$ (opp ∠'s of a cq/*teenoorst ∠'e van 'n kvh*)	✓**ST** ✓ **RE** (2)
7.2.6	$\widehat{N}_1 + \widehat{N}_3 = 90°$ (rad⊥tan/*rad⊥raaklyn*)	✓**ST** ✓ **RE** (2)
7.2.7	$\widehat{M}_2 + \widehat{M}_3 = 90°$ (∠ in semi-circle/*∠ in semi-sirkel*)	✓**ST** ✓ **RE** (2)
7.2.8	$\widehat{M}_1 = 52°$ (∠'s on str. line/*∠'e op reguitlyn*)	✓**ST** ✓ **RE** (2)
		[17]

QUESTION/*VRAAG* 8

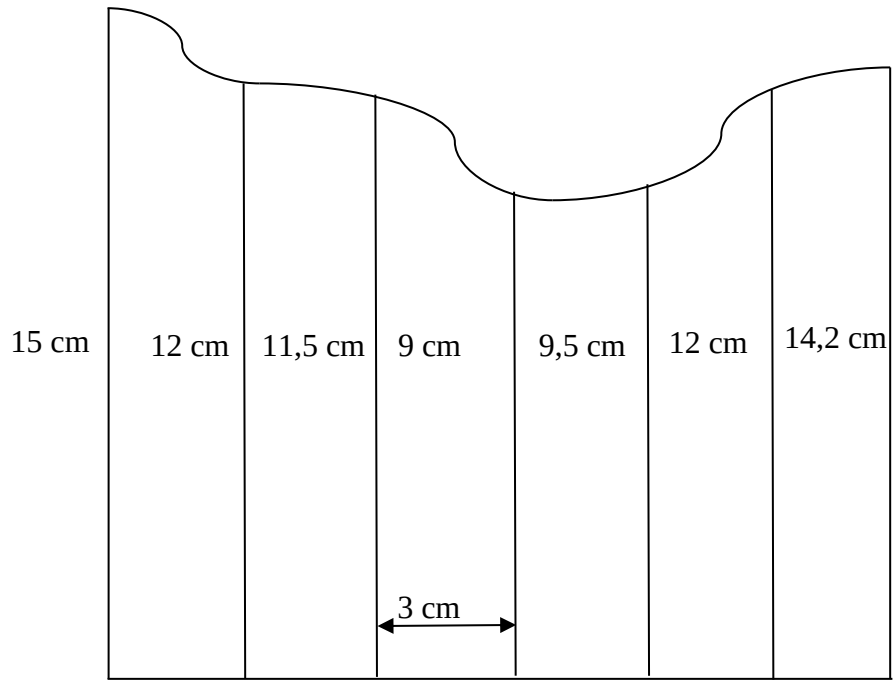
Ques		M
8.1	Equal/*gelyk*	✓**A** (1)
8.2		
8.2.1	$a = 50°$ (∠in semi-circle/∠ *in semi-sirkel)*	✓**ST** ✓ **RE** (2)
8.2.2	$b = 100°$ (ext ∠ of Δ/*buite ∠ van Δ)*	✓**ST** ✓ **RE** (2)
8.2.3	$c = 140°$ (opp ∠'s of a cq/*teenoorst ∠'e van 'n kvh*)	✓**ST** ✓ **RE** (2)
8.2.4	$d = 40°$ (rad⊥tan/*rad⊥raaklyn*)	✓**ST** ✓ **RE** (2)
8.2.5	$e = 40°$ (tan chord/*raaklyn koord*)	✓**ST** ✓ **RE** (2)
		[11]

