GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

PREPARATORY EXAMINATIONS
VOORBEREIDENDE EKSAMEN
2024

MARKING GUIDELINES/
NASIENRIGLYNE

TECHNICAL MATHEMATICS/*TEGNIESE WISKUNDE* (PAPER/*VRAESTEL 1*) (11091)

14 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 nie*
NPU	No penalty for units omitted/*Geen penalisering vir eenhede weggelaat nie*
S	Simplification/*Vereenvoudiging*
F	Formula/F*ormule*
SF	Substitution in correct formula/*Vervanging in korrekte formule*
AO	Answer only/*Slegs antwoord*

NOTES:

- If a candidate answers a question TWICE, only mark the FIRST attempt.
- If a candidate has crossed out an attempt to answer a question and did not redo it, mark the crossed-out version.
- Consistent accuracy applies in all aspects of the marking guidelines, where applicable.

LET WEL:

- *Indien 'n kandidaat 'n vraag TWEE keer beantwoord het, sien slegs die EERSTE poging na.*
- *Indien 'n kandidaat 'n antwoord deurgetrek het en nie weer beantwoord het nie, merk die deurgetrekte antwoord.*
- *Volgehoue akkuraatheid is deurgaans van toepassing op alle aspekte van die nasienriglyne waar aangedui.*

QUESTION/*VRAAG* 1				**[20]**	**CL**
1.1	1.1.1	$(3x+6)(x-5)=0$ $x=-2$ or/*of* $x=5$ **OR/*OF*** $3x^2-9x-30=0$ $x=\frac{-(-9)\pm\sqrt{(-9)^2-(4)(3)(-30)}}{2(3)}$ $x=\frac{9\pm\sqrt{441}}{6}$ $x=-2$ or/*of* $x=5$	✓ $x=-2$ ✓ $x=5$ **OR/*OF*** ✓$x=-2$ ✓$x=5$	A A A A (2)	1E
	1.1.2	$4x^2-5x-8=0$ $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$ $x=\frac{-(-5)\pm\sqrt{(-5)^2-4(4)(-8)}}{2(4)}$ $x=\frac{5\pm\sqrt{153}}{8}$ $x=2{,}17$ **or/*of*** $x=-0{,}92$	✓ Standard form/*Standaardvorm* ✓ SF ✓ $x=2{,}17$ or/*of* $x=-0{,}92$ AO = Full marks/*volpunte* PR	A CA CA (3)	1D

1.1	1.1.3	$x^2 \leq 3x$ $x(x-3) \leq 0$ $0 \leq x \leq 3$ **OR/*OF*** $x \in [0;3]$	✓ Factors/*Faktore* A ✓ End points/*Eindpunte* CA ✓ Notation/*Notasie* A (3) AO = Full marks/*volpunte*	2M
1.2		$x + 2y = 3$ ….. ① and/*en* $3x^2 + 4xy + 2y^2 = 9$ ….. ② From/*Van* ① $x = 3 - 2y$ ….. ③ Substitute/*Vervang* ③ in ② $3(3-2y)^2 + 4(3-2y)y + 2y^2 = 9$ $6y^2 - 24y + 18 = 0$ $y^2 - 4y + 3 = 0$ $(y-3)(y-1) = 0$ $y = 3$ or/*of* $y = 1$ $x = -3$ or/*of* $x = 1$	✓ $x = 3 - 2y$ A ✓ SF A ✓ $y^2 - 4y + 3 = 0$ CA ✓ $(y-3)(y-1)$ CA ✓ $y = 3$ or/*of* $y = 1$ CA ✓ $x = -3$ or/*of* $x = 1$ CA (6)	3E
		OR/*OF* From/*Van* ① $y = \frac{3}{2} - \frac{x}{2}$ ….. ③ Substitute/*Vervang* ③ in ② $3x^2 + 4x\left(\frac{3}{2} - \frac{x}{2}\right) + 2\left(\frac{3}{2} - \frac{x}{2}\right)^2 = 9$ $x^2 + 2x - 3 = 0$ $(x+3)(x-1) = 0$ $x = -3$ or/*of* $x = 1$ $y = 3$ or/*of* $y = 1$	**OR/*OF*** ✓ $y = \frac{3}{2} - \frac{x}{2}$ A ✓ SF A ✓ $x^2 + 2x - 3 = 0$ CA ✓ $(x+3)(x-1)$ CA ✓ $x = -3$ or/*of* $x = 1$ CA ✓ $y = 3$ or/*of* $y = 1$ CA (6)	

