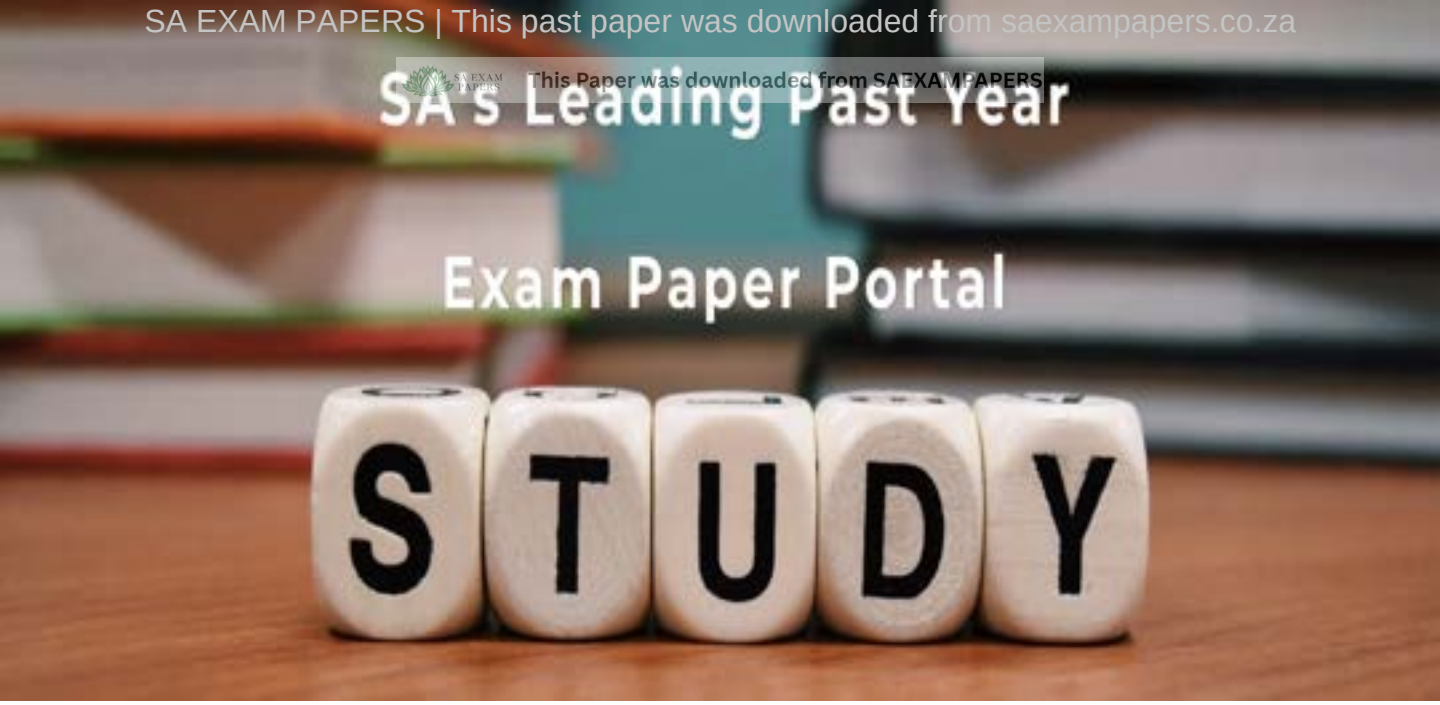


GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

JUNE EXAMINATION/ *EKSAMEN* GRADE/*GRAAD* 12

2026

MARKING GUIDELINES/*NASIENRIGLYNE*

TECHNICAL MATHEMATICS/ *TEGNIESE WISKUNDE*

(PAPER/*VRAESTEL* 2)

Marking Codes/*Nasienkodes*	
A	Accuracy/*Akkuraatheid*
CA	Consistent Accuracy/*Volgehoue Akkuraatheid*
M	Method/*Metode*
R	Rounding/*Afronding*
NPR	No Penalty for Rounding/*Geen straf vir afronding*
NPU	No Penalty for units omitted/*Geen straf vir weggelate eenhede*
S	Simplification/*Vereenvoudiging*
SF	Substitution in correct formula/*Vervanging in korrekte formule*
ST	Statement/*Stelling*
ST/RE	Statement and Reason/*Stelling en Rede*
RE	Reason/*Rede*

NOTE/*LET WEL*:

