GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

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

2024

MARKING GUIDELINES/*NASIENRIGLYNE*

TECHNICAL MATHEMATICS/*TEGNIESE WISKUNDE*

(PAPER/*VRAESTEL* 2)

18 pages/*bladsye*

Marking Codes/*Nasienkodes*	
A	Accuracy/*Akkuraatheid*
CA	Consistent Accuracy/*Volgehoue akkuraatheid*
M	Method/*Metode*
R	Rounding/*Afronding*
NPR	No Penalty for rounding/*Geen penalisering vir afronding*
NPU	No Penalty for units omitted/*Geen penalisering vir eenhede weggelaat nie*
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, mark only the FIRST attempt./*Indien 'n kandidaat 'n vraag TWEE keer beantwoord, sien slegs die EERSTE poging na.*
- If a candidate strikes off a response to a question and does not attempt the question again, mark the struck off question./*Indien 'n kandidaat 'n antwoord doodtrek en nie poog om die vraag weer te beantwoord nie, sien die doodgetrekte antwoord na.*
- Consistent accuracy applies in all aspects of the marking guidelines, where applicable./*Konstante akkuraatheid word toegepas dwarsdeur die nasienriglyne en waar van toepassing.*

AMENDMENT TO MARKING GUIDELINES

JUNE 2024 PROVINCIAL EXAMINATION

ATTENTION

THE CHIEF INVIGILATOR

SUBJECT / *VAK*	**TECHNICAL MATHEMATICS / *TEGNIESE WISKUNDE***
PAPER / *VRAESTEL*	**2**
DATE OF EXAMINATION	**3 JUNE / *JUNIE* 2024**

The errata for the Marking Guidelines of TECHNICAL MATHEMATICS P2 has reference.

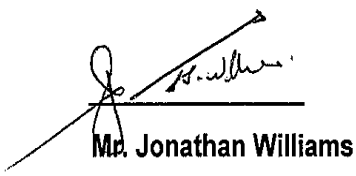
There was a typographical error in **Question 9.2** on both the English and Afrikaans versions of the question paper. This matter was addressed at the Marking Standardisation Meeting.

To ensure that candidates are not disadvantaged and prejudiced in way, you are advised to please ask your Mathematics Educator to **ignore Question 9.2.1** (which counts for 3 marks) when marking.

In other words, the paper must be marked out of a total of 147 instead of 150 and then the learners' marks must be converted to a mark out of 150. E.g., Should a learner attain 85/147 then that mark is recalculated as 87/150.

Use the formula: $\frac{a}{147} \times 100 = b.$ *Then,* $\frac{b}{100} \times 150 = c$

