GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

PREPARATORY EXAMINATIONS
VOORBEREIDENDE EKSAMEN
2025

MARKING GUIDELINES/
NASIENRIGLYNE

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

12 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/*Formule*
SF	Substitution in correct formula/*Vervanging in korrekte formule*

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 van toepassing.*

QUESTION/*VRAAG* 1			**CL/*DV***
1.1.1	$-x(2-4x)=0$ $x=\frac{2}{4}/\frac{1}{2}$ or/of $x=0$ **OR/*OF*** $4x^2-2x=0$ $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$ $=\frac{-(-2)\pm\sqrt{(-2)^2-(4)(4)(0)}}{2(4)}$ $=\frac{2\pm\sqrt{4}}{8}$ $x=\frac{1}{2}$ **or/*of*** $x=0$	✓ $x=\frac{2}{4}/\frac{1}{2}$ **A** ✓ $x=0$ **A** ✓$x=\frac{2}{4}/\frac{1}{2}$ **A** ✓$x=0$ **A** (2)	1E
1.1.2	$x^2-3=4-5x$ $x^2+5x-7=0$ $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$ $x=\frac{-(5)\pm\sqrt{(5)^2-4(1)(-7)}}{2(1)}$ $x=\frac{-5\pm\sqrt{53}}{2}$ $x=1{,}14$ **or/of** $x=-6{,}14$	✓ Std form/*vorm* **A** ✓ **SF** **CA** ✓ $x=1{,}14$ **CA** ✓ $x=-6{,}14$ **CA** (4) PR (Only once) AO: Full marks/*Volpunte*	2M

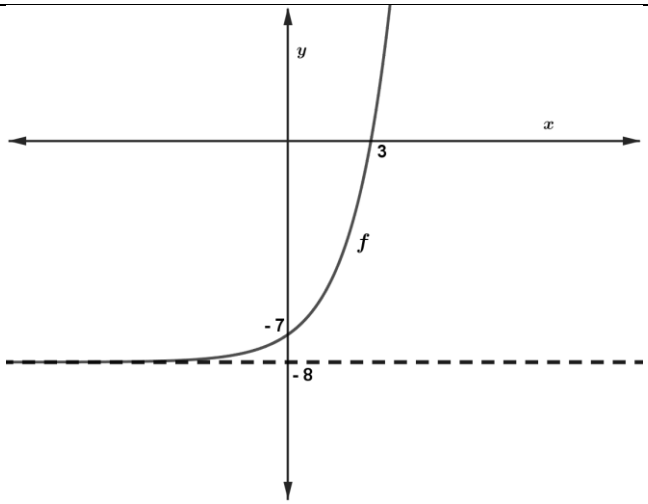
1.1.3	$x^2 + 5x \leq 6$ $x = \frac{-(5) \pm \sqrt{(5)^2 - 4(1)(-6)}}{2(1)}$ $x = \frac{-5 \pm \sqrt{49}}{2}$ **OR/*OF*** $(x + 6)(x - 1) \leq 0$ $-6 \leq x \leq 1$ **OR/*OF*** $x \in [-6; 1]$ Can represent it graphically/*Kan grafies voorstel*	✓ Factors/*Faktore* /SF **A** ✓ Both critical values/*Beide kritieke waardes* **CA** ✓ Correct notation/*Korrekte notasie* **CA** (3) AO: Full marks/*Volpunte*	3M
1.2	$x + y = 3$ $\therefore x = 3 - y$ $x^2 + y^2 = 89$ $(3 - y)^2 + y^2 = 89$ $9 - 6y + y^2 + y^2 = 89$ $2y^2 - 6y - 80 = 0$ $y^2 - 3y - 40 = 0$ $y = \frac{-(-3) \pm \sqrt{(-3)^2 - 4(1)(-40)}}{2(1)}$ $y = \frac{3 \pm \sqrt{169}}{2}$ $(y - 8)(y + 5) = 0$ $y = 8$ **or/*of*** $y = -5$ $\therefore x = 3 - (8) = -5$ **or/*of*** $x = 3 - (-5) = 8$ $x = -5$ or $x = 8$ **OR/*OF*** $\therefore y = 3 - x$ $x^2 + (3 - x)^2 = 89$ $x^2 + 9 - 6x + x^2 = 89$ $2x^2 - 6x - 80 = 0$ $x^2 - 3x - 40 = 0$ $x = \frac{-(-3) \pm \sqrt{(-3)^2 - 4(1)(-40)}}{2(1)}$ $x = \frac{3 \pm \sqrt{169}}{2}$ **OR/*OF*** $(x + 5)(x - 8) = 0$ $x = -5$ or $x = 8$ $\therefore y = 3 - (-5)$ or $y = 3 - 8$ $y = 8$ or $y = -5$	✓make x subject/ *maak x onderwerp* **A** ✓ Substitution/*Substitusie* **CA** ✓ Std form/*vorm* **CA** ✓ Factors/*Faktore*/**SF** **CA** ✓ Both y-values *Beide y-waardes* **CA** ✓ Both x-values *Beide x-waardes* **CA** (6) **OR/*OF*** ✓ make y subject/ *maak y onderwerp* **A** ✓ Substitution/*Substitusie* **A** ✓ Std form/*vorm* **CA** ✓ Factors/*Faktore*/**SF** **CA** ✓ Both x-values/ *Beide x-waardes* **CA** ✓ Both y-values/ *Beide y-waardes* **CA** (6)	3E

