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PREPARATORY EXAMINATIONS *VOORBEREIDENDE EKSAMEN* 2024

MARKING GUIDELINES/ *NASIENRIGLYNE*

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

14 pages/*bladsye*

MARKING CODES/ <i>NASIENKODES</i>	
A	Accuracy/ <i>Akkuraatheid</i>
CA	Consistent accuracy/ <i>Volgehoue akkuraatheid</i>
M	Method/ <i>Metode</i>
R	Rounding/ <i>Afronding</i>
NPR	No penalty for rounding/ <i>Geen penalisering vir afronding nie</i>
NPU	No penalty for units omitted/ <i>Geen penalisering vir eenhede weggelaat nie</i>
S	Simplification/ <i>Vereenvoudiging</i>
F	Formula/ <i>Formule</i>
SF	Substitution in correct formula/ <i>Vervanging in korrekte formule</i>
AO	Answer only/ <i>Slegs antwoord</i>

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 $x = 5$	$\checkmark x = -2$ $\checkmark x = 5$ OR/OF $\checkmark x = -2$ $\checkmark x = 5$	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 $x = -0,92$	$\checkmark$ Standard form/ <i>Standaardvorm</i> $\checkmark$ SF $\checkmark x = 2,17$ or/of $x = -0,92$	A CA CA (3)	1D
			AO = Full marks/volpunte PR		

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/ <i>Faktore</i> A ✓ End points/ <i>Eindpunte</i> CA ✓ Notation/ <i>Notasie</i> A (3) AO = Full marks/volpunte	2M
1.2		$x + 2y = 3$ ① and/en $3x^2 + 4xy + 2y^2 = 9$ ② From/ <i>Van</i> ① $x = 3 - 2y$ ③ Substitute/ <i>Vervang</i> 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 $x = 1$ OR/OF From/ <i>Van</i> ① $y = \frac{3}{2} - \frac{x}{2}$ ③ Substitute/ <i>Vervang</i> 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 $y = 1$	✓ $x = 3 - 2y$ 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) 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)	3E

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

QUESTION/VRAAG 2				[6]	CL
2.1	2.1.1	$x = 0$	$\checkmark x = 0$	A (1)	1E
	2.1.2	$25 - 2x \geq 0$ $-2x \geq -25$ $x \leq 12,5$	$\checkmark 25 - 2x \geq 0$ $\checkmark x \leq 12,5$	A 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/ <i>Reël, Irrasionaal en ongelyk</i>		$\checkmark$ SF $\checkmark$ Answer/ <i>Antwoord</i> $\checkmark$ Real, Irrational, Unequal/ <i>Reël Irrasionaal en ongelyk</i>	A CA CA (3)	1D
					[6]

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

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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 $r = 2,24$ $\theta = \tan^{-1} \frac{b}{a}$ $\theta = \tan^{-1} \left(\frac{2}{1} \right)$ $Ref. \angle = 63,43^\circ$ $\theta = 180^\circ - 63,43^\circ$ $\theta = 116,57^\circ$ $z = \sqrt{5} \text{cis } 116,57^\circ$ or/of $z = \sqrt{5}(\cos 116,57^\circ + i \sin 116,57^\circ)$ or/of $z = \sqrt{5} \angle 116,57^\circ$	✓ SF ✓ Modulus ✓ $\theta = \tan^{-1} \left(\frac{2}{1} \right)$ ✓ $Ref. \angle = 63,43^\circ$ ✓ $\theta = 116,57^\circ$ ✓ Polar form/ <i>Polêre vorm</i>	A CA A CA CA CA	2D
(6)					
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 ✓ $i^2 = -1$ ✓ $x = 7$ ✓ $y = 4$	A A CA CA	2M
(4)					
					[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 $x = 0$ $g(x) = \frac{-4}{x} - 3$ $y = \frac{-4}{0} - 3$ $x \neq 0$ $\therefore$ 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 $g(x)$ intercepts/touches the y-axis, the mark for the shape may not be awarded. <i>As $g(x)$ die y-as raak/sny, mag die punt vir die vorm nie toegeken word nie.</i>	✓ 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	$x + 1 = \frac{-4}{x} - 3$ $x^2 + x = -4 - 3x$ $x^2 + 4x + 4 = 0$ $(x + 2)(x + 2) = 0 \quad \text{or/of} \quad (x + 2)^2 = 0$ $x = -2$	✓ $x^2 + x = -4 - 3x$ 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 intersect at only one point. <i>Ja, die grafieke van f en g sny slegs by een punt.</i>	✓ ST From/van 4.1.4 CA ✓ R From/van 4.1.4 CA (2)	4E	