C is the mark that is entered into SASAMS ***out of 150****.*



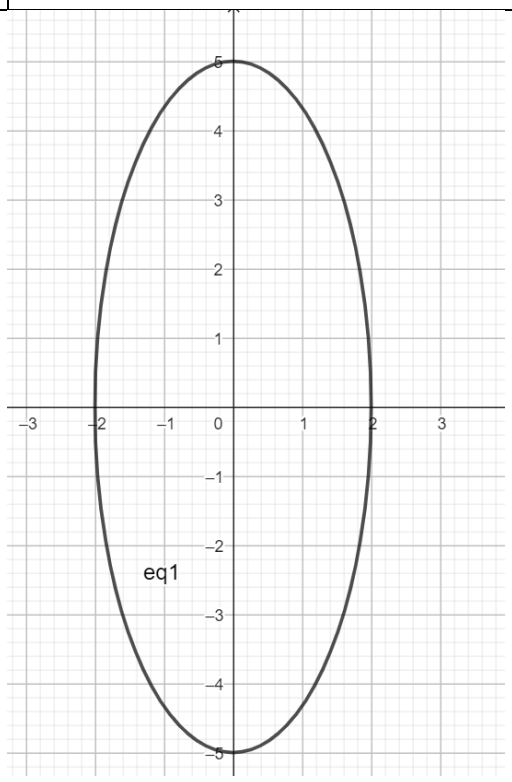
Mr. Jonathan Williams

DIRECTOR: EXAMINATIONS MANAGEMENT
3 JUNE 2024

QUESTION/*VRAAG* 1				CL
1.1	$AC = \sqrt{(x_A - x_C)^2 + (y_A - y_C)^2}$ $= \sqrt{(-2-(6))^2 + (-5-3)^2}$ $= 8\sqrt{2}$ **ONE MARK IF ANSWER IS A DECIMAL.**	✓ SF A ✓ $8\sqrt{2}$ CA **AO 2**	(2)	1M
1.2	$M_{AC}\left(\frac{x_2+x_1}{2};\frac{y_2+y_1}{2}\right)$ $\left(\frac{(6)+(-2)}{2};\frac{(3)+(-5)}{2}\right)$ $B(2;-1)$	✓ $x = 2$ A ✓ $y = -1$ A **AO 2**	(2)	1M
1.3	$m_{AC} = \frac{y_2 - y_1}{x_2 - x_1}$ $= \frac{(3)-(-5)}{(6)-(-2)}$ $= 1$	✓ SF A ✓ gradient/*gradiënt* CA	(2)	1M
1.4	$m_{AC} \times m_{BE} = -1$ $\therefore m_{BE} = -1$ $\tan\theta = -1$ Ref $\angle = 45°$ $\theta = 180° - 45°$ $\therefore \theta = 135°$	✓ $m_{BE} = -1$ CA ✓SF CA ✓ Angle/*Hoek* CA	(3)	2D

1.5	$y-y_1=m_{BE}(x-x_1)$ $y-(-1)=-1(x-(2))$ $y=-x+1$ **OR/*OF*** $y=mx+c$ $-1=-1(2)+c$ $1=c$ $\therefore y=-x+1$	✓ SF CA ✓ Equation/*Vergelyking* CA **OR/*OF*** ✓ SF CA ✓ Equation/*Vergelyking* CA	(2)	2E
1.6	$y=-x+1$ $E(-1;p)$ $p=-(-1)+1$ $\therefore p=2$ \	✓ SF CA ✓ Value of/*Waarde van p* CA	(2)	3E
				[13]

QUESTION/*VRAAG* 2					
2.1	2.1.1	$x^2+y^2=r^2$ $(-3)^2+(4)^2=r^2$ $25=r^2$ $y=+\sqrt{25-x^2}$	✓ SF A ✓ $25=r^2$ A ✓ Equation/*Vergelyking* CA **AO 3**	(3)	2E
	2.1.2	$m_{OA}=\frac{4}{-3}$	✓$-\frac{4}{3}$ A	(1)	1D
	2.1.3	$m_{EF}=\frac{3}{4}$	✓ Answer/*Antwoord* CA	(1)	2E

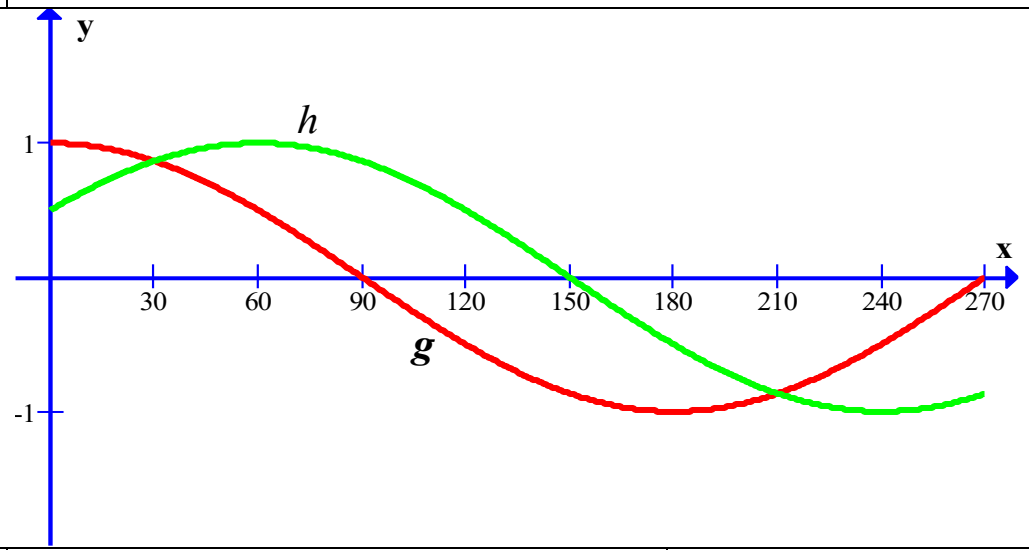
	2.1.4	$m_{EF} = \frac{3}{4}$ $A(-3\ ;\ 4)$ $y - y_1 = m(x - x_1)$ $y - (4) = \frac{3}{4}(x - (-3))$ $y = \frac{3}{4}x + \frac{25}{4}$ OR $x.x_1 + y.y_1 = r^2$ $-3x + 4y = 25$ $y = \frac{3x}{4} + \frac{25}{4}$	✓ SF A ✓ $\frac{3}{4}x$ CA ✓ $+\frac{25}{4}$ CA	(3)	2D
2.2			✓ Shape/*Vorm* A ✓ *y*-intercept/*y-afsnit* A ✓ *x*-intercept/*x-afsnit* A	(3)	2D
					[11]

