Province of the
EASTERN CAPE
EDUCATION

NATIONAL SENIOR CERTIFICATE/ *NASIONALE SENIOR SERTIFIKAAT*

GRADE/*GRAAD* 12

JUNE/*JUNIE* 2019

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:

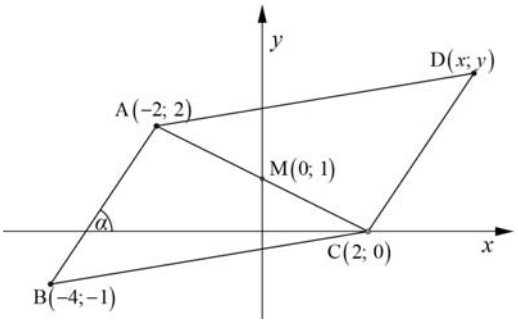
- Continuous accuracy (CA) applies in ALL aspects of the marking guideline.
- Assuming values/answers in order to solve a problem is unacceptable.

LET WEL:

- *Volgehoue akkuraatheid (CA) is deurgaans in ALLE aspekte van die nasienriglyn van toepassing.*
- *Aanvaarding van waardes/antwoorde om 'n probleem op te los, is onaanvaarbaar.*

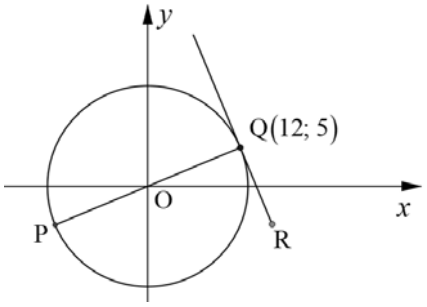
MARKING CODES / NASIENKODES	
M	Method/*Metode*
MA	Method with accuracy/*Metode met akkuraatheid*
A	Accuracy/*Akkuraatheid*
CA	Consistent accuracy/*Deurlopende akkuraatheid*
S	Simplification/*Vereenvoudiging*
SF	Substitution into the correct formula/*Vervanging in die korrekte formule*
R	Rounding penalty/Afronding penalisering
RE	Reason/*Rede*
ST	Statement/*Bewering*
SR	Statement and correct reason/*Bewering en korrekte rede*

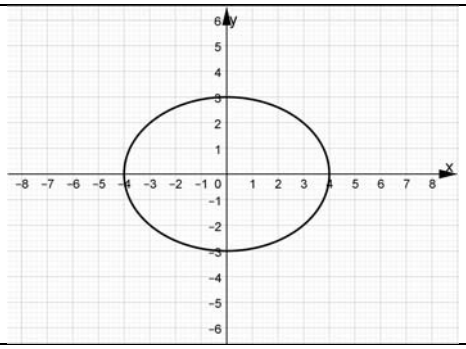
QUESTION/*VRAAG* 1



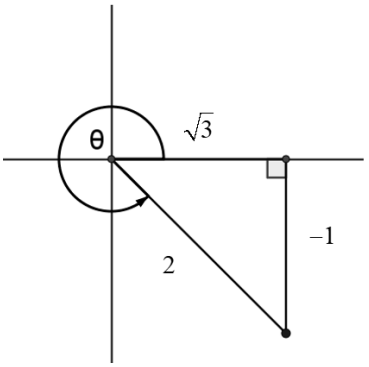
1.1	$AB = \sqrt{(-2-(-4))^2 + \left(2-(-1)\right)^2}$ $= \sqrt{13}$ $= 3,61$	✓ **SF/A** ✓ **CA** Answer/*Antwoord*	(2)
1.2	$m_{AB} = \frac{2-(-1)}{-2-(-4)}$ $= \frac{3}{2}$	✓ **SF/A** ✓ **A**	(2)
1.3	$m_{CD} = m_{AB} = \frac{3}{2}$ AB ∥ CD $y - y_1 = m(x - x_1)$ $y - 0 = \frac{3}{2}(x-2)$ $y = \frac{3}{2}x - 3$	✓ **ST** ✓ **SF/CA** ✓ **CA** Equation/*Vergelyking*	(3)
1.4	$\tan\alpha = \frac{3}{2}$ $\alpha = \tan^{-1}(\frac{3}{2})$ $= 56,31°$	✓**M** ✓**CA** $56,31°$	(2)
1.5	$1 = \frac{y_D - 1}{2}$ $y_D - 1 = 2$ $y_D = 3$	✓**M** ✓**A**	(2)
			[11]