1.3.1	$\eta = 1 - \frac{T_c}{T_h}$ $\frac{T_c}{T_h} = 1 - \eta$ $T_c = T_h\,(1 - \eta)$ **OR/*OF*** $\eta - 1 = -\frac{T_c}{T_h}$ $\frac{T_c}{T_h} = 1 - \eta$ $T_c = T_h\,(1 - \eta)$ **OR/*OF*** $\eta = 1 - \frac{T_c}{T_h}$ $\eta - 1 = -\frac{T_c}{T_h}$ $T_c = -T_h\,(\eta - 1)$	✓ $\frac{T_c}{T_h}$(Subject of formula/ *Onderwerp van formule*) **M** ✓Answer/*Antwoord* **A** ✓ $-\frac{T_c}{T_h}$(Subject of formula/ *Onderwerp van formule*) **M** ✓ Answer/*Antwoord* A (2)	2M
1.3.2	$T_c = T_h\,(1 - \eta)$ $T_c = 600\,(1 - 0{,}4)$ $\therefore\ T_c = 360\ K$	✓ Substitution/*Substitusie* **CA** ✓ Answer/*Antwoord* **CA** (2)	1E
1.4	$(11101_2 + 13) - 111_2$ $= (11101_2 + 1101_2) - 111_2$ $= 101010_2 - 111_2$ $= 100011_2$ **OR/*OF*** $(11101_2 + 13) - 111_2$ $= (29 + 13) - 7$ $= 42 - 7 = 35$ $= 100011_2$	✓ 1101_2 **A** ✓ 101010_2 **A** ✓Answer/*Antwoord* **CA** ✓ base/*basis* 2 **A** (4) AO: $\frac{4}{4}$ ✓ 29 **A** ✓ 35 **CA** ✓ Answer/*Antwoord* **CA** ✓ base 2 **A** (4)	1E
			[23]

QUESTION/*VRAAG* 2			**CL/ *DV***
2.1	$x^2 - px + p + 3 = 0$ $\Delta = b^2 - 4ac$ $\Delta = (-p)^2 - 4(1)(p+3)$ $\therefore \Delta = p^2 - 4p - 12$	✓ Substitution/*Substitusie* **A** ✓ Answer/*Antwoord* **CA** (2)	4E
2.2	$\Delta \geq 0$ $p^2 - 4p - 12 \geq 0$ $(p-6)(p+2) \geq 0$ $p \geq 6$ or/*of* $p \leq -2$ **OR/*OF*** $p = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{-(-4) \pm \sqrt{(-4)^2 - 4(1)(-12)}}{2(1)}$ $= \frac{4 \pm \sqrt{16+48}}{2}$ p = 6 **or/*of*** p = –2 (p – 6) (p + 2) ≥ 0 p ≥ 6 **or/*of*** p ≤ –2	✓ $\Delta \geq 0$ **A** ✓ Factors/*Faktore/SF* **A** ✓ Answer/*Antwoord* **CA** (3)	4E
			[5]