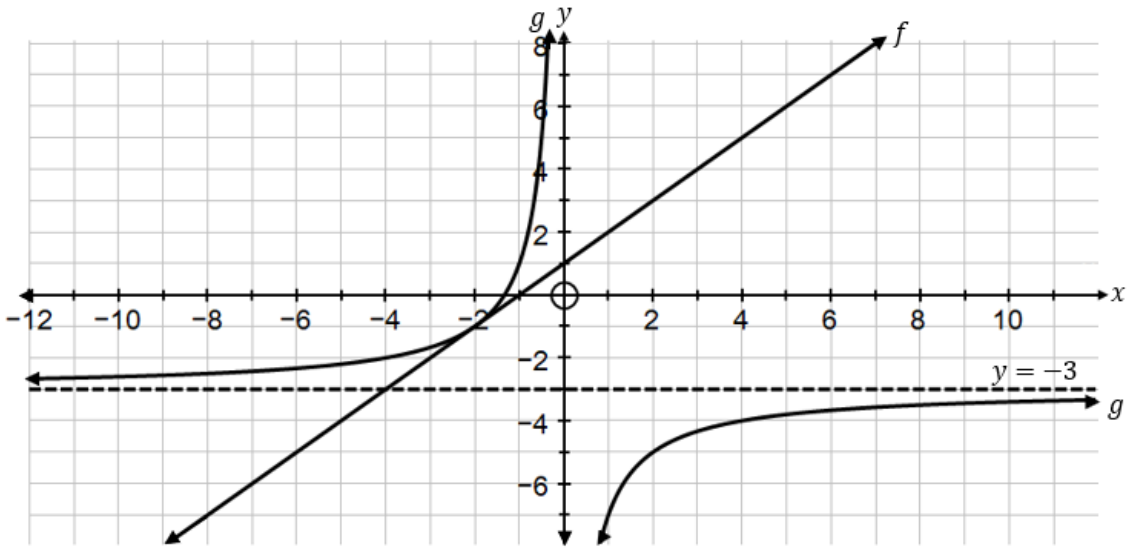
1.3	1.3.1	$a = \frac{v_2 - v_1}{t}$ $at = v_2 - v_1$ $at - v_2 = -v_1$ $v_1 = v_2 - at$	✓ $at = v_2 - v_1$ A ✓ $v_1 = v_2 - at$ CA (2)	2E
	1.3.2	$v_1 = v_2 - at$ $v_1 = 15 - 2{,}5x2$ $v_1 = 15 - 5$ $v_1 = 10\text{m/s}$	✓ SF CA ✓ 10 m/s CA (2)	1E
	1.3.3	1111_2	✓ 1111_2 A ✓ $_2$ A (2) AO = Full marks/*volpunte*	1E
				[20]

QUESTION/*VRAAG* 2			**[6]**	**CL**
2.1	2.1.1	$x = 0$	✓ $x = 0$ A (1)	1E
	2.1.2	$25 - 2x \geq 0$ $-2x \geq -25$ $x \leq 12{,}5$	✓ $25 - 2x \geq 0$ A ✓ $x \leq 12{,}5$ CA (2)	1E
2.2	$6x^2 - 6x + 1 = 0$ $\Delta = b^2 - 4ac$ $\Delta = (-6)^2 - 4(6)(1)$ $= 36 - 24$ $= 12$ Real, Irrational, and unequal/ *Reëel, Irrasionaal en ongelyk*		✓ SF A ✓ Answer/*Antwoord* CA ✓ Real, Irrational, Unequal/*Reëel Irrasionaal en ongelyk* CA (3)	1D
				[6]