QUESTION/*VRAAG* 2

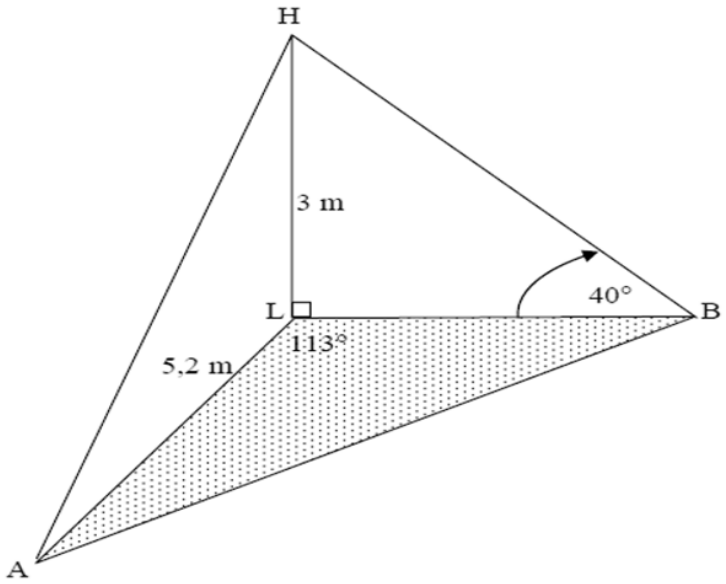


2.1.1	$x^2 + y^2 = r^2$ $(12)^2 + (5)^2 = r^2$ $169 = r^2$ $x^2 + y^2 = 169$	✓**SF/A** ✓ **A** Equation of circle/v*ergelyking van sirkel*	(2)
2.1.2	$m_{PQ} = \frac{5}{12}$ $m_{RQ} = -\frac{12}{5}$ (product of gradients) $y - y_1 = m(x - x_1)$ $y - 5 = -\frac{12}{5}(x - 12)$ $y = -\frac{12}{5}x + \frac{169}{5}$	✓**A** gradient/*gradiënt* PQ ✓**CA** gradient/*gradiënt* RQ ✓**SF/A** ✓**CA** equation/*vergelyking*	(4)
2.2.1	$9x^2 + 16y^2 = 144$ $\frac{x^2}{16} + \frac{y^2}{9} = 1$	✓**A** LHS/*LK* ✓**A** RHS/*RK* = 1	(2)
2.2.2	Major axis / *Groter*-as = 8 Minor axis / *Kleiner*-as = 6	✓**CA** ✓**CA**	(2)
2.2.3		✓**CA** both *x*-intercepts/*beide x-afsnitte* ✓**CA** both *y*-intercepts/*beide y-afsnitte* ✓ **CA** elliptical shape/*eliptiese vorm*	(3)
			[13]