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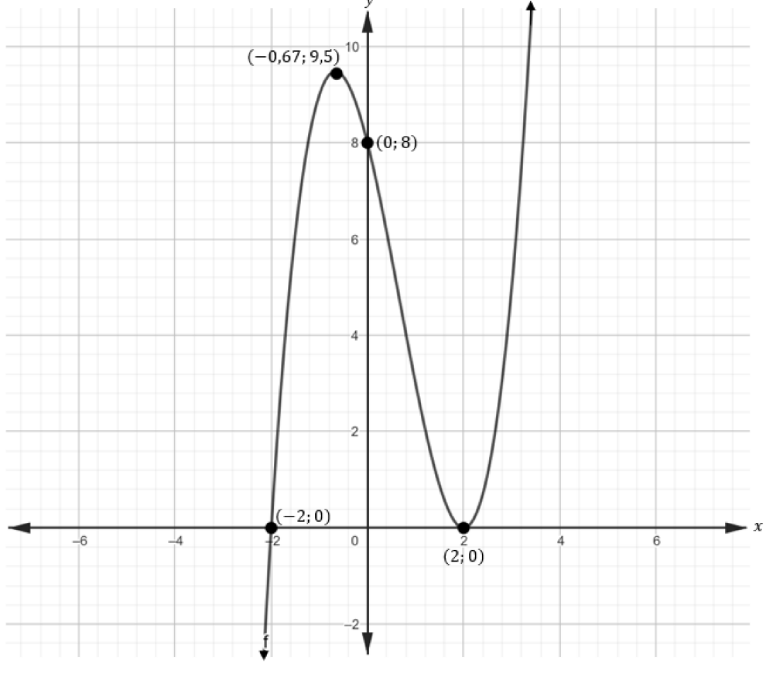
4.2	4.2.1	$0 = -x^2 - 4x + 5$ $0 = x^2 + 4x - 5$ $0 = (x - 1)(x + 5)$ $x = 1$ or/of $x = -5$ $E(-5; 0)$ and/en $P(1; 0)$	$\checkmark 0 = -x^2 - 4x + 5$ M $\checkmark$ Factors/ <i>Faktore</i> CA $\checkmark$ Both/ <i>Beide</i> x CA $\checkmark E(-5; 0)$ CA $\checkmark P(1; 0)$ CA (5)	2M
	4.2.2	$M(0; 5)$	$\checkmark x = 0$ A $\checkmark y = 5$ 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 $f'(x) = -2x - 4$ $0 = -2x - 4$ $2x = -4$ $x = -2$ $\checkmark M$ A $\checkmark$ SF A $\checkmark x = -2$ CA $\checkmark y = 9$ CA (4) AO = Full marks/volpunte	2E
	4.2.4	$c = 5$ $m = \frac{5-0}{0-(-5)}$ $m = 1$ $g(x) = x + 5$	$\checkmark c = 5$ A $\checkmark m = 1$ 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/ <i>eenhede</i>	$\checkmark M$ A $\checkmark -2 + 5$ CA $\checkmark 6$ CA (3)	2E
	4.2.6	$x \in (-5; 0)$ OR/OF $-5 < x < 0$	$\checkmark$ Notation/ <i>Notasie</i> A $\checkmark$ Endpoints/ <i>Eindpunte</i> 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	$150\,000 = 500\,000 \left(1 - \frac{12}{100}\right)^n$ $\frac{150\,000}{500\,000} = (0,88)^n$ $n = \log_{0,88}(0,3)$ $n = 9,418298 \dots$ $n = 10 \text{ years/jaar}$	✓ SF ✓ S ✓ M ✓ 10 ACCEPT/AANVAAR $n = 9,41$	A CA A CA (4)	3E
5.3	$A_1 = 182\,000 \left(1 + \frac{0,072}{2}\right)^{2 \times 2}$ $A_1 = 209\,657,5033$ $P_2 = 209\,657,5033 + 50\,000$ $P_2 = 259\,657,5033$ $A_2 = 259\,657,5033 \left(1 + \frac{0,072}{2}\right)^{2 \times 1}$ $A_2 = 278\,689,3597$ $P_3 = 278\,689,3597 - 30\,000$ $P_3 = 248\,689,3597$ $A_3 = 248\,689,3597 \left(1 + \frac{\frac{7}{100}}{4}\right)^{2 \times 4}$ $A_3 = R\,285\,714,68$ No, he will not have enough money. <i>Nee, hy sal nie genoeg geld hê nie.</i>	✓ SF ✓ 209 657,5033 ✓ + R50 000 ✓ $\left(1 + \frac{0,072}{2}\right)^{2 \times 1}$ ✓ -R30 000 ✓ R 285 714,68 ✓ RE	A CA A A A CA CA (7)	2D
				[14]