QUESTION/*VRAAG* 3			**CL/ *DV***
3.1.1	$\sqrt{25x^2 - 16x^2}$ $= \sqrt{9x^2}$ $= 3x$	✓ 3 **A** ✓x **A** (2) AO: Full marks/*Volpunte*	2M
3.1.2	$(\log_2 32)(\log_2 4)$ $= (\log_2 2^5)(\log_2 2^2)$ $= (5\log_2 2)(2\log_2 2)$ $= 5 \times 2(\log_2 2)$ **OR/*OF*** [5(1)][2(1)] $= 10$	✓ $5\log_2 2$ **A** ✓ $\log_2 2 = 1$ **A** ✓ Answer/*Antwoord* **CA** (3) AO:$\frac{1}{3}$	2E

3.2	$A = \dfrac{2^{3x} \times 3}{2^{3x} + 3.2^{3x+1}}$ $A = \dfrac{2^{3x} \times 3}{2^{3x} + 3 \times 2^{3x} \times 2^{1}}$ $A = \dfrac{2^{3x} \times 3}{2^{3x}(1+3\times 2)}$ $= \dfrac{3}{1+6}$ $A = \frac{3}{7}$	✓ $2^{3x} \times 2^{1}$ **A** ✓ 2^{3x} (common factor/*gemeenskaplike faktor)* **A** ✓$(1 + 3 \times 2)$ **CA** ✓ Answer/*Antwoord* **CA** (4)	3E
3.3.1	$z = 2\ cis\ 315^{\circ}$ $z = r\ (cos\ \theta + i\ sin\ \theta)$ $z = 2\ (cos\ 315° + i\ sin\ 315°)$ $z = 1{,}41\ - 1{,}41\ i$ z = $\sqrt{2} - \sqrt{2}i$	✓ Substitution/*Substitusie* **A** ✓ 1,41/$\sqrt{2}$ **A** ✓ 1,41 i/ $-\sqrt{2}\ i$ **A** AO: Full marks/*Volpunte* (3)	2E
3.3.2	Fourth quadrant/*Vierde kwadrant*	✓ Answer/*Antwoord* **A** (1)	1E
3.3.3	$r = 2$	✓ Answer/*Antwoord* **A** (1)	1E
3.4	$(x - yi) = i(4i - 3)$ $x - yi = 4i^2 - 3i$ $x - yi = -4 - 3i$ $x = -4$ or/*of* $y = 3$	✓S **A** ✓$i^2 = -1$ **A** ✓$x = -4$ **CA** ✓$y = 3$ **CA** (4)	3E
			[18]

QUESTION/*VRAAG* 4			**CL/*DV***
4.1.1	$y = -8$	✓ $y = -8$ **A** No marks for writing only -8 *Geen punte vir die skryf van net -8 nie* (1)	1E
4.1.2	For y-intercept let/*vir y-afsnit laat* $x = 0$ $f(x) = 2^x - 8$ $y = 2^0 - 8$ $y = 1 - 8$ $y = -7$ For *x*-intercept let/*vir y-afsnit laat* $y = 0$ $2^x - 8 = 0$ $2^x = 8$ $2^x = 2^3$ $x = 3$	✓ $x = 0$ A ✓ $y = -7$ **CA** ✓ y = 0 **A** ✓x = 3 **CA** (4)	2E
4.1.3		✓ Shape/*Vorm f* **A** ✓ Asymptote/ *Asimptoot* **CA** ✓ x intercept/ *x-afsnit f* **CA** ✓ y intercept/ *y-afsnit f* **CA** (4)	1M

4.2.1	$g(x) = -2x + d$ $(-2\,;0)$ $0 = -2(-2) + d$ $d = -4$	✓ **SF** **A** ✓ $d = -4$ **CA** (2)	2M
4.2.2 (a)	$C(0;\,-4)$	✓ $x = 0$ **A** ✓ $y = -4$ **CA** (2)	1M
(b)	$h(x) = -\sqrt{16 - x^2}$	✓ Answer/ *Antwoord* **CA** (1)	3M
(c)	$-4 \leq x \leq 4$ **OR/*OF*** $x \in [-4;4]$	✓ Notation/*Notasie* A ✓ Critical values/ *Kritieke waardes* CA CA from 4.2.1 *CA vanaf 4.2.1* (2)	2M
4.3.1	$K\,(-6\,;0)$ $L\,(2\,;0)$	✓ $K\,(-6\,;0)$ **A** ✓ $L\,(2\,;0)$ **A** (2)	1E
4.3.2	$f(x) = x^2 + 4x - 12$ $x = -\frac{b}{2a}$ **OR/*OF*** $f'(x) = 2x + 4$ **OR/*OF*** $\boldsymbol{x = \frac{-6+2}{2}}$ $x = -\frac{4}{2(1)}$ $0 = 2x + 4$ $x = -2$ $x = -2$ $x = -2$ $f(-2) = (-2)^2 + 4(-2) - 12 = -16$ $N\,(-2\,;-16)$	✓ Standard form/ *Standaardvorm* **A** ✓ **M** **A** ✓ x-value /*waarde* **CA** ✓ y-value/*waarde* **CA** (4)	4E
4.3.3 (a)	For y-intercept let $x = 0$/*Vir y-afsnit stel* $x = 0$ $f(0) = (0)^2 + 4(0) - 12$ $f(0) = -12$ **or/*of*** $f(0) = (0 + 6)\,(0 - 2)$ $f\,(0) = -12$ $M\,(0\,;-12)$	✓ 0 **A** ✓ -12 CA (2)	1E
(b)	$y \geq -16$ **or/*of*** y ∈ (–16 ; ∞)	✓ Answer/*Antw* **CA** CA from 4.3.2 *CA vanaf 4.3.2* (1)	1D
(c)	$x = 0$ $y = -16$	✓ $x = 0$ **A** ✓ $y = -16$ **CA** (2)	2E