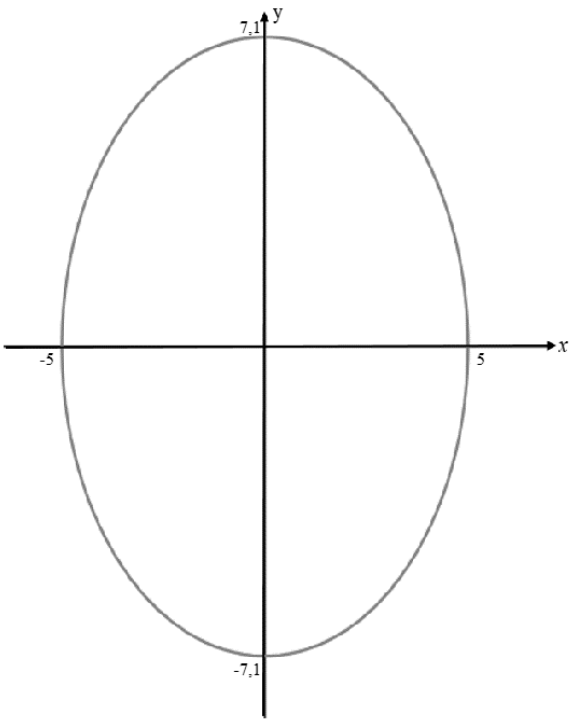
- If a candidate answers a question TWICE, only mark the FIRST attempt.
  Indien 'n kandidaat 'n vraag TWEE keer beantwoord het, sien slegs die eerste poging na.
- If a candidate has crossed out an attempt to answer the question and did not redo it, mark the crossed-out version.
  Indien 'n kandidaat 'n antwoord doodgetrek het, maar dit nie probeer oordoen het nie, sien die doodgetrekte weergawe na.
- Consistent Accuracy applies in all aspects of the marking guidelines, where indicated.
  Volgehoue Akkuraatheid word toegepas dwarsdeur die nasienriglyne en waar aangedui.

QUESTION/*VRAAG* 1				CL
1.1	$M\left(\frac{x_2+x_1}{2};\frac{y_2+y_1}{2}\right)$ $M\left(\frac{2+6}{2};\frac{-3+3}{2}\right)$ $S(4\,;0)$	✓ x-coordinate/*koördinaat* A ✓ y-coordinate/*koördinaat* A **AO: Full marks/*Volpunte***	(2)	1M
1.2	$m_{PQ}=\frac{y_2-y_1}{x_2-x_1}$ $m_{PQ}=\frac{3-(-1)}{2-(-4)}$ $m_{PQ}=\frac{2}{3}$ **OR/*OF*** $m_{PQ}=0{,}67$	✓ SF A ✓ gradient/*gradiënt* CA **AO: Full marks/*Volpunte***	(2)	1M
1.3	$\tan\theta=\frac{2}{3}$ Ref angle/*hoek* $=33{,}67^\circ$ $\theta=180^\circ-33{,}67^\circ=146{,}33^\circ$ **OR/*OF*** $\theta=180^\circ-34^\circ=146^\circ$	✓ SF CA ✓ ref angle/*verw hoek* CA accept/*aanvaar* 34° ✓ size of angle/*hoekgrootte* CA accept/*aanvaar* 146°	(3)	

1.4	$m_{PR} = \frac{3-(-3)}{2-(6)}$ $m_{PR} = \frac{-3}{2}$ $m_{PQ} \times m_{PR}$ $\frac{2}{3} \times \frac{-3}{2} = -1$ PQ ⊥ PR $\therefore \hat{P} = 90^0$ **OR/*OF*** $PR^2 = (6-2)^2 + (3-(-3))^2 = 52$ $PQ^2 = (-4-2)^2 + (-1-3)^2 = 52$ $QR^2 = (-4-6)^2 + (-1-3)^2 = 104$ $PR^2 + PQ^2 = QR^2$ ∴ ΔPQR is a right-angled triangle ∴ ΔPQR is 'n reghoekige Δ	✓$m_{PR} = \frac{-3}{2}$ A ✓ $\frac{2}{3} \times \frac{-3}{2} = -1$ CA ✓ PQ ⊥ PR CA **OR/*OF*** ✓PR^2 A ✓ PQ^2 A ✓ QR^2 A	(3)	2D
1.5	QR is the diameter *QR is die deursnit/middellyn*	✓ Answer/*Antwoord* CA	(1)	L1
1.6	$QR = \sqrt{(x_2-x_1)^2 + (y_2-y_1)^2}$ $= \sqrt{(6-(1))^2 + (-3-(-2))^2}$ $QR = \sqrt{26}$	✓ SF A ✓ QR= $\sqrt{26}$ CA	(3)	1M

