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GRADE/GRAAD 12

JUNE/JUNIE 2024

**TECHNICAL MATHEMATICS P1/TEGNIESE WISKUNDE V1
MARKING GUIDELINE/NASIENRIGLYN**

MARKS/PUNTE: 150

MARKING CODES/NASIENKODES	
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>
SF	Substitution in correct formula/ <i>Vervanging in korrekte formule</i>
AO	Answer Only/ <i>Antwoord alleenlik</i>

This marking guideline consists of 15 pages. /
Hierdie nasienriglyn bestaan uit 15 bladsye.



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NOTE:

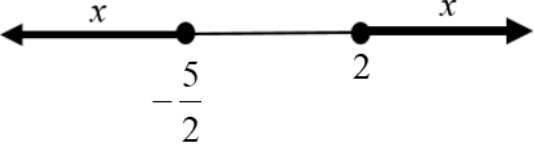
- If a candidate answers a question TWICE, only mark the FIRST attempt.
- If a candidate has crossed out an attempt of a question and not redone the question, mark the crossed-out version.
- Consistent accuracy (CA) applies to ALL aspects of the marking guideline.
- Assuming answers/values to solve a problem is NOT acceptable.

LET WEL:

- Indien 'n kandidaat 'n vraag TWEE keer beantwoord, sien slegs die EERSTE poging na.
- Indien 'n kandidaat 'n poging kanselleer en die vraag nie oor probeer nie, merk die gekanselleerde poging.
- Volgehoue akkuraatheid (CA) is van toepassing op ALLE aspekte van die nasienriglyn.
- Die aanvaarding van antwoorde/waardes om 'n probleem op te los is NIE aanvaarbaar NIE.

QUESTION/VRAAG 1			
1.1	1.1.1	$3x - \frac{x^2}{4} = 0$ $x\left(3 - \frac{x}{4}\right) = 0 \quad \text{OR / OF} \quad x = \frac{-(3) \pm \sqrt{(3)^2 - 0}}{2\left(-\frac{1}{4}\right)}$ $x = 0 \text{ or/of } 3 - \frac{x}{4} = 0$ $x = 0 \text{ or/of } x = 12$ <p style="text-align: center;">OR/OF</p> $3x - \frac{x^2}{4} = 0$ $12x - x^2 = 0$ $x(12 - x) = 0$ $x = 0 \text{ or/of } x = 12$	<p>✓ Factors / Substitution Faktore / Vervanging A</p> <p>✓ $x = 0$ CA ✓ $x = 12$ CA</p> <p style="text-align: right;">(3)</p>
	1.1.2	$x(x - 3) = 13$ $x^2 - 3x - 13 = 0$ $x = \frac{-(-3) \pm \sqrt{(-3)^2 - 4(1)(-13)}}{2(1)}$ $\therefore x = 5,41 \text{ or/of } x = -2,41$	<p>✓ Standard Form / Standaardvorm A ✓ SF CA</p> <p>✓ $x = 5,41$ CA ✓ $x = -2,41$ CA</p> <p style="text-align: right;">(4)</p>



	<p>1.1.3 $-2x^2 - x + 10 \leq 0$ CVs/KWs: $-2x^2 + 4x - 5x + 10 = 0$ $-2x(x-2) - 5(x-2) = 0$ $(-2x-5)(x-2) = 0$ OR / OF CVs/KWs: $\frac{-(-1) \pm \sqrt{(-1)^2 - 4(-2)(10)}}{2(-2)}$ CVs/KWs: $-\frac{5}{2}$ and/en 2 $\therefore x \leq -\frac{5}{2}$ or/of $x \geq 2$</p> 	<p>✓ Factors / Substitution Faktore / Vervanging A</p> <p>✓ Critical values / Kritiese waardes CA ✓ Notation / Notasie A</p> <p>✓ Correct number line / Korrekte getallelyn CA</p> <p>(4)</p>
<p>1.2</p>	<p>$y - x = 2$ and/en $\frac{x^2}{y} = 1$ $y = x + 2$.....(3) $\frac{x^2}{x+2} = 1$ $x^2 = x + 2$ $x^2 - x - 2 = 0$ $(x-2)(x+1) = 0$ or/of $x = \frac{-(-1) \pm \sqrt{(-1)^2 - 4(1)(-2)}}{2(1)}$ $x = 2$ or/of $x = -1$ $y = 2 + 2$ or/of $y = -1 + 2$ $\therefore y = 4$ or/of $y = 1$</p> <p style="text-align: center;">OR/OF</p>	<p>✓ y subject / onderwerp A</p> <p>✓ Simplification / Vereenvoudiging CA ✓ Standard form / Standaardvorm CA ✓ Factors/Substitution / Faktore / Vervanging CA ✓ x-values / waardes CA ✓ y-values CA</p> <p style="text-align: center;">OR/OF</p>