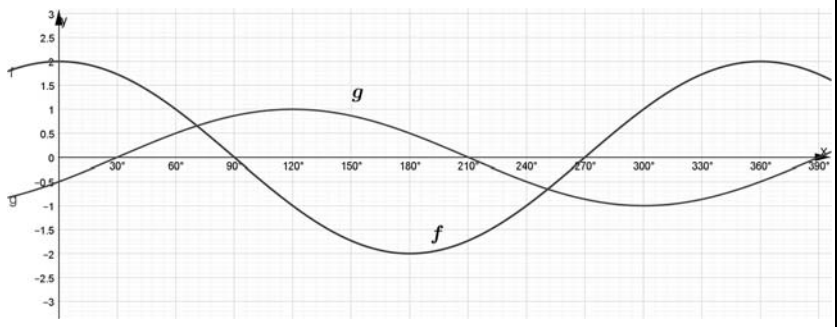
QUESTION/*VRAAG* 3			
3.1	$\frac{\cos ec^2 100^\circ}{-\sec 80^\circ}$ $= -0,179$	✓✓**A** **R**	(2)
3.2.1	$\tan(180^\circ-\theta).\cos^2(180^\circ+\theta)+\cos(180^\circ-\theta).\sin\theta.\sec\frac{\pi}{3}$ $=(-\tan\theta)(-\cos\theta)^2+(-\cos\theta)(\sin\theta)(\sec 60^\circ)$ $=\left(-\frac{\sin\theta}{\cos\theta}\right)(\cos^2\theta)-\cos\theta\sin\theta(2)$ $=-\sin\theta\cos\theta-2\sin\theta\cos\theta$ $=-3\sin\theta\cos\theta$	✓**A** (-tan θ) ✓**A** (-cos θ) ✓**A** (-cos θ) ✓**A 60°** ✓**A** $\frac{\sin\theta}{\cos\theta}$ ✓**A (2)** ✓**CA S**	(7)
3.2.2	$\frac{1-\sin^2 x.\frac{\cos^2 x}{\sin^2 x}}{2(\sin^2 x+\cos^2 x)}$ $=\frac{1-\cos^2 x}{2(1)}$ $=\frac{\sin^2 x}{2}$	✓**A** $\frac{\cos x}{\sin x}$ ✓**S** ✓**A** $\sin^2 x+\cos^2 x=1$ ✓**CA S**	(4)
3.3	$\frac{2}{\sec\theta\sec(360^\circ-\theta)-\tan 45^\circ}$ $=\frac{2}{(\sec\theta).(\sec\theta)-1}$ $=\frac{2}{\sec^2\theta-1}$ $=\frac{2}{\tan^2\theta}$ $=2\cot^2\theta$	✓**A** tan 45° = 1 ✓**A** (sec θ) ✓**A** ($\tan^2$ θ) ✓**A** $\cot\theta=\frac{1}{\tan\theta}$	(4)
			[17]

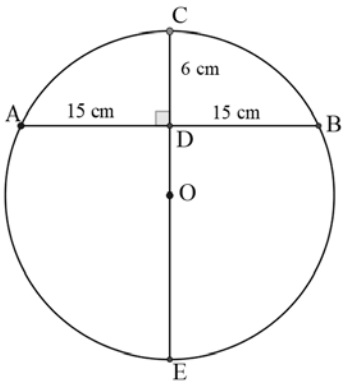
QUESTION/*VRAAG* 4			
4.1.1	 $\sin\theta = \frac{-3}{6}$ $= \frac{-1}{2}$ $x^2 = r^2 - y^2$ $x = \sqrt{2^2 - (-1)^2}$ $= \sqrt{3}$ $\tan\theta = -\frac{1}{\sqrt{3}}$	✓**A** sin θ **S** ✓ **CA** value of *x/ waarde van x* ✓ correct quadrant/ *korrekte kwadrant* ✓**CA** value of tan θ/ *waarde van tan θ*	(4)
4.1.2	$\sin\theta + \sec\theta$ $= \frac{-1}{2} + \frac{2}{\sqrt{3}}$ $= \frac{-\sqrt{3}+4}{2\sqrt{3}}$	✓**CA** $-\frac{1}{2}$ ✓**CA** $\frac{2}{\sqrt{3}}$ ✓**CA** $\frac{-\sqrt{3}+4}{2\sqrt{3}}$	(3)
4.2	$2\sin\theta - \cos\theta = 0$ $2\sin\theta = \cos\theta$ $\frac{\sin\theta}{\cos\theta} = \frac{1}{2}$ $\tan\theta = \frac{1}{2}$ Ref /verwys $\angle = 26{,}57°$ $\theta = 26{,}57°$ or/of $180° + 26{,}57° = 206{,}57°$	✓**A** $\tan\theta = \frac{1}{2}$ ✓**CA** Ref/verwys $\angle$ ✓**CA** θ = 26,57° ✓**M** 180° + ✓**CA** θ = 206,57°	(5)
			[12]