QUESTION/*VRAAG* 3			**[23]**	**CL**
3.1	3.1.1	$(81)^{-\frac{3}{4}}$ $=(3^4)^{-\frac{3}{4}}$ $=3^{-3}$ or / of $=\frac{1}{27}$	✓ 3^4 A ✓✓ 3^{-3} or / of $=\frac{1}{27}$ CA (3)	1D
	3.1.2	$\frac{2^{x+1}-3.2^{x-1}}{\left(\frac{1}{2}\right)^{-x}}$ $=\frac{2^x.2^1-3.2^x.2^{-1}}{(2^{-1})^{-x}}$ $=\frac{2^x\left(2-\frac{3}{2}\right)}{2^x}$ $=\frac{1}{2}$	✓ $2^x \times 2^1 - 3 \times 2^x \times 2^{-1}$ A ✓ (2^{-1}) A ✓ $2^x\left(2-\frac{3}{2}\right)$ Factors/*faktore* CA ✓ 2^x A ✓ $\frac{1}{2}$ CA (5)	3E
3.2		$\log_4(x+2)-\log_4 3=2$ $\log_4\left(\frac{x+2}{3}\right)=2$ $\therefore 4^2=\frac{x+2}{3}$ $\therefore 48=x+2$ $\therefore x=46$	✓ $\log_4\left(\frac{x+2}{3}\right)$ A ✓ $4^2=\frac{x+2}{3}$ CA ✓ $x=46$ CA (3)	2D
3.3	3.3.1	$z=\frac{-3+6i}{3}$ $z=-1+2i$ $\bar{z}=-1-2i$	✓ $z=-1+2i$ A ✓ $\bar{z}=-1-2i$ A (2) AO = Full marks/*volpunte* *ACCEPT/AANVAAR:* $\bar{z}=\frac{-3-6i}{3}$	1D

3.3	3.3.2	$z = -1 + 2i$ $r = \sqrt{a^2 + b^2}$ $r = \sqrt{(-1)^2 + (2)^2}$ $r = \sqrt{5}$ or/*of* $r = 2{,}24$ $\theta = \tan^{-1}\frac{b}{a}$ $\theta = \tan^{-1}\left(\frac{2}{1}\right)$ $Ref.\angle = 63{,}43°$ $\theta = 180° - 63{,}43°$ $\theta = 116{,}57°$ $z = \sqrt{5}cis\ 116{,}57°$ or/*of* $z = \sqrt{5}(cos116{,}57° + isin116{,}57°)$ or/*of* $z = \sqrt{5}\ \lfloor 116{,}57°$	✓ SF A ✓Modulus CA ✓ $\theta = \tan^{-1}\left(\frac{2}{1}\right)$ A ✓ $Ref.\angle = 63{,}43°$ CA ✓ $\theta = 116{,}57°$ CA ✓Polar form/*Polêre vorm* CA (6)	2D
3.4		$(x + yi) = 6i + 4 - 3i^2 - 2i$ $(x + yi) = 4 - 3(-1) + 4i$ $(x + yi) = 4 + 3 + 4i$ $(x + yi) = 7 + 4i$ $\therefore x = 7$ and/*en* $y = 4$	✓ S A ✓ $i^2 = -1$ A ✓ $x = 7$ CA ✓ $y = 4$ CA (4)	2M
				[23]

QUESTION/*VRAAG* 4				**[34]**	**CL**
4.1	4.1.1	$x = 0$ $y = -3$	✓ $x = 0$ ✓ $y = -3$	A A (2)	1E
	4.1.2	For *y*-intercept let $x = 0$/*Vir y-afsnit stel* $x = 0$ $g(x) = \frac{-4}{x} - 3$ $y = \frac{-4}{0} - 3$ $x \neq \mathbf{0}$ **∴ no solution/*geen oplossing nie*** **There is no *y*-intercept/*Daar is geen y-afsnit nie.***	✓$x \neq 0$ ✓R	A A (2)	4E