	$x = y - 2$ $\frac{(y-2)^2}{y} = 1$ $y^2 - 4y + 4 = y$ $y^2 - 5y + 4 = 0$ $(y-4)(y-1) = 0$ OR / OF $y = \frac{-(-5) \pm \sqrt{(-5)^2 - 4(1)(4)}}{2(1)}$ $y = 4$ or/of $y = 1$ $x = 4 - 2$ or/of $x = 1 - 2$ $\therefore x = 2$ or/of $x = -1$	\checkmark x subject / onderwerp A \checkmark Simplification / Vereenvoudiging CA \checkmark Standard form / Standaardvorm CA \checkmark Factors/Substitution / Faktore/ Vervanging CA \checkmark y-values /waardes CA \checkmark x-values / waardes CA (6)	
1.3	1.3.1	$P = I^2 R$ $I^2 = \frac{P}{R}$ $I = \sqrt{\frac{P}{R}}$	\checkmark I^2 the subject / die onderwerp A \checkmark Square root both sides / Vierkantwortel beide kante CA (2)
	1.3.2	$P = I^2 R$ $I = \sqrt{\frac{5}{20}}$ $I = 0,5A$ $5 = I^2 20$ $I = \sqrt{\frac{5}{20}}$ $I = 0,5A$	\checkmark Substitution / Vervanging CA \checkmark $I = 0,5$ CA <div style="border: 1px solid black; padding: 2px; display: inline-block;">AO: Full Marks / Volpunte</div> \checkmark Substitution / Vervanging CA \checkmark Answer / Antwoord CA (2)
	1.3.3	$I = 5 \times 10^{-1} A$	\checkmark Answer / Antwoord CA (1)



1.4	$A = 1010100_2 - 111011_2$ $A = 84 - 59$ $A = 25$	✓ 84 ✓ 59 ✓ 25	A A CA
	OR / OF	OR / OF	
	$ \begin{array}{r} A = 1010100_2 \\ -111011_2 \\ \hline 011001_2 \\ \\ 11001_2 = 25 \end{array} $	✓ Method / <i>Metode</i> ✓ 11001_2 ✓ 25	A A CA
			(3)
			[25]



QUESTION/VRAAG 2				
2.1	2.1.1	$x = 0$	$\checkmark x = 0$	A (1)
	2.1.2	$1 - x^2 = 0$ $1 = x^2$ $x = \pm 1$ OR / OF $1 - x^2 = 0$ $(1 - x)(1 + x) = 0$ $\therefore x = \pm 1$	$\checkmark 1 - x^2 = 0$ \checkmark Simplification/ <i>Vereenvoudiging</i> $\checkmark x = \pm 1$	A A CA (3)
2.2		$9x^2 - 12kx + 4k^2 = 0$ $\Delta = b^2 - 4ac$ $= (-12k)^2 - 4(9)(4k^2)$ $= 144k^2 - 144k^2$ $\Delta = 0$ Δ will always be 0 for all the values of k and so roots will always be equal. Δ sal altyd 0 wees vir al die waardes van k en dus sal die wortels altyd gelyk wees.	\checkmark SF \checkmark Simplification / <i>Vereenvoudiging</i> CA $\checkmark \Delta = 0$ \checkmark Conclusion/ <i>Gevolgtrekking</i>	A A CA (4)
				[8]