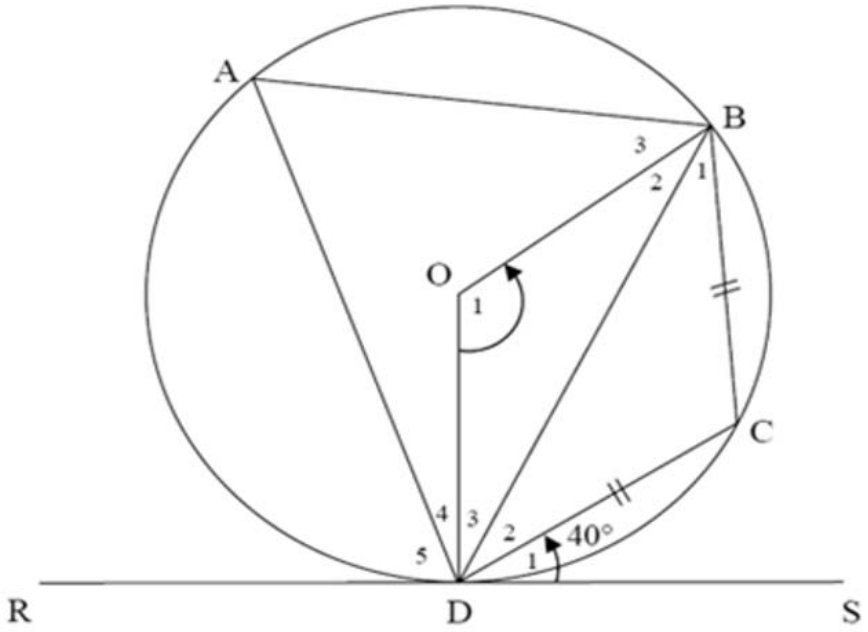
QUESTION/*VRAAG* 5



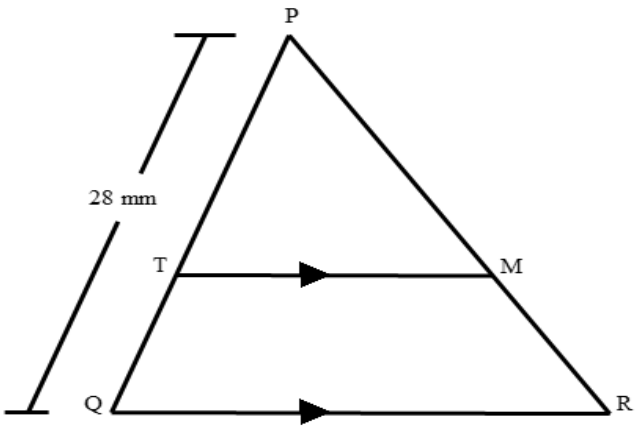
5.1	$B\hat{H}L = 180^\circ - (90^\circ + 40^\circ)$ $= 50^\circ$	✓**A**	(1)
5.2	*In*ΔBHL $\tan 50^\circ = \frac{LB}{3}$ $LB = 3\tan 50^\circ$ $= 3,58$ m **OR/*OF*** $\cot 40° = \frac{LB}{3}$ $LB = 3\cot 40°$ $= 3,58$ m	✓**M** ✓**A**	(2)
5.3	$AB^2 = AL^2 + LB^2 - 2.AL.LB.\cos A\hat{L}B$ $AB = \sqrt{(5,2)^2 + (3,58)^2 - 2(5,2)(3,58)\cos(113^\circ)}$ $= 7,38m$	✓**M** ✓ **A SF** ✓ **CA S**	(3)
5.4	$\Delta ALB = \frac{1}{2} AL \times LB.\sin A\hat{L}B$ $= \frac{1}{2}(5,2)(3,58)\sin(113^\circ)$ $= 8,57m^2$	✓**M** ✓**A SF** ✓**CA S**	(3)
			[9]

QUESTION/*VRAAG* 6			
6.1	$f(x) = 2\cos x$ and $g(x) = \sin(x - 30°)$		
		***f:*** ✓***x*-**intercepts / *x-afsnitte* ✓Turning points / *draaipunte* ✓ shape/*vorm* ***g:*** ✓*x*-intercepts / *x-afsnitte* ✓Turning points / *draaipunte* ✓ shape/*vorm*	(6)
6.2	Amplitude $f = 2$	✓**A**	(1)
6.3	Period $g = 360°$	✓**A**	(1)
6.4	$x \in (0^\circ; 30^\circ]$ *or / of* $x \in [210°; 360^\circ)$	✓**CA** end points/ *eindpunte* ✓**CA** notation/*notasie* ✓**CA** end points/ *eindpunte* ✓**CA** notation/*notasie*	(4)
			[12]