	$radius = \frac{\sqrt{26}}{2} \approx 2{,}55$	✓ $\frac{\sqrt{26}}{2} \approx 2{,}55$ CA		
			[14]	

QUESTION/*VRAAG* 2				
2.1.1	$x^2 + y^2 = r^2$ $(0)^2 + (5)^2 = r^2$ $25 = r^2$ **OR/*OF*** $x^2 + y^2 = 25$ **OR/*OF*** $y = \pm\sqrt{25 - x^2}$	✓ SF A ✓ equation/*vergelyking* CA accept/*aanvaar* $25 = r^2$ A **AO: Full marks/*Volpunte***	(2)	2E
2.1.2	M is midpoint of AC/*M is die middelpunt van AC* $M_x = \frac{x_2 + x_1}{2}$ $2 = \frac{x + 0}{2}$ $x = 4$ $M_y = \frac{y_2 + y_1}{2}$ $4 = \frac{y + 5}{2}$ $4 = \frac{y + 5}{2}$ $8 = y + 5$ $y = 3$ $C\ (4; 3)$	✓ SF A ✓ $x = 4$ CA ✓ SF A ✓ $y = 3$ CA **AO: Full marks/*Volpunte***	(4)	3E

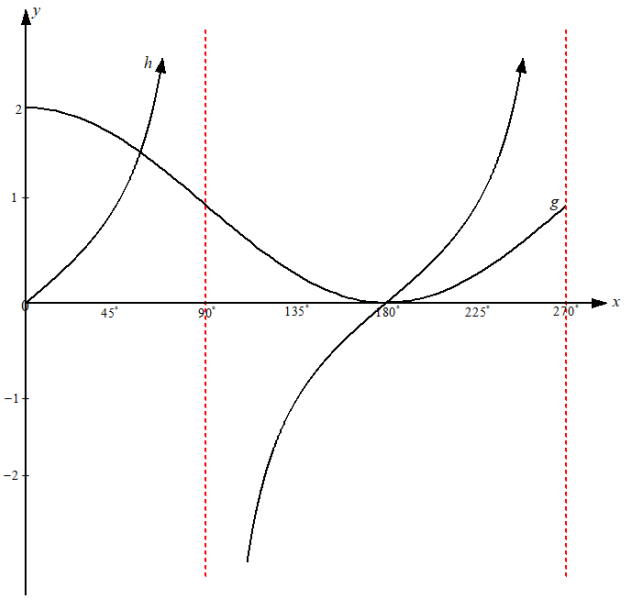
2.1.3	$B\hat{A}C = 90°$	✓ Answer/A*ntwoord* A	(1)	1D
2.1.4	$m_{OB} = m_{AB} = 2$ $A(0;5)$ $y - y_1 = m(x - x_1)$ $y - (5) = 2(x - (0))$ $y = 2x + 5$	✓ $m_{OB} = m_{AB} = 2$ A ✓ $A(0;5)$ A ✓ equation/*vergelyking* CA	(3)	3M
2.2		✓ shape/*vorm* A ✓ *y*-intercept/*y-afsnit* A ✓ *x*-intercept/*x-afsnit* A accept/*aanvaar* $x = \pm\sqrt{25}$ $y = \pm\sqrt{50}$	(3)	2D
			[13]	