4.3.4	$t(x) = \frac{a}{x} + q$ $0 = \frac{a}{-6} - 16$ $\frac{a}{6} = -16$ $a = -96$	✓ $q = -16$ **CA** ✓ Subst/*Vervang* $(-6\,;0)$ **CA** ✓ a = –96 **CA** (3)	2D
4.3.5	$-6 < x < 0$ **OR/*OF*** $x \in (-6;0)$	✓ Notation/*Notasie* **A** ✓ Both critical values/ *Beide kritieke waardes* **CA** (2)	3M
4.3.6	$x < -6$ $x > 0$	✓ $x < -6$ CA ✓ $x > 0$ **A** (2)	4E
			[34]

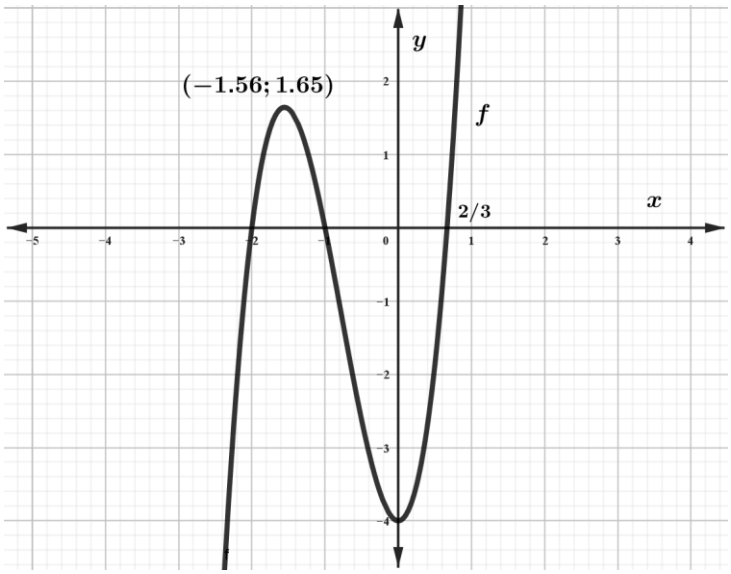
QUESTION/*VRAAG* 5			**CL/*DV***
5.1.1	$A = P(1+i)^n$ $A = 150\,000\left(1 + \frac{0.18}{12}\right)^{2\times12}$ $A = \text{R}214\,425{,}42$	✓ Formula/*Formule* **A** ✓ SF A ✓$i = \frac{0.18}{12}$ **A** ✓ Answer/*Antwoord* **CA** **NPR** (4)	2E
5.1.2	$i = \left(1 + \frac{i}{m}\right)^m - 1$ $i = \left(1 + \frac{0{,}18}{12}\right)^{12} - 1$ $i = 0{,}1956$ $r = 19{,}56\%$	✓ F **A** ✓ SF **A** ✓ 19,56% **CA** **NPR** (3)	2E
5.2	$A = P(1-in)$ $A = 100\,000(1 - 0{,}02 \times 10)$ $A = \text{R}80\,000$	✓ **F** **A** ✓ **SF** **A** ✓ Answer/*Antwoord* **CA** **NPR** (3)	2M