QUESTION/*VRAAG* 7			
7.1.1	Perpendicular/*loodreg*	✓**A**	(1)
7.1.2	Equal/*gelyk*	✓**A**	(1)
7.1.3	Supplementary/*aanvullend*	✓**A**	(1)
7.2			
7.2.1	Let DO = x cm $\therefore$ BO $= (x+6)$ cm $\therefore (x+6)^2 = x^2 + 15^2$ (Pyth) $x^2 + 12x + 36 = x^2 + 225$ $12x = 189$ $x = 15,75$ DO = 15,75 cm	✓**M** Apply Pyth/ *Toepassing Pyth* ✓**ST** ✓**S** ✓**CA** length of DO/ *Lengte van DO*	(4)
7.2.2	$\tan \hat{DOB} = \frac{15}{15,75}$ $\hat{DOB} = 43,6°$ $\hat{AOB} = 2\hat{DOB} = 2(43,6°) = 87,2°$	✓**M** ✓**S** ✓**S**	(3)

7.3			
7.3.1	RS is a tangent, because it touches the surface at one point only./*RS is 'n raaklyn omdat dit die oppervlakte by slegs een punt raak.*	✓**A** tangent/*raaklyn* ✓**A** touches one point/*raak by een punt*	(2)
7.3.2	$D\hat{B}C = 40^\circ$ tan – chord thm $C\hat{D}B = 40^\circ$ $\angle^S$ opp equal side	✓**ST** ✓**RE** ✓**SR**	(3)
7.3.3	$\hat{D}_3 = 90^\circ - (\hat{D}_2 + \hat{D}_1)$ tan ⊥ rad $= 10^\circ$ $\hat{B}_2 = 10^\circ$ ∠s opp equal side; OB = OD (radii)	✓**ST** ✓**RE** ✓**SR**	(3)
7.3.4	$B\hat{D}S = 80°$ $\hat{A} = 80°$ (tan-chord) **OR/*OF*** $\hat{C} = 100^\circ$ $\angle^s$ of Δ thm $\hat{A} = 80^\circ$ $opp\angle^s$ of cyclic quad **OR/*OF*** $\hat{O}_1 = 160°$ Int ∠s of Δ $\hat{A} = 80°$ ∠ at centre = 2 × ∠at circumf	✓**ST** ✓**ST** ✓**RE** **OR/*OF*** ✓**SR** ✓**ST** ✓**RE** **OR/*OF*** ✓**SR** ✓**ST** ✓**RE**	(3)
			[21]