QUESTION/*VRAAG* 3				
3.1.1	$\hat{S} = \frac{4}{9}\pi \times \frac{180^\circ}{\pi}$ $\hat{S} = 80^\circ$	✓ Answer/*antwoord* A	(1)	L1
3.1.2	$\cot 2\hat{T} + \sqrt{\sin \hat{S}}$ $\frac{1}{\tan(2\times 120^\circ)} + \sqrt{\sin 80^\circ}$ $= 1,57$	✓ SF A ✓ reciprocal/*resiprook* A ✓ Answer/*antwoord* CA **AO: Full marks/*Volpunte Aanvaar/* accept 1,6** **NPR**	(3)	3M
3.2.1	$x^2 + y^2 = r^2$ $(m)^2 + (-3)^2 = \left(\sqrt{34}\right)^2$ $\sqrt{m^2} = \pm\sqrt{25}$ $\therefore m = 5$ $\cos\theta = \frac{5}{\sqrt{34}}$	✓ SF A ✓correct value of m/*regte waarde van m* CA ✓ $\cos\theta = \frac{5}{\sqrt{34}}$ CA	(3)	1D
3.2.2	$\cot^2\theta - 1$ $= \frac{1}{\left(\frac{-3}{5}\right)^2} - 1$ $= \frac{16}{9}$ ***OF*/OR** $\cot^2\theta - 1$ $= \left(\frac{5}{-3}\right)^2 - 1$ $= \frac{16}{9}$	✓ $\frac{-3}{5}$ CA ✓ answer/*antwoord* CA ✓ $\frac{5}{-3}$ CA ✓ answer/*antwoord* CA	(2)	3E

3.3	$2\sin(x+30°) = 1,5$ $\sin(x+30°) = \frac{1,5}{2}$ $\sin(x+30°) = 0,75$ ref. angle/*verw.hoek* $= 48,59°$ 1st quadrant/*1ste kwadrant*: $x + 30° = 48,59°$ $x = 18,59°$ 2nd quadrant/*2de kwadrant*: $x + 30° = 180° - 48,59$ $x = 101,41°$	✓ $0,75$ / $\frac{3}{4}$ A ✓ ref. angle/*verw.hoek* A $48,59°$ accept/*aanvaar* $49°$ ✓ $x = 18,59°$ CA accept/*aanvaar* $19°$ ✓ $x = 180° - ref/ver$ CA ✓ $x = 101,41°$ CA accept/*aanvaar* $101°$ **NPR**	(5)	4E
			[14]	

QUESTION/*VRAAG* 4				
4.1.1	$\sin(2\pi - x)$ $= \sin(360° - x)$ $= -\sin x$	✓ answer/*antwoord* A	(1)	2M
4.1.2	$\cot(\pi - x)$ $\cot(180 - x)$ $-\cot x$ / $\frac{-1}{\tan x}$ / $\frac{-\cos x}{\sin x}$	✓ answer/*antwoord* CA	(1)	2M
4.1.3	$\frac{\sin(2\pi - x).\operatorname{cosec} x.\cos(180° - x)}{\tan(180° - x).\cot(\pi - x).\cos x}$ $= \frac{\sin(360 - x).\operatorname{cosec} x.\cos(180° - x)}{\tan(180° - x).\cot(180 - x).\cos x}$ $= \frac{(-\sin x).(\operatorname{cosec} x).(-\cos x)}{(-\tan x).(-\cot x).(\cos x)}$ $= \frac{(-\sin x).\left(\frac{1}{\sin x}\right).(-\cos x)}{(-\tan x).\left(\frac{-1}{\tan x}\right).(\cos x)}$ $= 1$ OR/*OF* $\frac{\sin(2\pi - x).\operatorname{cosec} x.\cos(180° - x)}{\tan(180° - x).\cot(\pi - x).\cos x}$ $= \frac{\sin(360 - x).\operatorname{cosec} x.\cos(180° - x)}{\tan(180° - x).\cot(180 - x).\cos x}$ $= \frac{(-\sin x).(\operatorname{cosec} x).(-\cos x)}{(-\tan x).(-\cot x).(\cos x)}$ $= \frac{(-\sin x).\left(\frac{1}{\sin x}\right).(-\cos x)}{\left(\frac{1}{-\cot x}\right).(-\cot x).(\cos x)}$ $= 1$	✓ $-\cos x$ A ✓ $-\tan x$ A ✓ $\frac{1}{\sin x}$ A ✓ $\frac{-1}{\tan x}$ A ✓ answer/*antwoord* CA OR/*OF* ✓ $-\cos x$ A ✓ $-\tan x$ A ✓ $\frac{1}{\sin x}$ A ✓ $\frac{1}{-\cot x}$ A ✓ answer/*antwoord* CA		3E