4.1	4.1.3			2E
		If $g(x)$ intercects/touches the *y*-axis, the mark for the shape may not be awarded. *As $g(x)$ die y-as raak/sny, mag die punt vir die vorm nie toegeken word nie.*	✓ Shape/*vorm* $g(x)$ A ✓ Asymptote/*Assimptoot* $g(x)$ A ✓ *x*-intercept/*afsnit* $g(x)$ A ✓ $m > 0$ for $f(x)$ A ✓ *x*-intercept/*afsnit* $f(x)$ A ✓ *y*-intercept/*afsnit* $f(x)$ A (6)	
	4.1.4	$x + 1 = \frac{-4}{x} - 3$ $x^2 + x = -4 - 3x$ $x^2 + 4x + 4 = 0$ $(x + 2)(x + 2) = 0$ or/*of* $(x + 2)^2 = 0$ $x = -2$	✓ $x^2 + x = -4 - 3x$ A ✓ $x^2 + 4x + 4 = 0$ CA ✓ Factors/*Faktore* CA ✓ $x = -2$ CA (4)	3E
	4.1.5	Yes, the graphs of f and g intersects at only one point. *Ja, die grafieke van f en g sny slegs by een punt.*	✓ ST From/*van* 4.1.4 CA ✓ R From/*van* 4.1.4 CA (2)	4E

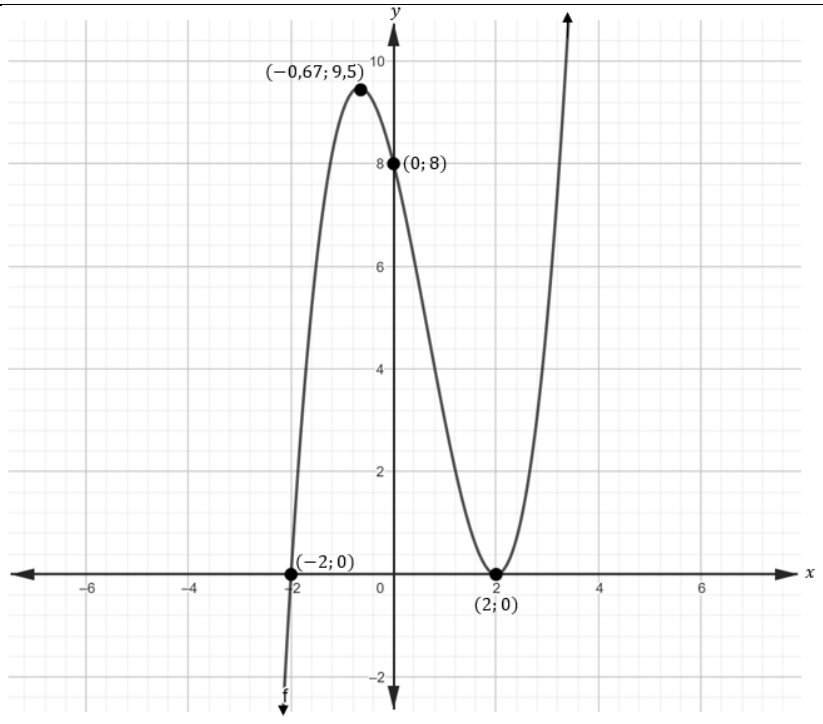
4.2	4.2.1	$0 = -x^2 - 4x + 5$ $0 = x^2 + 4x - 5$ $0 = (x-1)(x+5)$ $x = 1$ or/*of* $x = -5$ E$(-5;0)$ and/*en* P$(1;0)$		✓ $0 = -x^2 - 4x + 5$ M ✓Factors/*Faktore* CA ✓ Both/*Beide x* CA ✓ E$(-5;0)$ CA ✓ P$(1;0)$ CA (5)	2M
	4.2.2	M$(0;5)$		✓ $x = 0$ A ✓ $y = 5$ A (2)	1E
	4.2.3	$x = -\frac{b}{2a}$ **OR/*OF*** $x = \frac{-(-4)}{2(-1)}$ $x = -2$ $f(-2) = -(-2)^2 - 4(-2) + 5$ $f(-2) = 9$ $N = (-2;9)$	$x_D = \frac{x_E + x_P}{2}$ $x_D = \frac{-5+1}{2}$ $x_D = -2$ **OR/*OF*** $f'(x) = -2x - 4$ $0 = -2x - 4$ $2x = -4$ $x = -2$	✓ *M* A ✓ SF A ✓$x = -2$ CA ✓$y = 9$ CA (4) AO = Full marks/*volpunte*	2E
	4.2.4	$c = 5$ $m = \frac{5-0}{0-(-5)}$ $m = 1$ $g(x) = x + 5$		✓$c = 5$ A ✓$m = 1$ CA (2) AO = Full marks/*volpunte*	2M
	4.2.5	NT $= 9 - (-2 + 5)$ $y_N = 9$ N$(-2;9)$ NT $= 9 - 3$ $y_T = 3$ T$(-2;3)$ NT $= 6$ units/*eenhede*		✓ M A ✓ $-2 + 5$ CA ✓ 6 CA (3)	2E
	4.2.6	$x \in (-5;0)$ OR/*OF* $-5 < x < 0$		✓ Notation/*Notasie* A ✓ Endpoints/*Eindpunte* CA (2)	2E
					[34]