5.3	$A = 6\,000\left(1+\frac{0{,}096}{4}\right)^{2\times4}$ $A = \text{R}7253{,}554918$ $A = 7253{,}554918\left(1+\frac{0{,}106}{2}\right)^{4\times2}$ $A = \text{R}10\,964{,}22$	✓ SF **A** ✓ $i = \frac{0{,}096}{4}$ **A** ✓ SF **CA** ✓ $\frac{0{,}106}{2}$ **A** ✓ $R10\,964{,}22$ **CA** **NPR** (5)	2D
			[15]

QUESTION/*VRAAG* 6			**CL/*DV***
6.1	$f(x) = -3x + 5$ $f(x+h) = -3(x+h) + 5$ $= -3x - 3h + 5$ $f'(x) = \lim_{h\to0}\frac{f(x+h)-f(x)}{h}$ $f'(x) = \lim_{h\to0}\frac{-3x-3h+5-(-3x+5)}{h}$ $= \lim_{h\to0}\frac{-3x-3h+5+3x-5}{h}$ $= \lim_{h\to0}\frac{-3h}{h}$ $= -3$	✓ Definition/ *Definisie* **A** ✓ SF **CA** ✓ S **CA** ✓ Answer/ *Antwoord* **CA** AO: $\frac{0}{4}$ (4)	2D
6.2.1	$f(x) = 4\sqrt{x} + 2(3x^{-3})^0$ $f(x) = 4x^{\frac{1}{2}} + 2$ $f'(x) = 2\,x^{-\frac{1}{2}}$ **or/*of*** $2\frac{1}{\sqrt{x}}$ **or/*of*** $\frac{2}{\sqrt{x}}$	✓ $4x^{\frac{1}{2}}$ **A** ✓ 2 **A** ✓Answer/*Antwoord* **CA** (3)	2D
6.2.2	$D_x[\frac{(x+2)^2}{x}]$ $= D_x[\frac{x^2+4x+4}{x}]$ $= D_x[\frac{x^2}{x} + \frac{4x}{x} + \frac{4}{x}]$ $= D_x[x + 4 + 4x^{-1}]$ $= 1 - 4x^{-2}$ or/of $= 1 - \frac{4}{x^2}$	✓ **S** **A** ✓ 1 **CA** ✓ $-4x^{-2}$ **CA** (3)	3M

6.2.3	$\frac{d}{dx}(7x^3 + 3\pi^2 - x^{-4})$ $= 21x^2 + 4x^{-5}$ **or/*of*** $21x^2 + \frac{4}{x^5}$	✓ $21x^2$ **A** ✓ $4x^{-5}$ **A** (2)	3E
6.3	$g(x) = x^2 - 8x + 20$ $g'(x) = 2x - 8$ $4 = 2x - 8$ $2x = 12$ $x = 6$ $g(6) = (6)^2 - 8(6) + 20 = 8$ Point on the curve/*Punt op die kromme*: $(6\,;8)$	✓ $g'(x) = 2x - 8$ **A** ✓ $g'(x) = 4$ **A** ✓ x-value/x-*waarde* **CA** ✓ y-value/y-*waarde* **CA** (4)	2D
			[16]

QUESTION/*VRAAG* 7		**[17]**	**CL**
7.1	$(x + 1)$	✓ Answer/*Antwoord* **A** (1)	1M
7.2	$x = \frac{2}{3}$ $or/\mathbf{of}$ $x = -2$ or/of $x = -1$	✓$x = \frac{2}{3}$ **A** ✓$x = -2$ A ✓$x = -1$ **CA** (3)	1M
7.3	$(0\,;-4)$	✓ 0 **A** ✓–4 **A** (2)	1M
7.4	$f(x) = 3x^3 + 7x^2 - 4$ $f'(x) = 9x^2 + 14x$ $9x^2 + 14x = 0$ $x(9x + 14) = 0$ **OR/*OF*** $x = \frac{-(14) \pm \sqrt{(14)^2 - 4(9)(0)}}{2(9)}$ $9x + 14 = 0$ or $x = 0$ $x = -\frac{14}{9} \approx -1{,}56$ $f\left(-\frac{14}{9}\right) = 3(-\frac{14}{9})^3 + 7(-\frac{14}{9})^2 - 4 = \frac{400}{243} \approx 1{,}65$ $f(0) = 3(0)^3 + 7(0)^2 - 4 = -4$ TP $(0, -4)$ and/*en* TP $(-1{,}56;\ 1{,}65)$	✓ Derivative/*Afgeleide* **A** ✓ Equating derivative to 0/*Stel afgeleide gelyk aan 0* **A** ✓ Factors/*Faktore/SF* **CA** ✓ x-values/x-*waardes* **CA** ✓ y-values/y-*waardes* **CA** (5)	3E