	OR/*OF* $\frac{\sin(2\pi - x).\operatorname{cosec} x.\cos(180° - x)}{\tan(180° - x).\cot(\pi - x).\cos x}$ $= \frac{\sin(360 - x).\operatorname{cosec} x.\cos(180° - x)}{\tan(180° - x).\cot(180 - x).\cos x}$ $= \frac{(-\sin x).(\operatorname{cosec} x).(-\cos x)}{(-\tan x).(-\cot x).(\cos x)}$ $= \frac{(-\sin x).\left(\frac{1}{\sin x}\right).(-\cos x)}{\left(\frac{-\sin x}{\cos x}\right).\left(\frac{-\cos x}{\sin x}\right).(\cos x)}$ $= 1$	OR/*OF* ✓ $-\cos x$ A ✓ $-\tan x$ A ✓ $\frac{1}{\sin x}$ A ✓ $\frac{-\sin x}{\cos x}$ A ✓ answer/*antwoord* CA	(5)	
4.2	$\tan^2 \beta$	✓ answer/*antwoord* A	(1)	1E
4.3	$\frac{\sin^2 B}{1 - \sin^2 B} = \sec^2 B - 1$ $\text{LH} = \frac{\sin^2 B}{1 - \sin^2 B}$ $= \frac{\sin^2 B}{\cos^2 B}$ $= \tan^2 B$ =RHS	✓ $\cos^2 B$ A ✓ $\frac{\sin^2 B}{\cos^2 B}$ A ✓ **I** A	(3)	3D
			[11]	

QUESTION/*VRAAG* 5				
5.1.1	***DO NOT MARK***			
5.1.2	Period/*Periode* = 360°	✓✓ answer/*antwoord* A	(2)	1E
5.2	$g(x) = \cos x + 1$ $f(x) = \cos x$	✓ answer/*antwoord* A	(1)	2D
5.3		$h(x)$: ✓ $x = 90°$ A ✓ $x = 270°$ A ✓shape/*vorm* A ✓ *x*-intercepts/*afsnitte* A $g(x)$: ✓ intercepts/*afsnitte* A ✓ shape/*vorm* A ✓ turning point/*draaipunt* A $(180^\circ; 0^\circ)$	(7)	2M
5.4	$x \in (90^\circ; 180°]$ **OR/*OF*** $90° < x \leq 180°$ **OR/*OF*** x greater then/*groter as* 90° x less than and equal to/ *minder as en gelyk aan* 180°	✓ endpoints/*eindpunte* A ✓ notation/*notasie* A	(2)	4E
			[12]	

QUESTION/*VRAAG* 6				
6.1	$\cos 32° = \frac{HI}{KI} / \frac{k}{h}$	✓ A	(1)	1E
6.2	$\cos 32° = \frac{13,11}{KI}$ $KI = \frac{13,11}{\cos 32°}$ $KI = 15,46$ m	✓ SF CA ✓ answer/*antwoord* CA	(2)	2M
6.3	$k^2 = i^2 + j^2 - 2ij\cos\hat{K}$	✓ answer/*antwoord* A	(1)	1
6.4	$JI^2 = (17,21)^2 + (15,46)^2 - 2(17,21)(15,46)\cos(86°)$ $JI^2 = 498,08$ $JI = \sqrt{498,08}$ $\therefore JI = 22,32$	✓ SF A ✓ 22,32 CA **NPR**	(2)	1D
6.5	$\Delta HIK: \ Area = \frac{1}{2} \times h \times k \times \sin\hat{I}$ $= \frac{1}{2}(13,11)(15,46)\sin(32)$ $= 53,70$ $\Delta JKI: \ Area = \frac{1}{2} \times i \times j \times \sin\hat{K}$ $= \frac{1}{2}(17,21)(15,46)\sin(86)$ $= 132,71$ $Area \ of \ HIJK = 53,70 + 132,41$ $= 186,41$	✓ SF A ✓ area/*opp* 1 CA ✓ SF A ✓ area/*opp* 2 CA ✓ total area/ *totale opp* CA **NPR** **NPU**	(5)	2M
			[11]	

QUESTION/*VRAAG* 7				
7.1	$\hat{S} = 60°$ [∠ at ctr = 2× ∠ at cir] [*midpt ∠ = 2× omtreks∠*] $\hat{P}_1 = 60°$ [Alt ∠s QS ‖ PT] [*Verwis. ∠s* QS ‖ PT] $P\hat{Q}S = 60°$ [tan chord thm.] [*raaklyn-koord-st.*]	✓ST A ✓RE A ✓ST A ✓RE A ✓ST A ✓RE A	(6)	1E
7.2	$\hat{R} + \hat{S} = 180°$ [opp ∠s of cylc quad] $\hat{R} + 60° = 180°$ [*teenoor ∠'e kvh*] $\hat{R} = 120°$	✓RE A ✓ST A	(2)	1E
7.3	$\hat{P}_3 = \hat{Q}_2$ [∠s opp = sides] [*∠e teenoor gelyke sye*] **OR/*OF*** $\hat{P}_3 = \frac{180°-120°}{2}$ [sum of ∠s in a Δ] [*∠e van* Δ] $\hat{P}_3 = 30°$	✓RE A ✓ST CA	(2)	1E
			[10]	