QUESTION/*VRAAG* 3					
3.1	$\cos ec\,\hat{F} \times \tan \hat{N}$ $\frac{1}{\sin(60°)} \times \tan(100°)$ $= -6,55$		✓ Subst. A ✓ Answer/*Antwoord* A **AO 2**	(2)	1D
3.2	3.2.1	$x = \sqrt{(10)^2 - (-6)^2}$ $x = 8$	✓ M **A** ✓ Answer/*Antwoord* CA **AO 2**	(2)	1D
	3.2.2	$2\sin\beta + \cos\beta$ $= 2\left(-\frac{6}{10}\right) + \frac{8}{10}$ $= \left(-\frac{12}{10}\right) + \frac{8}{10}$ $= -\frac{4}{10}$ $= -\frac{2}{5}$	✓ $-\frac{6}{10}$ CA ✓ $\frac{8}{10}$ CA ✓ Answer/*Antwoord* A **AO $\frac{1}{3}$**	(3)	3E

3.3	$\cot x = -0{,}5$ Ref. angle/*Verw. hoek* $\frac{1}{\tan x} = -0{,}5$ $\tan x = -2$ $= 63{,}4349°$ **In quadrant/*kwadrant* 2**: $x = 180° - 63{,}4349°$ $x = 116{,}57°$ **In quadrant/*kwadrant* 4:** $x = 360° - 63{,}4349°$ $x = 296{,}57°$	✓ $\frac{1}{\tan x} = -0{,}5$ A ✓ Ref. angle/*verw. hoek* A ✓ $x = 116{,}57°$ CA ✓ $x = 296{,}57°$ CA		(4)	4E
					[11]

QUESTION/*VRAAG* 4						
4.1	4.1.1	$sin\,(180° + x)$ $= -sin\,x$	✓ Answer/*Antwoord*	A	(1)	1E
	4.1.2	$\sec^2(\pi - x)$ $= +\sec^2 x$ or/*of* $\frac{1}{+\cos^2 x}$	✓ Answer/*Antwoord*	A	(1)	2M