QUESTION/*VRAAG* 5			**[14]**	**CL**
5.1	$i_{eff} = \left(1 + \frac{0{,}123}{4}\right)^4 - 1$ $i_{eff} = 0{,}12879$ Eff $= 12{,}88\%$	✓ F ✓ SF ✓ 12,88	A A CA (3)	2E
5.2	$150\,000 = 500\,000\left(1 - \frac{12}{100}\right)^n$ $\frac{150\,000}{500\,000} = (0{,}88)^n$ $n = log_{0{,}88}(0{,}3)$ $n = 9{,}418298$ ... $n = 10$ years/*jaar*	✓SF ✓ S ✓ M ✓ 10 ACCEPT/*AANVAAR* $n = 9{,}41$	A CA A CA (4)	3E
5.3	$A_1 = 182\,000\left(1 + \frac{0{,}072}{2}\right)^{2\times2}$ $A_1 = 209\,657{,}5033$ $P_2 = 209\,657{,}5033 + 50\,000$ $P_2 = 259\,657{,}5033$ $A_2 = 259\,657{,}5033\left(1 + \frac{0{,}072}{2}\right)^{2\times1}$ $A_2 = 278\,689{,}3597$ $P_3 = 278\,689{,}3597 - 30\,000$ $P_3 = 248\,689{,}3597$ $A_3 = 248\,689{,}3597\left(1 + \frac{\frac{7}{100}}{4}\right)^{2\times4}$ $A_3 = \text{R } 285\,714{,}68$ No, he will not have enough money. *Nee, hy sal nie genoeg geld hê nie.*	✓SF ✓ 209 657,5033 ✓ + R50 000 ✓ $\left(1 + \frac{0{,}072}{2}\right)^{2\times1}$ ✓−R30 000 ✓ R 285 714,68 ✓ RE	A CA A A A CA CA (7)	2D
				[14]