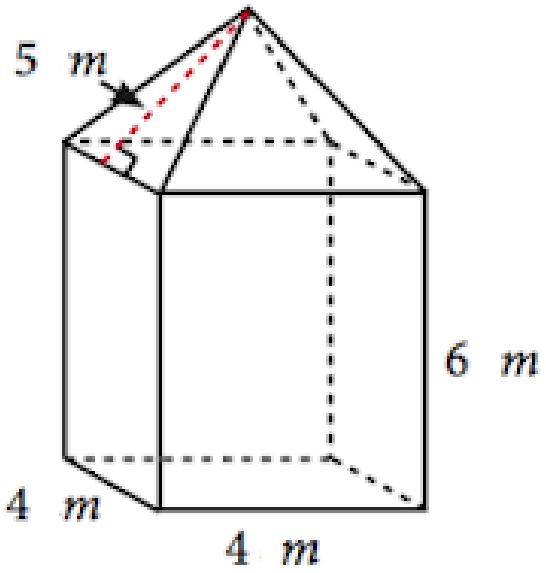
QUESTION/*VRAAG* 9

Ques		M
9.1.1	*Area of a sector* | *Opp. van 'n segment* $= \frac{r^2\theta}{2}$ $\therefore 8{,}5 = \frac{(2{,}1)^2\theta}{2}$ $17 = 4{,}41\theta$ $3{,}8548\ldots = \theta$ $\therefore 3{,}8548\ldots \times \frac{180^\circ}{\pi} = \theta$ $221^\circ = \theta$	✓ **F** ✓**SF** ✓ 3,8545… ✓221° (4)
9.1.2	$s = r\theta$ $= (2{,}1)(3{,}8548\ldots)$ $= 8{,}10$ cm	✓ **F** ✓ **SF** ✓8,10 cm (3)
9.2.1	$v = \pi Dn$ $v = \pi(80)(21)$ $v = 1680\pi$ ***or/of*** 5278 mm/s	✓ **F** ✓ **SF** ✓ 1680π *or/of* 5278 mm/s (3)
9.2.2	$\omega = 2\pi n$ $\omega = 2\pi(21)$ $\omega = 42\pi$ *or/of* 132 rad/s **OR/*OF*** $v = \omega r$ $\omega = \frac{v}{r}$ $= \frac{1680\pi}{40}$ $= 42\pi$ rad/s	✓ **F** ✓ **SF** ✓ 42π *or/of* 132 rad/s **OR/*OF*** ✓ **F** ✓ **SF** ✓ 42π *or/of* 132 rad/s (3)

Ques		M
9.3	$4h^2 - 4dh + x^2 = 0$ $4h^2 - 4(30)h + (5)^2 = 0$ $4h^2 - 120h + 25 = 0$ $h = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$ $h = \frac{-(-120) \pm \sqrt{(-120)^2-4(4)(25)}}{2(4)}$ $\therefore h = 29{,}79$ cm or/of $h = 0{,}21$ cm $\therefore h = 29{,}79$ cm (larger/*groter* segment)	✓ **F** ✓ **SF** ✓Standard form/*standaard vorm* ✓**F** ✓**SF CA** ✓ $h = 29{,}79$mm **CA** ✓ $h = 0{,}21$mm **CA** ✓ $h = 29{,}79$mm **CA**
	OR/*OF*	**OR/*OF***
		
	$CE = 2{,}5$ cm (line of centre ⊥ chord / lyn vanuit midpunt ⊙na koord	✓**ST** ✓**RE**
	OC = 15 cm (radius)	
	$x^2 + 2{,}5^2 = 15^2$ (*Pyth*)	✓**ST**
	$x^2 = 218{,}75$	✓**ST**
	$x = 14{,}79 \quad (x > 0)$	✓**S** ✓**CA** value of /*waarde van x* ✓$x > 0$
	∴ Height of larger segment/*Hoogte van groter segment* $= 29{,}79$ cm	✓ height / *hoogte*
		(8)
		[21]

QUESTION/*VRAAG* 10

Ques.		M
		
10.1	$A_T = a(m_1 + m_2 + m_3 + \ldots + m_n)$ $A_T = 3(13{,}5 + 11{,}75 + 10{,}25 + 9{,}25 + 10{,}75 + 13{,}1)$ $A_T = 3(68{,}6)$ $A_T = 205{,}8$ cm^2 **OR/*OF*** $A_T = a\left(\frac{o_1 + o_n}{2} + o_2 + o_3 + o_4 + \cdots + o_{n-1}\right)$ $A_T = 3\left(\frac{15 + 14{,}2}{2} + 12 + 11{,}5 + 9 + 9{,}5 + 12\right)$ $A_T = 3(68{,}6)$ $A_T = 205{,}8$ cm^2	✓ **F** ✓ **SF** ✓ **S** ✓ 205,8 cm^2 ✓ **F** ✓ **SF** ✓ **S** ✓ 205,8 cm^2 (4)

10.2		
10.2.1	$A_T = (2lh + 2wh) + (2bs + b^2)$ $A_T = (2(4)(6) + 2(4)(6)) + (2(4)(5) + (4)^2)$ $A_T = 96 + 56$ $A_T = 152\ \text{m}^2$	✓ $(2lh + 2wh)$ ✓$(2bs + b^2)$ ✓ **SF** ✓ $152\ \text{m}^2$ (4)
10.2.2	*Area of base* $= s^2 = (4)^2 = 16\ \text{m}^2$ $(5)^2 = H^2 + \left(\frac{4}{2}\right)^2$ $25 = H^2 + 4$ $21 = H^2$ $\pm\sqrt{21} = H$ $\therefore H = \sqrt{21}$ $Vol = (lwh) + \left(\frac{1}{3}AH\right)$ $Vol = (4 \times 4 \times 6) + \left(\frac{1}{3} \times 16 \times \sqrt{21}\right)$ $Vol = 96 + 24{,}44\ ...$ $Vol = 120{,}44\ \text{m}^3$	✓$16\ \text{m}^2$ ✓$(5)^2 = H^2 + \left(\frac{4}{2}\right)^2$ ✓$\sqrt{21}$ **CA** ✓**F** ✓**SF** ✓$120{,}44\ \text{m}^3$ **CA** (6)
		[14]
	TOTAL/*TOTAAL:*	**150**