	4.1.3	$\frac{\sin(180°+x).\cos(2\pi+x).\sec^2(\pi-x)}{\cot(360°-x).\sin 150°}$			3E
		$=\frac{(-\sin x).(\cos x).\left(\frac{1}{\cos^2 x}\right)}{\left(-\frac{1}{\tan x}\right).\left(\frac{1}{2}\right)}$	✓ $\cos x$ A ✓ $\left(\frac{1}{2}\right)$ A ✓ $-\frac{1}{\tan x}$ A		
		$=\frac{\frac{-\sin x}{\cos x}}{-\frac{1}{2\tan x}}$	✓ S CA		
		$=-\tan x \times -2\tan x$	✓ $-\tan x$ CA		
		$=2\tan^2 x$	✓ Answer/*Antwoord* CA	(6)	
4.2	sin^2x		✓ Answer/*Antwoord* A	(1)	1E
4.3	$\frac{10\ cotx.(1-cos^2x).(1+tan^2x)}{\tan x}=10$				3D
	LH $=\frac{10\frac{cosx}{sinx}.(sin^2x).(sec^2x)}{\tan x}$		✓ $\frac{cosx}{sinx}$ A ✓ sec^2x A		
	$=\frac{10\ cosx.sinx.\frac{1}{\cos^2 x}}{\tan x}$		CA		
	$=\frac{\frac{10\sin x}{\cos x}}{\tan x}$		✓ S		
	$=\frac{10\sin x}{\cos x}\div\frac{\sin x}{\cos x}$		✓ $\frac{\sin x}{cosx}$ A		
	$=\frac{10\sin x}{\cos x}\times\frac{\cos x}{\sin x}$		✓ $\frac{10\sin x}{\cos x}\times\frac{\cos x}{\sin x}$ CA		
	$=10$				
	= RHS/*RK*			(5)	
					[14]

QUESTION/*VRAAG* 5					
5.1	5.1.1	Amplitude = 1	✓ Answer/*Antwoord* A	(1)	1E
	5.1.2	Period/*Periode* = *360°*	✓ Answer/*Antwoord* A	(1)	1E
5.2	$h(x)=\sin(x+30°)$ $h(x)=\sin(x+30°-30°)$ $f(x)=\sin x$		✓ Answer/*Antwoord* A	(1)	2D
5.3	*h*(*x*): ✓ intercepts/*afsnitte* *A* ✓ shape/*vorm* *A* ✓ end points/*eindpunte* *A* *g*(*x*): ✓ intercepts/*afsnitte* *A* ✓ shape/*vorm* *A* ✓ turning point/*draaipunt* *A*			(6)	2M
					
5.4	$x\in(60°;240°)$		✓ Notation/*Notasie* CA ✓ Endpoints/*Eindpunte* CA	(2)	4E
					[11]

QUESTION/*VRAAG 6*						
6.1	$AB = \sqrt{(5)^2 + (12)^2}$ $= 13\ m$ **OR/*OF*** $\sin 30° = \frac{t}{s}$ $\sin 30° = \frac{12}{s}$ $s = 24$ **OR/OF** $\cos 30° = \frac{5}{s}$ $s =$ 5,77 m		✓ SF ✓ 13 m **OR/OF** 24 m **OR/OF** 5,77m	A CA	(2)	1M
6.2	$C\hat{T}D = 180° - 90° - 65° = 25°$		✓ 25°	A	(1)	1E
6.3	6.3.1	$\frac{\boldsymbol{CD}}{\sin C\hat{T}D} = \frac{TC}{\sin \boldsymbol{C\hat{D}T}}$ **OR/*OF*** $\frac{\mathbf{5}}{\sin 25°} = \frac{TC}{\mathbf{\sin 110°}}$	✓ Answer/*Antwoord*	CA	(1)	1M
	6.3.2	$\frac{5}{\sin 25°} = \frac{TC}{\sin 110°}$ $\frac{5 \times \sin 110°}{\sin 25°} = TC$ $TC = 11{,}12\ m$	✓ SF ✓ Answer/*Antwoord*	CA CA	(2)	2M
	6.4	$a^2 = b^2 + c^2 - 2bc\cos A$ BC^2 $= 12^2 + 11{,}12^2 2(11{,}12)(12)\cos 65°$ $BC^2 = 154{,}8660383$ $BC = 12{,}44\ m$	✓ F ✓ SF ✓ Answer/*Antwoord*	A CA CA	(3)	2D