QUESTION/*VRAAG* 6			**[19]**	**CL**
6.1	$f(x) = -x - 6$ $f(x+h) = -(x+h) - 6$ $f(x+h) = -x - h - 6$ $f'(x) = \lim_{h\to 0} \frac{f(x+h) - f(x)}{h}$ $f'(x) = \lim_{h\to 0} \frac{-x - h - 6 - (-x - 6)}{h}$ $= \lim_{h\to 0} \frac{-x - h - 6 + x + 6}{h}$ $= \lim_{h\to 0} \frac{-h}{h}$ $= -1$		✓ Definition/*Definisie* A ✓ SF A ✓ S CA ✓ -1 CA (4)	2E
6.2	6.2.1	$f(x) = \sqrt[3]{x^3} + 2x^{-2} - \frac{1}{2x}$ $f(x) = x + 2x^{-2} - \frac{1}{2}x^{-1}$ $f'(x) = 1 - 4x^{-3} + \frac{x^{-2}}{2}$	✓ x and/*en* $\frac{1}{2}x^{-1}$ A ✓ 1 CA ✓ $-4x^{-3}$ CA ✓ $\frac{x^{-2}}{2}$ CA (4)	2E
	6.2.2	$\frac{d}{dx}\left(\frac{2x^2 + 3x - 1}{x}\right)$ $= \frac{d}{dx}\left(\frac{2x^2}{x} + \frac{3x}{x} - \frac{1}{x}\right)$ $= \frac{d}{dx}(2x + 3 - x^{-1})$ $= 2 + x^{-2}$	✓ $2x + 3 - x^{-1}$ A ✓2 CA ✓ $+ x^{-2}$ CA (3)	3M
6.3	$f(x) = x^2 - 1$ $f(2) = (2)^2 - 1 = 4 - 1 = 3$ $(2; 3)$ $f(6) = (6)^2 - 1 = 36 - 1 = 35$ $(6; 35)$ $M_{\text{ave}/gem} = \frac{f(6) - f(2)}{6 - 2}$ $= \frac{35 - 3}{6 - 2}$ $= \frac{32}{4}$ $= 8$		✓ y-values/*waardes* A ✓ SF CA ✓ 8 CA (3)	2D

6.4	$g(x) = 5x^2 - 3x$ $g(1) = 5(1)^2 - 3(1) = 5 - 3 = 2$ $(1; 2)$ $g'(x) = 10x - 3$ $g'(1) = 10(1) - 3 = 10 - 3 = 7$ $y - 2 = 7(x - 1)$ $y - 2 = 7x - 7$ $y = 7x - 5$	✓ $y = 2$ A ✓ $g'(x)$ A ✓ $m = 7$ CA ✓ SF CA ✓Equation/*Vergelyking* CA (5)	3E
			[19]

QUESTION/*VRAAG* 7		**[13]**	**CL**
7.1	$f(x) = x^3 - 2x^2 - 4x + 8$ $f(2) = (2)^3 - 2(2)^2 - 4(2) + 8$ $= 8 - 8 - 8 + 8$ $= 0$ $\therefore (x - 2)$ is a factor/*is 'n faktor*	✓ $f(2) = 0$ A (1)	1M
7.2	$y = 8$	✓ $y = 8$ A (1)	1E
7.3	$x^3 - 2x^2 - 4x + 8 = 0$ $0 = (x - 2)(x^2 - 4)$ $0 = (x - 2)(x - 2)(x + 2)$ $(x + 2)(x - 2)^2 = 0$ $x = -2$ or/*of* $x = 2$	✓ M A ✓ $x^2 - 4$ CA ✓ Both x-values/*Beide x waardes* CA (3)	2E

7.4	$f(x) = x^3 - 2x^2 - 4x + 8$ $f'(x) = 3x^2 - 4x - 4$ $3x^2 - 4x - 4 = 0$ $(3x + 2)(x - 2) = 0$ $x = -\frac{2}{3}$ or/*of* $x = 2$ $f\left(-\frac{2}{3}\right) = \left(-\frac{2}{3}\right)^3 - 2\left(-\frac{2}{3}\right)^2 - 4\left(-\frac{2}{3}\right) + 8$ $f\left(-\frac{2}{3}\right) = \frac{256}{27}$ or/of 9,48 $f(2) = (2)^3 - 2(2)^2 - 4(2) + 8$ $f(2) = 0$ $(2; 0)$ & $\left(-\frac{2}{3}; \frac{256}{27}\right)$ or/*of* $(-0{,}67; 9{,}48)$	✓ $f'(x)$ A ✓ $f'(x) = 0$ A ✓ M CA ✓ x-values/*waardes* CA ✓ y-values/*waardes* CA (5)	3E
7.5		✓All int./*All afsn.* CA ✓ TP/*DP* CA ✓ Shape/*Vorm* CA Shape: Must be cubic with 2 TP. *Vorm: Moet derdegraads wees met 2 DP.* (3)	2E
			[13]