QUESTION/VRAAG 3			
3.1	3.1.1	$\log_x x + \log_y 1$ $= 1 + 0$ $= 1$	✓ Log property/eienskap A ✓ Log property/eienskap A (2)
	3.1.2	$\frac{\sqrt{18} - \sqrt{128}}{5\sqrt{2}}$ $= \frac{\sqrt{3^2 \times 2} - \sqrt{2^7}}{5\sqrt{2}}$ OR / OF $\frac{\sqrt{9 \times 2} - \sqrt{64 \times 2}}{5\sqrt{2}}$ $= \frac{3\sqrt{2} - 2^3\sqrt{2}}{5\sqrt{2}}$ $= \frac{3\sqrt{2} - 8\sqrt{2}}{5\sqrt{2}}$ OR / OF $\frac{\sqrt{2}(3-8)}{5\sqrt{2}}$ $= \frac{-5\sqrt{2}}{5\sqrt{2}}$ $= -1$	✓ Prime factors / Square factors / Priemfaktore / Vierkant faktore A ✓ Simplification / Vereenvoudiging CA ✓ -1 CA (3)
3.2		$7^{x-1} - 7^x = -\frac{2}{9}$ $7^x \left(\frac{1}{7} - 1 \right) = -\frac{2}{9}$ $7^x \left(-\frac{6}{7} \right) = -\frac{2}{9}$ $7^x = -\frac{2}{9} \times -\frac{7}{6}$ $7^x = \frac{7}{27}$ $x = \log_7 \left(\frac{7}{27} \right)$ $x = \log_7 7 - \log_7 27$ $x = 1 - 1,69$ $x = -0,69$	✓ Common factor / Gemene faktor A ✓ Simplification / Vereenvoudiging CA ✓ 7^x subject / onderwerp CA ✓ Logarithm/ Logaritme A ✓ Log Property / eienskap CA ✓ Substitution / Vervanging CA ✓ Correct value of x / Korrekte waarde van x CA (7)



3.3	3.3.1	$ z = \sqrt{2}$	$\checkmark \sqrt{2}$	A (1)
	3.3.2	$k = -1$ and/ en $m = -1$	$\checkmark k = -1$	A
			$\checkmark m = -1$	A (2)
3.3.3	$z = -1 - i$	$\checkmark z = -1 - i$	CA (1)	
3.4	$x = 0$ and/ en $y = 0$	$\checkmark x = 0$	A	
		$\checkmark y = 0$	A (2)	
				[18]



QUESTION/VRAAG 4				
4.1	4.1.1	$y = 1$	$\checkmark y = 1$	A (1)
	4.1.2	$f(0) = 3^0 + 1$ $f(0) = 2$ <div style="border: 1px solid black; padding: 5px; display: inline-block; margin: 5px 0;">AO: 2 MARKS/ PUNTE</div>	$\checkmark x = 0$ $\checkmark y = 2$	A CA (2)
	4.1.3	y -int. $y = 2$ x -int. $0 = 3x + 2$ $3x = -2$ $x = -\frac{2}{3}$	$\checkmark y = 2$ $\checkmark y = 0$ $\checkmark x = -\frac{2}{3}$	A A CA (3)
	4.1.4		f : \checkmark Shape/ <i>Vorm</i> A \checkmark y -intercept / <i>afsnit</i> CA \checkmark Asymptote / <i>Asimptoot</i> CA g : \checkmark Shape / <i>Vorm</i> A \checkmark y -intercepts/ <i>afsnitte</i> A \checkmark x -intercepts / <i>afsnitte</i> CA	(6)
	4.1.5	$3x + 2 = 1$ $x = -\frac{1}{3}$	$\checkmark y = 1$ $\checkmark x = -\frac{1}{3}$	A CA (2)
	4.1.6	$x \in (-\infty; -\frac{1}{3})$ OR/OF $x < -\frac{1}{3}$	\checkmark Critical values \checkmark Notation	A A (2)