7.5		✓ x-intercepts/ *x-afsnitte* **CA** ✓ y-intercept/*y-afsnit* **CA** ✓ turning points/ *draaipunte* **CA** ✓ shape/*vorm* **CA** (4)	1D
7.6	$-\frac{14}{9} < x < 0$ **or/*of*** *– 1,56 < x < 0* **OR/*OF*** $x \in (-\frac{14}{9}; 0)$ **or/*of*** $x \in$ (–1,56 ; 0)	✓ Notation/*Notasie* **CA** ✓ Critical values/ *Kritieke waardes* **CA** (2)	3E
			[17]

QUESTION/*VRAAG* 8			**CL/*DV***
8.1	$Volume = \pi r^2 h$ $864 = \pi r^2 h$ $h = \frac{864}{\pi r^2}$ or/*of* $\frac{V}{\pi r^2}$	✓ Answer/ *Antwoord* **A** (1)	2D
8.2	$SA = 2\pi r^2 + 2\pi rh$ $SA = 2\pi r^2 + \frac{2\pi r.864}{\pi r^2}$ $= 2\pi r^2 + \frac{1728}{r}$	✓**SF** **CA** ✓**S** **CA** (2)	2D
8.3	$S(r) = 1728\, r^{-1} + 2\pi r^2$ $S'(r) = -1728r^{-2} + 4\pi r$ $-1728r^{-2} + 4\pi r = 0$ at minimum/*ten minste* $-\frac{1728}{r^2} = -4\pi r$ $1728 = 4\pi r^3$ $r^3 = \frac{1728}{4\pi}$ $r = \sqrt[3]{\frac{432}{\pi}}$ **or/*of*** 5,16	✓ Standard form/ *Standaardvorm* **CA** ✓ Derivative/ *Afgeleide* **CA** ✓ Equating derivative to 0/*Stel afgeleide gelyk aan 0* **A** ✓ S **CA** ✓r value/*waarde* **CA** (5)	4E
			[8]

QUESTION/*VRAAG* 9			**CL/*DV***
Do not penalise if C is omitted in question 9.1.2 and 9.2.1./*Moet nie penaliseer indien C weggelaat word by vraag 9.1.2 en 9.2.1 nie.*			
9.1.1	$\int dx$ $= x + C$	✓ x **A** ✓C **A** (2)	1E
9.1.2	$\int \left[x\left(x+\frac{2}{x}\right)+\frac{3}{x}\right]dx$ $= \int \left[x^2+2+\frac{3}{x}\right]dx$ $= \frac{x^3}{3}+2x+3lnx+C$	✓S **A** ✓ $\frac{x^3}{3}$ **CA** ✓ $2x$ **CA** ✓$3lnx+C$ **A** (4)	4E
9.2.1	$\int(-x^3)dx$ $= -\frac{1}{4}x^4+C$	✓$-\frac{1}{4}x^4+C$ **A** (1)	2E
9.2.2	$\int_{-2}^{0}(-x^3)dx$ $A_1 = \left[-\frac{1}{4}x^4\right]_{-2}^{0}$ $= \left[-\left(\frac{1}{4}\right)\times 0^4\right]-\left[-\left(\frac{1}{4}\right)\times(-2)^4\right]$ $= [0]-[-4]$ $= 4$ units/*eenhede²* $A_2 = -\left[-\frac{1}{4}x^4\right]_0^2$ $= -\left[-\left(\frac{1}{4}\right)\times 2^4\right]-\left[-\left(\frac{1}{4}\right)\times(0)^4\right]$ $= -[(-4)-0]$ $= 4\,units^2/eenhede^2$ $A_{total/totaal} = 4+4 = 8\,units^2/eenhede^2$	✓ Area notation using integrals/*Area-notasie met gebruik van integrale* **A** ✓ **SF** **CA** ✓A_1 value/*waarde* **CA** ✓ **SF** **CA** ✓A_2 value/*waarde* **CA** ✓ M **CA** ✓ Answer/ *Antwoord* **CA** (7)	3E
			[14]

TOTAL/*TOTAAL:* 150