6.5	ΔABT $area = \frac{1}{2}bh$ $area = \frac{1}{2}(5)(12)$ $area = 30\ m^2$ ΔBTC $area = \frac{1}{2}ab\sin C$ $area = \frac{1}{2}(12)(11{,}12)\sin 65°$ $area = 60{,}47\ \ m^2$ ΔCDT $\hat{C} = 180° - 110° - 25°$ $\hat{C} = 45°$ $area = \frac{1}{2}ab\sin C$ $area = \frac{1}{2}(5)(11{,}12)\sin 45°$ $area = 19{,}66\ m^2$ Total area/*Totale oppervlakte* $30 + 60{,}47 + 19{,}66 = 110{,}13\ m^2$	ΔABT ✓ Answer/*Antwoord* CA ✓ SF CA ✓ Answer/*Antwoord* CA ✓ $\hat{C} = 45°$ CA ✓ SF CA ✓ Answer/*Antwoord* CA ✓ Answer/*Antwoord*	(7)	3D
				[16]

QUESTION/*VRAAG* 7					
7.1	90° or right angle		✓ R A	(1)	1E
7.2	7.2.1	Radius = 15 cm	✓ ST A	(1)	1E
	7.2.2	∠s in semicircle/∠e *in halfsirkel* **OR/*OF*** diameter subtends right angle/*middellyn onderspan regte hoek*	✓ R A	(1)	1E
	7.2.3	$\widehat{M}_3 = 55°$ [∠s opp equal sides]/[$\angle^e$ *teenoor gelyke sye*] $\hat{L}_1 = 55°$ [tan chord theorem] [*Raaklyn-koord st.]*	✓ ST A ✓ RE A ✓ ST A ✓ RE A	(4)	2E
					[7]

QUESTION/*VRAAG* 8					
8.1	Interior opposite angle/*Teenoorstaande binnehoek*		✓ R A	(1)	1E
8.2	8.2.1 (a)	$\hat{B}_2 = 66°$ [∠s in the same seg./$\angle^e$ *in dies. Θ segm.*]	✓ ST A ✓ RE A	(2)	1M
	8.2.1 (b)	$\hat{C}_1 = 30°$ [∠s in the same seg./$\angle^e$ *in dies. Θ segm.*]	✓ ST A ✓ RE A	(2)	1M
	8.2.1 (c)	YD̂C = 30° + 66° = 96° [ext ∠of a cycl quad/*buite ∠van kvh*]	✓ ST CA ✓ RE A	(2)	2M
8.3	8.3.1	$AT = TB$ [Tans from common pt **OR** Tans from same pt/ *Raaklyne vanuit dies. punt*] $\therefore \hat{A}_3 = \hat{B}_4$ [∠s opp equal sides/$\angle^e$ *teenoor gelyke sye*] $\hat{A}_3 + \hat{B}_4 = 180° - 75°$ (∠ sum in Δ/$\angle^e$ *van Δ)* $\therefore \hat{B}_4 = \frac{180° - 75°}{2}$ $\therefore \hat{B}_4 = 52{,}5°$	✓ ST/RE A ✓ ST/RE A ✓ ST A ✓ RE A	(4)	3D
	8.3.2 (a)	$\hat{C} = 52{,}5°$ [tan-chord theorem/ *raaklyn - koord st*]	✓ RE A ✓ ST CA	(2)	2E

	8.3.2 (b)	$\widehat{O}_1 = 105°$ [∠ at centre = 2 ×∠ at circum./*Midpts∠ = 2 x Omtreks∠*]	✓ RE A ✓ ST CA	(2)	1D
	8.3.2 (c)	$AO = OB$ (= radii) $\therefore \hat{A}_2 = \hat{B}_3$ [∠s opp equal side/*∠e teenoor gelyke sye*] $\hat{A}_2 + \hat{B}_3 = 180° - 105°$ (∠ sum in Δ/*∠e van Δ)*] $\therefore \hat{A}_2 = \frac{180° - 105°}{2}$ $\therefore \hat{A}_2 = 37{,}5°$	✓ ST/RE A ✓ ST/RE A ✓ ST CA	(3)	2D
					[18]