QUESTION/*VRAAG* 8



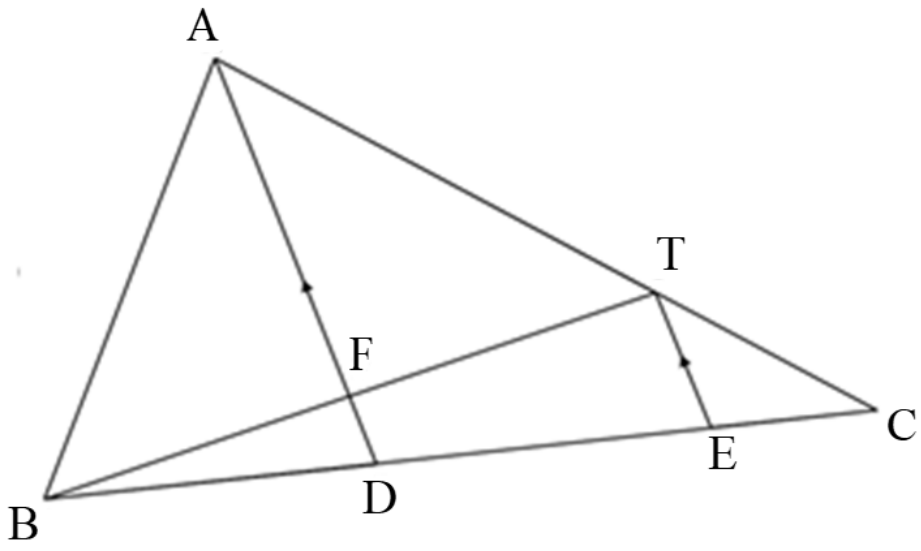
8.1

$\frac{TQ}{PQ} = \frac{MR}{PR}$ prop theorem; $TM \,//\, QR$ ✓**ST** ✓**RE**

$= \frac{3}{7}$ ✓**S**

$TQ = \frac{3}{7} \times 28$

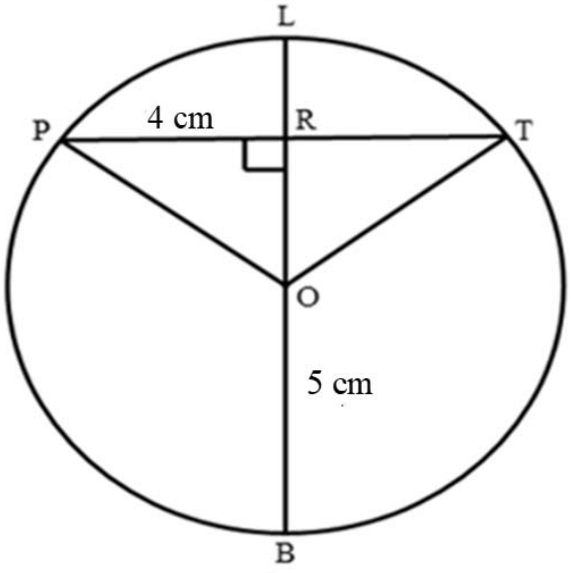
$TQ = 12$ mm ✓**S** (4)

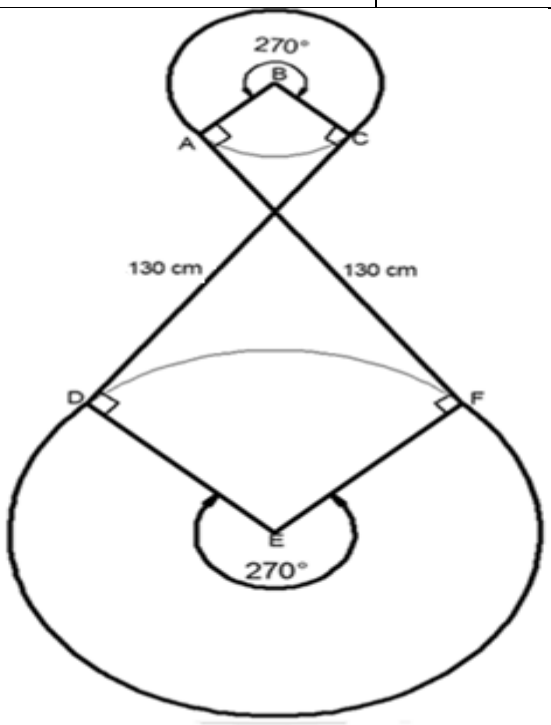


8.2.1 $\frac{CE}{ED} = \frac{1}{2}$ prop theorem; TE//AD ✓**ST** ✓**RE** (2)

8.2.2	$\frac{DE}{DC}=\frac{AT}{AC}=\frac{2}{3}$ prop theorem; AD//TE $\text{DE}=\frac{2}{3}\times 9$ $=6$ $\therefore D$ is the mid-pt of BE $BD=DE=6$	✓**SR** ✓**RE** ✓**S** ✓**S**	(4)
8.2.3	BD = DE D as mid-pt BE, proved BF = TF line through midpt □ to 2nd side TE = 2DF Midpt theorem TE = 4 *cm*	✓**ST** ✓**RE** ✓**SR** ✓**ST**	(4)
8.2.4	$\frac{Area\ \Delta ADC}{Area\ \Delta ADB}=\frac{\frac{1}{2}\times h\times DC}{\frac{1}{2}\times h\times BD}$ $DC=9 \quad BD=6$ Δ^s have same height from A on BC $\therefore \frac{Area\Delta ADC}{Area\Delta ABD}=\frac{9}{6}$ $=\frac{3}{2}$	✓**M** ✓**S** ✓**S**	(3)
			[17]

QUESTION/*VRAAG* 9



9.1	$4h^2 - 4dh + x^2 = 0$ $4h^2 - 4(10)h + 8^2 = 0$ $4h^2 - 40h + 64 = 0$ $h^2 - 10h + 16 = 0$ $(h-2)(h-8) = 0$ $h = 2$ cm & 8 cm	✓ **A** formula/*formule* ✓**SF/A** ✓**S** ✓**S:** factorizing/*faktorisering* ✓**S:** heights/*hoogtes*	(5)
			