QUESTION/VRAAG 6			[19]	CL
6.1	$f(x) = -x - 6$ $f(x + h) = -(x + h) - 6$ $f(x + h) = -x - h - 6$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x + h) - f(x)}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{-x - h - 6 - (-x - 6)}{h}$ $= \lim_{h \rightarrow 0} \frac{-x - h - 6 + x + 6}{h}$ $= \lim_{h \rightarrow 0} \frac{-h}{h}$ $= -1$		✓ 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	$f(x) = x^2 - 1$ $f(2) = (2)^2 - 1 = 4 - 1 = 3 \quad (2; 3)$ $f(6) = (6)^2 - 1 = 36 - 1 = 35 \quad (6; 35)$ $M_{\text{ave/gem}} = \frac{f(6) - f(2)}{6 - 2}$ $= \frac{35 - 3}{6 - 2}$ $= \frac{32}{4}$ $= 8$		✓ y-values/waardes A ✓ SF CA ✓ 8 CA (3)	2D

6.4	$g(x) = 5x^2 - 3x$ $g(1) = 5(1)^2 - 3(1) = 5 - 3 = 2 \quad (1; 2)$ $g'(x) = 10x - 3$ $g'(1) = 10(1) - 3 = 10 - 3 = 7$ $y - 2 = 7(x - 1)$ $y - 2 = 7x - 7$ $y = 7x - 5$	$\checkmark y = 2 \quad A$ $\checkmark g'(x) \quad A$ $\checkmark m = 7 \quad CA$ $\checkmark SF \quad CA$ $\checkmark \text{Equation/Vergelyking} \quad CA$ (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	$\checkmark f(2) = 0$ 		