QUESTION/*VRAAG* 8			**[8]**	**CL**
8.1	Length/*Lengte*$= 54 - x - 4 = 50 - x$ Breadth/*Breedte* $= x - 4$	✓ $50 - x$ ✓ $x - 4$	A A (2)	3E
8.2	Area = length x breadth/*Oppervlakte = lengte x breedte* $= (x - 4)(50 - x)$ $= 50x - x^2 - 200 + 4x$ $= -x^2 + 54x - 200$	✓ F ✓ SF from/*van* 8.1	A CA (2)	2E
8.3	$\frac{dA}{dx} = -2x + 54$ $-2x + 54 = 0$ $\therefore -2x = -54$ $\therefore x = 27$ Area $= -(27)^2 + 54(27) - 200$ $= 529\ cm^2$	✓ $-2x + 54$ ✓ $-2x + 54 = 0$ ✓ $x = 27$ ✓ $529\ cm^2$	CA A CA CA (4) NPU	4E
				[8]

QUESTION/*VRAAG* 9			[13]	CL
Penalise only once in 9.1 and/or 9.2.1 for the omission of the c. Penaliseer slegs eenkeer in 9.1 en/of 9.2.1 vir die weglating van c.				
9.1	9.1.1	$4\int(\frac{1}{x}-3^{2x}-2)dx$ $=\int\left(\frac{4}{x}-4.3^{2x}-8\right)dx$ $=4lnx-\frac{4.3^{2x}}{2ln3}-8x+c$ $=4lnx-\frac{2.3^{2x}}{ln3}-8x+c$ **OR/OF** $4\int(\frac{1}{x}-3^{2x}-2)dx$ $=4\left(lnx-\frac{3^{2x}}{2ln3}-2x+c\right)$ $=4lnx-\frac{4.3^{2x}}{2ln3}-8x+c$ $=4lnx-\frac{2.3^{2x}}{ln3}-8x+c$	✓ $\frac{4}{x}-4.3^{2x}-8$ A ✓ $4lnx-\frac{4.3^{2x}}{2ln3}$ CA ✓ $-8x+c$ CA (3) **OR/OF** ✓ $lnx-\frac{3^{2x}}{2ln3}$ CA ✓ $-2x+c$ CA ✓ $4lnx-\frac{4.3^{2x}}{2ln3}-8x+C$ A	3E
	9.1.2	$\int(1-2x)^2dx$ $=\int(1-4x+4x^2)dx$ $=x-2x^2+\frac{4}{3}x^3+c$	✓ $1-4x+4x^2$ A ✓ x CA ✓ $-2x^2$ CA ✓ $\frac{4}{3}x^3+c$ CA (4)	4E

9.2	9.2.1	$\int(-x^2 + 3)dx$ $= -\frac{1}{3}x^3 + 3x + c$	✓$-\frac{1}{3}x^3$ A ✓$3x + c$ A (2)	2M
	9.2.2	$A = \int_{-1}^{1}(-x^2 + 3)dx$ $A = \left[-\frac{1}{3}x^3 + 3x\right]_{-1}^{1}$ $A = \left[-\frac{1}{3}(1)^3 + 3(1)\right] - \left[-\frac{1}{3}(-1)^3 + 3(-1)\right]$ $A = \frac{8}{3} - \left(-\frac{8}{3}\right)$ $A = \frac{16}{3}$ or/*of* $A = 5\frac{1}{3}$ or/*of* $A = 5{,}33\ \text{unit}^2/eenheid^2$	✓Area notation using integrals/*Area notasie deur integrale te gebruik* A ✓ SF $x = 1$ CA ✓ SF $x = -1$ CA ✓ $\frac{16}{3}$ CA (4)	3E
		If a learner substitutes the $x-$ values into the original equation MAX 1/4 Indien 'n leerder die $x-$ waardes in die oorspronklike vergelyking vervang: MAKS 1/4		
				[13]

TOTAL/*TOTAAL:* **150**