4.2	4.2.1	$y = -2$	$\checkmark y = -2$	A (1)
	4.2.2	$q = -2$	$\checkmark q = -2$	A (1)
	4.2.3	$0 = \frac{1}{x} - 2$ $\therefore x = \frac{1}{2}$	$\checkmark y = 0$ $\checkmark x = \frac{1}{2}$	A CA (2)
	4.2.4	$-\infty < x < 0$ or/of $0 < x < \infty$ OR / OF $x \in (-\infty; 0)$ or/of $x \in (0; \infty)$ OR $x \in \mathbb{R}$ but/maar $x \neq 0$	\checkmark Domain / def versameling	A (1)
	4.2.5	$x - 2 = \frac{1}{x} - 2$ $x^2 = 1$ $x = \pm 1$ $y = 1 - 2$ or/of $y = -1 - 2$ $y = -1$ or/of $y = -3$	\checkmark Equating / Gelykstel \checkmark Simplification / Vereenvoudiging \checkmark Both x values / Beide x -waardes \checkmark Both y values / Beide y -waardes	A CA CA CA (4)
4.3	4.3.1	$y = -1$	$\checkmark y = -1$	A (1)
	4.3.2	$p = 1$ and/en $q = -5$	$\checkmark p = 1$ $\checkmark q = -5$	A A (2)
	4.3.3	$y = 0$ and/en $\frac{x_B - 4}{2} = -1$ $x_B - 4 = -2$ $x_B = 2$ OR/OF $x_B - (-1) = -1 - (-4)$ $x_B - (-1) = 3 - 1$ $x_B = 2$	$\checkmark y = 0$ $\checkmark x = 2$ OR/OF \checkmark Equation / Vergelyking $\checkmark x = 2$	A A A AO: FULL MARKS / VOLPUNTE (2)
	4.3.4	$-4 < x < -1$ or/of $x > 2$ OR/OF $x \in (-4; -1)$ or/of $x \in (2; \infty)$ OR/OF $x > -4$ and/en $x < -1$ or/of $x > 2$	\checkmark Critical values / Kritiese waardes \checkmark Notation / Notasie $\checkmark x > 2$	 (3)
				[33]

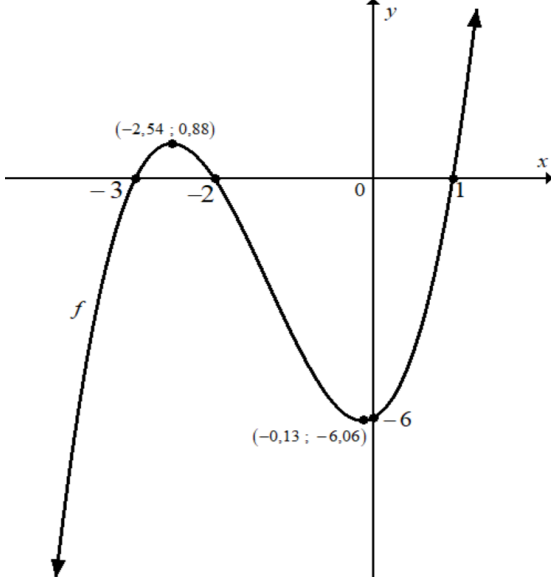


QUESTION/ VRAAG 5			
5.1.1	11% of R7 300 = R803	✓ Answer / Antwoord	A (1)
5.1.2	Discounted/Afslag Stamper = R7 300 – R803 Discounted/ Afslag Stamper = R6 497	✓ M ✓ Answer / Antwoord	CA CA (2)
5.2	$A = P(1+i)^n$ $60 = 2(1+0,05)^n$ $30 = 1,05^n$ $n = \log_{1,05} 30$ $n = 69,71 \text{ years / jare}$	✓ F ✓ SF ✓ Simplification / vereenvoudiging CA ✓ Logarithm / Logaritme ✓ $n = 69,71$	A A CA A CA (5)
5.3	$880\,000 = (500\,000(1+0,07 \times 5) + 77\,000) \left(1 + \frac{x\%}{12}\right)^{3 \times 12}$ $\frac{880\,000}{(500\,000(1+0,07 \times 5) + 77\,000)} = \left(1 + \frac{x\%}{12}\right)^{36}$ $\left(\frac{880\,000}{(500\,000(1+0,07 \times 5) + 77\,000)}\right)^{\frac{1}{36}} - 1 = \frac{x\%}{12}$ $12 \times 100 \left[\left(\frac{880\,000}{(500\,000(1+0,07 \times 5) + 77\,000)}\right)^{\frac{1}{36}} - 1 \right] = x$ $x = 5,25\%$ <p style="text-align: center;">OR/OF</p> $A_{500\,000} = 500\,000(1+0,07 \times 5) \left(1 + \frac{x\%}{12}\right)^{3 \times 12}$ $A_{77\,000} = 77\,000 \left(1 + \frac{x\%}{12}\right)^{3 \times 12}$ $880\,000 = A_{500\,000} + A_{77\,000}$ $\left(\frac{880\,000}{(500\,000(1+0,07 \times 5) + 77\,000)}\right)^{\frac{1}{36}} - 1 = \frac{x\%}{12}$ $12 \times 100 \left[\left(\frac{880\,000}{(500\,000(1+0,07 \times 5) + 77\,000)}\right)^{\frac{1}{36}} - 1 \right] = x$ $x = 5,25\%$	✓ R880 000 A ✓ 500 000(1+0,07 × 5) A ✓ +77 000 A ✓ $\left(1 + \frac{x\%}{12}\right)^{3 \times 12}$ A ✓ Simplification / vereenvoudiging CA ✓ $x = 5,25\%$ CA <p style="text-align: center;">OR / OF</p> ✓ 500 000(1+0,07 × 5) A ✓ $\left(1 + \frac{x\%}{12}\right)^{3 \times 12}$ A ✓ 77 000 $\left(1 + \frac{x\%}{12}\right)^{3 \times 12}$ A ✓ 880 000 A ✓ Simplification / vereenvoudiging CA ✓ $x = 5,25\%$ CA (6)	
			[14]