7.4	$f(x) = x^3 - 2x^2 - 4x + 8$ $f'(x) = 3x^2 - 4x - 4$ $3x^2 - 4x - 4 = 0$ $(3x + 2)(x - 2) = 0$ $x = -\frac{2}{3} \text{ or/of } x = 2$ $f\left(-\frac{2}{3}\right) = \left(-\frac{2}{3}\right)^3 - 2\left(-\frac{2}{3}\right)^2 - 4\left(-\frac{2}{3}\right) + 8$ $f\left(-\frac{2}{3}\right) = \frac{256}{27} \text{ or/of } 9,48$ $f(2) = (2)^3 - 2(2)^2 - 4(2) + 8$ $f(2) = 0$ $(2; 0) \text{ \& } \left(-\frac{2}{3}; \frac{256}{27}\right) \text{ or/of } (-0,67; 9,48)$	✓ $f'(x)$ 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/ <i>Lengte</i> = $54 - x - 4 = 50 - x$ Breadth/ <i>Breedte</i> = $x - 4$	$\checkmark 50 - x$ $\checkmark x - 4$	A A (2)	3E
8.2	Area = length x breadth/ <i>Oppervlakte = lengte x breedte</i> $= (x - 4)(50 - x)$ $= 50x - x^2 - 200 + 4x$ $= -x^2 + 54x - 200$	$\checkmark F$ $\checkmark SF \text{ from/van } 8.1$	A CA (2)	2E
8.3	$\frac{dA}{dx} = -2x + 54$ $-2x + 54 = 0$ $\therefore -2x = -54$ $\therefore x = 27$ Area = $-(27)^2 + 54(27) - 200$ $= 529 \text{ cm}^2$	$\checkmark -2x + 54$ $\checkmark -2x + 54 = 0$ $\checkmark x = 27$ $\checkmark 529 \text{ cm}^2$	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	$4 \int \left(\frac{1}{x} - 3^{2x} - 2 \right) dx$ $= \int \left(\frac{4}{x} - 4 \cdot 3^{2x} - 8 \right) dx$ $= 4 \ln x - \frac{4 \cdot 3^{2x}}{2 \ln 3} - 8x + c$ $= 4 \ln x - \frac{2 \cdot 3^{2x}}{\ln 3} - 8x + c$ OR/OF $4 \int \left(\frac{1}{x} - 3^{2x} - 2 \right) dx$ $= 4 \left(\ln x - \frac{3^{2x}}{2 \ln 3} - 2x + c \right)$ $= 4 \ln x - \frac{4 \cdot 3^{2x}}{2 \ln 3} - 8x + c$ $= 4 \ln x - \frac{2 \cdot 3^{2x}}{\ln 3} - 8x + c$	$\checkmark \frac{4}{x} - 4 \cdot 3^{2x} - 8$ $\checkmark 4 \ln x - \frac{4 \cdot 3^{2x}}{2 \ln 3}$ $\checkmark -8x + c$ (3) OR/OF $\checkmark \ln x - \frac{3^{2x}}{2 \ln 3}$ $\checkmark -2x + c$ $\checkmark 4 \ln x - \frac{4 \cdot 3^{2x}}{2 \ln 3} - 8x + C$ A	A CA CA (3) CA CA A	3E
	9.1.2	$\int (1 - 2x)^2 dx$ $= \int (1 - 4x + 4x^2) dx$ $= x - 2x^2 + \frac{4}{3}x^3 + c$	$\checkmark 1 - 4x + 4x^2$ $\checkmark x$ $\checkmark -2x^2$ $\checkmark \frac{4}{3}x^3 + c$ (4)	A CA CA CA	4E

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9.2	9.2.1	$\int (-x^2 + 3)dx$ $= -\frac{1}{3}x^3 + 3x + c$	$\checkmark -\frac{1}{3}x^3$ A $\checkmark 3x + c$ A (2)	2M
	9.2.2	$A = \int_{-1}^1 (-x^2 + 3)dx$ $A = \left[-\frac{1}{3}x^3 + 3x\right]_{-1}^1$ $A = \left[-\frac{1}{3}(1)^3 + 3(1)\right] - \left[-\frac{1}{3}(-1)^3 + 3(-1)\right]$ $A = \frac{8}{3} - \left(-\frac{8}{3}\right)$ $A = \frac{16}{3} \text{ or/of } A = 5\frac{1}{3} \text{ or/of } A = 5,33 \text{ unit}^2/\text{eenheid}^2$	$\checkmark$ Area notation using integrals/ <i>Area notasie deur integrale te gebruik</i> A $\checkmark$ SF $x = 1$ CA $\checkmark$ SF $x = -1$ CA $\checkmark \frac{16}{3}$ 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