QUESTION/*VRAAG* 8				
8.1.1	(a) AC = CB =12 [line from centre ⊥ to cord] [lyn vanuit midpt⊥ op koord]	✓ ST A ✓ RE A	(2)	1
	(b) $OC = \sqrt{13^2 - 12^2}$ (Pyth) $OC = 5$	✓ SF CA ✓ answer/*antwoord* CA **AO: Full marks/*Volpunte***	(2)	2
8.1.2	$O\hat{C}B = 90°$	✓ ST A	(1)	1D
	OC = OC	✓ ST A	(1)	1D
	Radii/*Radiusse*	✓ RE A	(1)	1D
	$\Delta OCB \equiv \Delta OCA$	✓ ST A	(1)	1D
8.2.1	(a) $\hat{D}_1 = 30°$ [∠'s on the same seg.] [∠ *in dies. segm*]	✓ ST A ✓RE A	(2)	3D
	(b) $\hat{A} = 60°$ (sum of/*som van* ∠Δ) [∠*e van* Δ]	✓ ST A	(1)	
8.2.2	$\hat{C}_1 + \hat{C}_2 = 120°$ [opp ∠s of cyc. quad.] [*teenoor ∠'e kvh*] $\hat{D}_2 + \hat{C}_1 + \hat{C}_2 = 180°$ [co-int ∠s] [*ko-binne ∠'e*] ∴ AD || BC	✓ ST CA ✓ RE A ✓ ST A ✓ RE A	(4)	3D
8.2.3	$\hat{D}_1 + \hat{D}_2 = 90°$ [subt. by 90°] [*onderspan deur 90°*] $E\hat{D}C = 90°$ ∴ CE is the diameter of the circle *CE is die deursnee van die sirkel*	✓ ST A ✓ RE A	(2)	3E
			[17]	

QUESTION/*VRAAG* 9				
9.1	Proportionally *Eweredig*	✓ Theorem Statment A	(1)	1M
9.2.1	$O\hat{M}P = 90°$ (tan ⊥ rad) [*raaklyn* ⊥ *radius*] $O\hat{N}Q = 90°$ (given/*gegee*) $\therefore QR \| \| PT$ corr. ∠'s are equal *ooreenk.. ∠'s are equal*	✓ ST A ✓ RE A ✓ RE A	(3)	2D
9.2.2	$PT:QR = 10:6$ (similar triangles) *(gelykvormige driehoeke)* $= 5:3$	✓ RE A ✓ ST A	(2)	4E
9.2.3	$\frac{OR}{OT} = \frac{ON}{OM}$ (*prop thm.*, $QR // PT$) $\frac{6}{10} = \frac{12-MN}{12}$ $10(12-MN) = 6\times12$ $120-10MN = 72$ $-10MN = 72-120$ $MN = 4{,}8$	✓ ST/RE A ✓ SF CA ✓ answer/*antwoord* CA	(3)	3E
9.2.4	$ON = 12 - 4{,}8 = 7{,}2$ $\frac{Area\Delta OTM}{Area\Delta ORN}$ $= \frac{0{,}5(16)(12)}{0{,}5(9{,}6)(7{,}2)}$ $= \frac{25}{9}$	✓ length/*lengte* CA ✓ SF A ✓ answer/*antwoord* CA	(3)	
			[12]	

QUESTION 10				
10.1.1	$D = 20 \times 2 = 40\,cm$	✓ diam./*deursnee* A	(1)	
10.1.2	$4h^2 - 4dh + x^2 = 0$ $4h^2 - 4(40)h + (25)^2 = 0$ $4h^2 - 160h + 625 = 0$ $h = \frac{-(-160) \pm \sqrt{(-160)^2 - 4(4)(625)}}{2(4)}$ $h = 35,61 \quad or \quad h = 4,39$ $\therefore SP = 4,39$	✓ F A ✓ SF CA ✓ both values/ *beide waardes* CA ✓ correct value/ *regte waarde* CA **NPR**	(4)	
10.1.3	$n = \frac{3500}{60} = 58,33$	✓ answer/*antwoord* A **NPR**	(1)	
10.1.4	$\omega = 2\pi n$ $= 2\pi(58,33)$ $= \frac{833}{50}\pi$ $\approx 366,50\ rad/\sec$	✓ F A ✓ SF CA ✓ 366,50 *rad* / sec CA **NPR** **NPU**	(3)	
10.1.5	$D = \frac{40}{100} = 0,4\,m$	✓ diam./*deursnee* CA **NPR** **NPU**	(1)	