9.2.1	$s = r\theta$ $= 85 \times 270° \times \frac{\pi}{180°}$ $= 127,5\pi$ ≈ 401 cm	✓**A** formula/*formule* ✓**A SF** ✓ $\frac{\pi}{180°}$ **M** ✓**S**	(4)
9.2.2	Length of belt/*Lengte van dryfband* = $165 + 130 \times 2 + 401 = 826$ cm	✓**M** ✓**CA** belt length/*bandlengte*	(2)
9.3.1	$\omega = 2\pi n$ $= 2\pi\left(\frac{420}{1m}\right)\left(\frac{1m}{60s}\right)$ $= 14\pi$ rad/s or/of =43,98 rad/s	✓**A** formula/*formule* ✓**A SF** ✓**A** conversion/*herleiding* ✓**CA** angular velocity / *hoeksnelheid*	(4)
9.3.2	$\upsilon = \omega r$ $= 14\pi\left(\frac{240}{2 \times 1000}\right)$ $= \frac{42}{25}\pi$ $= 5,28$ m/s **OR/*OF*** $v = \pi Dn$ $= \pi\left(\frac{240}{1000}\right)\left(\frac{420}{60}\right)$ $= 5,28$ m/s	✓**A** formula/*formule* ✓**A SF** ✓ **A** conversion/*herleiding* ✓**A** value/*waarde* r ✓**CA** circum velocity / *omtreksnelheid*	(5)
			[20]

QUESTION/*VRAAG* 10			
10.1.1	$l = \sqrt{h^2 + r^2}$	✓**A**	(1)
10.1.2	$\text{Vol}_{cone} = \frac{1}{3}\text{Vol}_{cylinder}$ or $\text{Vol}_{cylinder} = 3\text{Vol}_{cone}$	✓**A**	(1)
10.1.3	$\pi r\sqrt{h^2 + r^2} = 2\pi rh$ $\sqrt{h^2 + r^2} = 2h$ $h^2 + r^2 = 4h^2$ $r^2 = 3h^2$	✓**ST** ✓**S**	(2)
10.1.4	$\text{V}_{cone} = \frac{1}{3}\pi r^2 h$ $= \frac{1}{3}\pi\left(3h^2\right)h$ $= \pi h^3$	✓**A SF** ✓**S**	(2)
10.1.5(a)	$Vol_{cylinder} - Vol_{cone} = 54\pi$ $3\left(\pi h^3\right) - \pi h^3 = 54\pi$ $2\pi h^3 = 54\pi$ $h^3 = 27$ $h = \sqrt[3]{27}$ $= 3$	✓**M** ✓**A SF** ✓**S** ✓**S**	(4)
10.1.5(b)	$r^2 = 3h^2$ $= 3(3)^2$ $= 27$ $r = \sqrt{27}$ $= 3\sqrt{3}$	✓ **A SF** ✓ **A** value of/*waarde van* r	(2)

10.2.1	$A_T = a\left(\frac{o_1 + o_n}{2} + o_2 + o_3 + o_4 + ... + o_{n-1}\right)$ $= 110\left(\frac{430 + 347}{2} + 793 + 1167 + 1475 + ... + 529\right)$ $= 110(388,5 + 10244)$ $= 1\ 169\ 575\ km^2$ **OR/*OF*** $A_T = a(m_1 + m_2 + m_3 + ... + m_3)$ $= 110\left(\frac{430+793}{2} + \frac{793+1167}{2} + \frac{1167+1475}{2} + ... + \frac{529+347}{2}\right)$ $= 110(611,5 + 980 + 1321 + 1442 + 1420 + 1398 + 1285 + 1037,5 + 699,5 + 438)$ $= 1\ 169\ 575\ km^2$	✓**A** formula/*formule* ✓**A SF** ✓**CA** value of / *waarde van* $\mathbf{A_T}$ ✓**A** formula/*formule* ✓**A SF** ✓**CA** value of/*waarde van* $\mathbf{A_T}$	(3)
10.2.2	Shaded region = Tot_rect_region - map_region $= (110 \times 10) \times 1475 - 1169575$ $= 452\ 925\ km^2$	✓ **A** Area total region / *Area van totale gebied* ✓**M** ✓ **CA Area**	(3)
			[18]
		TOTAL/*TOTAAL*:	**150**