QUESTION/*VRAAG* 9					
9.1	Proportionally/*Eweredig*		✓ R A	(1)	1M
9.2	9.2.1	ΔEMA *and* ΔFMB: $E\hat{M}A = F\hat{M}B$; [given/*gegee*] $E\hat{A}M = F\hat{B}M = 90°$ $A\hat{E}M = M\hat{F}B$ [Int ∠s Δ/*∠e van Δ)*] $\therefore \Delta AEF \,\|\|\| \,\Delta CMB$; ∠ ∠ ∠ ,HHH	Do not mark	(0)	3E
	9.2.2	$AM = 120\ cm = 1{,}2\ m$ $MB = 4{,}5\ m$ $EA = 160\ cm = 1{,}6\ m$ $\frac{MB}{MA} = \frac{FB}{AE}$ $\frac{4{,}5}{1{,}2} = \frac{FB}{1{,}6}$ [line || one side of Δ/*lyn || een sy van Δ]* $1{,}2 \times FB = 4{,}5 \times 1{,}6$ $FB = \frac{4{,}5 \times 1{,}6}{1{,}2}$ FB = 6 m	✓ Conversion to metres/cm A *Omskakeling na meter/cm* 1,6 m & 1,2 m or 450cm CA ✓ ST A ✓ RE ✓ Answer/ *Antwoord* CA	(4)	3E
9.3	Equal to half the length of the third side *Gelyk aan die helfte van die derde sy.*		✓ RE A	(1)	1M

9.4	9.4.1	Yes/*Ja* [Midpt Theorem/ *Midpt.-stelling]*	✓ ST A ✓ RE A	(2)	4E
	9.4.2	$DE = \frac{1}{2}BC$ [Midpt Theorem/*Midpt.-stelling*] $\therefore A\hat{E}D = 64°$ [corresp ∠s; DE || BC/ ooreenk. ∠^{e}; DE || BC	✓ Answer/*Antwoord* CA	(1)	1D
	9.4.3	$2y + 1 = \frac{1}{2}(22)$ $y = 5$ $\therefore DE = 11\ cm$	✓ value of y/ *waarde van y* CA ✓ length of DE/ *lengte van DE*	(2)	2D
					[14]

QUESTION/*VRAAG* 10					
10.1	10.1.1	$n=\frac{4500}{60}$ $n=75\ r/s$	✓ Answer/*Antwoord* A	(1)	1E
	10.1.2	$\omega=2\pi n$ $=2\pi(75)$ $=150\pi\ /\ 471,24\ rad/s$	✓ F A ✓ SF A ✓ Answer/*Antwoord* CA	(3)	2E
	10.1.3	$4h^2-4dh+x^2=0$ $4(115)^2-4(460)(115)+x^2=0$ $-158700+x^2=0$ $x^2=158700$ $x=\sqrt{158700}$ $x=398,37$ **OR/OF** $D=h+\frac{x^2}{4h}$ $460=115+\frac{x^2}{4(115)}$ $x^2=158700$ $x=\sqrt{158700}$ $x=398,37$	✓ F A ✓ SF A ✓ S CA ✓ Value/*Waarde* CA	(4)	2D
10.2	10.2.1	$110°\times\frac{\pi}{180}=\frac{11}{18}\pi$ or/of 1,92rad	✓ Answer/*Antwoord* A	(1)	1E
	10.2.2	$A=\frac{1}{2}r^2\theta$ $A=\frac{1}{2}(130)^2\left(\frac{11}{18}\pi\right)$ $A=\frac{46475}{9}\pi\ \text{mm}^2\ /\ 16223\ \text{mm}^2$	✓ F A ✓ SF CA ✓ Answer/*Antwoord* CA	(3)	2D

	10.2.3	Area of $\Delta BOC = \frac{1}{2}(OB)(OC)\sin\hat{O}$ $= \frac{1}{2}(130)(130)\sin(110°)$ $= 7\,940,40 \text{ mm}^2$ Area of/*van* segment = 16 222,84 – 7 940,40 = 8 828,44 mm^2	✓ *F* A ✓ SF A ✓ area of Δ *Oppervlakte van Δ* CA ✓ M A ✓ Answer/*Antwoord* CA	(5)	3D
					[17]