10.1.6	$V = \pi Dn$ $= \pi(0,4)(58,33)$ $= \frac{5833}{250}\pi$ $\approx 73,30 \ m/\text{sec}$ **OR/*OF*** $V = \omega.r$ $= \left(\frac{5833}{50}\pi\right)(0,2)$ $= \frac{5833}{250}\pi$ $\approx 73,30 \ m/\text{sec}$	✓ F A ✓ SF CA ✓ 73,30 m/sec CA **NPR** **NPU** **OR/*OF*** ✓ F A ✓ SF CA ✓ 73,30 m/sec CA **NPR** **NPU**	(3)	
10.2.1	$A = \frac{1}{2} \times q \times r \times \sin\theta$ $153,21 = \frac{1}{2}(20)(20)\sin\theta$ $\sin\theta = \frac{153,21}{\frac{1}{2}(20)(20)}$ $\sin\theta = 0,77$ $\theta = \sin^{-1}(0,77)$ $\theta = 50^\circ$ $\therefore \ \text{QÔR} = 180° - 50° = 130°$	✓ F A ✓ SF A ✓ value of/ *waarde van* θ CA ✓ value of/ *waarde van* QÔR CA **NPR**	(4)	
10.2.2	$S = r\theta$ $= (20)\left(130^\circ \times \frac{\pi}{180^\circ}\right)$ $= \frac{130}{9}\pi$ **OR/OF** $= 45,38$	✓ F A ✓ SF CA ✓ arc length/ *booglengte* CA **NPR**	(3)	
			[20]	

QUESTION/*VRAAG* 11				
11.1.1	$A = a(\frac{o_1 + o_n}{2} + o_2 + o_3 + \cdots + o_{n-1})$ $A = 1{,}5\left(\frac{3+2}{2} + 5 + 3 + 1 + 2 + 7\right)$ $A = 30{,}75\ m^2$ **OF/*OR*** $A = a(m_1 + m_2 + m_3 + m_4 + m_5 + m_6)$ $A = 1{,}5\left(\frac{3+5}{2} + \frac{5+3}{2} + \frac{3+1}{2} + \frac{1+2}{2} + \frac{2+7}{2} + \frac{7+2}{2}\right)$ $A = 1{,}5(20{,}5)$ $A = 30{,}75\ m^2$	✓ F A ✓ $a = 1{,}5$ A ✓ SF A ✓answer/*antwoord* CA OF/*OR* ✓ F A ✓ $a = 1{,}5$ A ✓ SF A ✓answer/*antwoord* CA **NPR** **NPU**	(4)	2D
11.2.1	$r = 2{,}5m$	✓ answer/answer A	(1)	1E
11.2.2	$SA = \pi r^2 + 2\pi rh$ $SA = \pi(2{,}5)^2 + 2\pi(2{,}5)(3{,}5)$ $SA = 74{,}61\ m^2$	✓ F A ✓ SF CA ✓ answer/*antwoord* CA **NPR** **NPU**	(3)	2M
11.2.3	$74{,}61 \div 2{,}3 = 32{,}44\ liter$ for one coat $32{,}44\ liter \times 2 = 64{,}88\ l$	✓ M A ✓ M A ✓ answer/*antwoord* CA NPR NPU	(3)	2D

11.2.4	$3,5 - 0,14 = 3,36$ $V = \pi r^2 \times h$ $V = \pi(2,5)^2 \times 3,36$ $V = 21\pi$ $V = 65,97\ m^3$ $1m^3 = 1000\ l$ $65,97 \times 1000 = 65\,970\ l$	✓ 3,36 A ✓ SF CA ✓ answer/*antwoord* CA ✓ M A ✓ answer/*antwoord* CA **NPR** **NPU**	(5)	
			[16]	
				TOTAL/*TOTAAL:* 150