QUESTION/VRAAG 6		
6.1	$f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{3a(x+h) + 5 - (3ax + 5)}{h}$ $= \lim_{h \rightarrow 0} \frac{3ax + 3ah + 5 - 3ax - 5}{h}$ $= \lim_{h \rightarrow 0} \frac{3ah}{h}$ $f'(x) = 3a$	<p>✓ Definition / <i>Definisie</i> A</p> <p>✓ Substitution / <i>Vervanging</i> CA</p> <p>✓ Simplification / <i>Vereenvoudiging</i> CA</p> <p>✓ Simplification / <i>Vereenvoudiging</i> CA</p> <p>✓ $f'(x) = 3a$ CA</p> <p style="text-align: right;">(5)</p>
6.2	<p>6.2.1</p> <p>$\frac{dy}{dx}$ if / as $xy = \sqrt{x}$</p> $y = \frac{\sqrt{x}}{x}$ $y = \frac{x^{\frac{1}{2}}}{x}$ $y = x^{-\frac{1}{2}}$ $\frac{dy}{dx} = -\frac{1}{2}x^{-\frac{3}{2}} \quad \text{OR / OF} \quad \frac{dy}{dx} = -\frac{1}{2\sqrt{x^3}}$	<p>✓ y subject / <i>onderwerp</i> A</p> <p>✓ Exponential form / <i>Eksponensiële vorm</i> A</p> <p>✓ Simplification / <i>Vereenvoudiging</i> CA</p> <p>✓ $-\frac{1}{2}x^{-\frac{3}{2}} \quad \text{OR / OF} \quad -\frac{1}{2\sqrt{x^3}}$ CA</p> <p style="text-align: right;">(4)</p>
	<p>6.2.2</p> $D_x \left[\frac{3}{2x} \right]$ $= D_x \left[\frac{3x^{-1}}{2} \right]$ $= -\frac{3x^{-2}}{2} \quad \text{OR / OF} \quad -\frac{3}{2x^2}$	<p>✓ Simplification / <i>Vereenvoudiging</i> A</p> <p>✓ $-\frac{3x^{-2}}{2} \quad \text{OR / OF} \quad -\frac{3}{2x^2}$ CA</p> <p style="text-align: right;">(2)</p>
6.3	<p>Average Gradient = $\frac{y_2 - y_1}{x_2 - x_1}$</p> <p>Average Gradient/ Gemiddelde Gradiënt = $\frac{-1-5}{-2-3}$</p> <p>Average Gradient = $\frac{6}{5}$ OR / OF = 1,2</p>	<p>✓ F A</p> <p>✓ Substitution / <i>Vervanging</i> A</p> <p>✓ $\frac{6}{5}$ OR / OF = 1,2 CA</p> <p style="text-align: right;">(3)</p>
[14]		