QUESTION/*VRAAG 11*					
11.1	11.1.1	$\frac{170}{100} = 1,7$ m	✓ Answer/*Antwoord* A	(1)	1E
	11.1.2	$A = a(m_1 + m_2 + m_3 + m_4)$ $= 1,5\left(\frac{1,6+1,4}{2} + \frac{1,4+0,85}{2} + \frac{0,85+1,7}{2} + \frac{1,7+1,8}{2}\right)$ $= \frac{339}{40}$ / 8,48 m^2 OR/OF $A = a\left(\frac{O_1+O_n}{2} + O_2 + O_3 + ... + O_{n-1}\right)$ $= 1,5\ \left(\frac{1,6+1,8}{2} + 1,4 + 0,85 + 1,7\right)$ = 8,48 m^2	✓ F A ✓ $a = 1,5$ A ✓ SF CA ✓ Answer/*Antwoord* CA ✓ F A ✓ $a = 1,5$ A ✓ SF CA ✓ Answer/*Antwoord* CA	(4)	2D
	11.1.3	A = (ℓ × b) – (area of irregular/*opp van onreëlmatige*) = (6 × 1,8) – (8,48) = 2,32 m^2	✓ F A ✓ SF A ✓ Answer/*Antwoord* CA	(3)	3E

11.2	11.2.1	There are 4 people in Mrs Saaiman's household. *Daar is 4 mense in Mev. Saaiman se huishouding.* Area of solar panels/Opp *van sonpanele* $4 + (2 \times 0{,}8) = 5{,}6\ m^2$ $Area = l \times b$ $5{,}6 = l \times 2$ $l = \frac{5{,}6}{2}$ $l = 2{,}8\ m$	✓ area/*opp* $5{,}6\ m^2$ CA ✓ F A ✓ SF CA ✓ Answer/*Antwoord* CA	(4)	2D
11.2	11.2.2	$1l = 1000\ cm^3$ $200\ l = 200\ 000\ cm^3$ $h = 2\ m = 200\ cm$ $V = \pi r^2 h$ $200\ 000 = \pi r^2 (200)$ $\frac{200\ 000}{\pi(200)} = r^2$ $r = \sqrt{\frac{200\ 000}{\pi(200)}}$ $r = 17{,}84\ cm$ $r \approx 18\ cm$	A ✓ conversion/*herlei* $200\ 000\ cm^3$ A ✓ conversion/*herlei* $200\ cm$ A ✓ F A ✓ make r the subject/ *maak r die onderwerp* CA ✓ SF ✓ Answer/*Antwoord* CA	(6)	2D
					[18]

TOTAL/*TOTAAL*:	**147**

PLEASE REFER TO THE ADDENDUM ON THE NEXT PAGE, WHICH APPLIES **ONLY TO THE AFRIKAANS** VERSION OF THE MARKING GUIDELINES FOR **QUESTION 11.1 ONLY.**

ADDENDUM (FOR AFRIKAANS ONLY)

THE FOLLOWING ADDENDUM APPLIES **ONLY TO THE AFRIKAANS** VERSION OF THE MARKING GUIDELINES FOR **QUESTION 11.1 ONLY.**

11.1.1	170 *m*	✓ A (1)
11.1.2	$A = a(m_1 + m_2 + m_3 + m_4)$ $= 1,5\left(\frac{1,6+1,4}{2} + \frac{1,4+0,85}{2} + \frac{0,85+170}{2} + \frac{170+1,8}{2}\right)$ $= \frac{10437}{40} m^2 / 260,93\ m^2$ **OF** $A = a\left(\frac{O_1+O_n}{2} + O_2 + O_3 + ... + O_{n-1}\right)$ $= 1,5\left(\frac{1.6+1.8}{2} + 1,4 + 0,85 + 170)\right)$ $= \frac{10437}{40} m^2 / 260,93\ m^2$	✓ F ✓ $a = 1,5$ ✓ SF ✓ *Antwoord* (4)
11.1.3	A = (ℓ × b) – (*opp van onreëlmatige*) = (6 × 1,8) – (260,93) = −250,13 m^2 **Also mark 250,13 m^2**	✓ F ✓ SF ✓ *Antwoord* (3)