QUESTION/VRAAG 7		
7.1	$x = 1$ or/of $x = -2$ or/of $x = -3$	✓ $x = 1$ or/of $x = -2$ or/of $x = -3$ A (1)
7.2	$y = -6$	✓ $y = -6$ A (1)
7.3	$f(x) = (x - 1)(x + 2)(x + 3)$ $f(x) = (x - 1)(x^2 + 5x + 6)$ $f(x) = x^3 + 5x^2 + 6x - x^2 - 5x - 6$ $f(x) = x^3 + 4x^2 + x - 6$ $f'(x) = 3x^2 + 8x + 1 = 0$ $x = \frac{-(-8) \pm \sqrt{(-8)^2 - 4(3)(1)}}{2(3)}$ $x = -0,13$ or/of $x = -2,54$ $y = (-0,13 - 1)(-0,13 + 2)(-0,13 + 3)$ $y = -6,06$ or/of $y = (-2,54 - 1)(-2,54 + 2)(-2,54 + 3)$ $y = 0,88$	✓ $f(x) = x^3 + 5x^2 + 6x - x^2 - 5x - 6$ A ✓ $f'(x) = 0$ CA ✓ SF CA ✓ Both x values / Beide x -waardes CA ✓ Both y values / Beide y -waardes -CA (5)
7.4		✓ Shape / Vorm A ✓ x - intercepts / afsnitte CA ✓ y - intercept / afsnit CA ✓ Turning points / Draaipunte CA (4)
7.5	$x < -3$ or/of $-2 < x < 1$	✓ $x < -3$ ✓ $-2 < x < 1$ (2)
		[13]



QUESTION/VRAAG 8			
8.1	$h_0 = 1000 \text{ m}$	$\checkmark h_0 = 1\ 000$	A (1)
8.2	$h_1 = 1000 (0,09)^1$ $h_1 = 90 \text{ m}$	$\checkmark h_1 = 90$	A (1)
8.3	$h(t) = h_0 (0,09)^t$ $8,1 = 1000(0,09)^t$ $\frac{8,1}{1000} = (0,09)^t$ $t = \log_{0,09} \left(\frac{8,1}{1000} \right)$ $t = 2\text{s}$	\checkmark Substitution / <i>Vervanging</i> \checkmark Simplification / <i>Vereenvoudiging</i> \checkmark Logarithm / <i>Logaritme</i> $\checkmark t = 2 \text{ s}$	A CA CA CA (4)
8.4	Average speed = $\frac{1000 - 8,1}{0 - 2}$ Gemiddelde spoed = 496m/s	\checkmark F \checkmark 496 m/s	A A (2)
8.5	Ave speed / <i>Gemid spoed</i> = 496m/s = 1786,6 km/h The plane is in a crisis of falling from the sky. <i>Die vliegtuig is in 'n krisis om uit die lug te val.</i>	\checkmark 1786,6 km/h \checkmark Conclusion / <i>Gevolgtrekking</i> CA	CA CA (2)
			[10]



QUESTION/VRAAG 9			
9.1	9.1.1	$\int (-3x^2 + 2x^{-1}) dx$ $= -x^3 + 2 \ln x + c$	✓ $-x^3$ A ✓ $2 \ln x$ A ✓ C A (3)
	9.1.2	$\int (x-3)(x-5) dx$ $= \int (x^2 - 8x + 15) dx$ $= \frac{x^3}{3} - 4x^2 + 15x + c$	✓ Simplification / Vereenvoudiging A ✓ $\frac{x^3}{3}$ CA ✓ $-4x^2$ CA ✓ $15x + c$ CA (4)
9.2	$A = \int_{-2}^{-1.5} \left(x^3 + 3x^2 + \frac{5}{4}x - \frac{3}{2} \right) dx + \int_0^{0.5} \left(x^3 + 3x^2 + \frac{5}{4}x - \frac{3}{2} \right) dx$ $= \left[\frac{x^4}{4} + x^3 + \frac{5}{8}x^2 - \frac{3}{2}x \right]_{-2}^{-1.5} + \left[\frac{x^4}{4} + x^3 + \frac{5}{8}x^2 - \frac{3}{2}x \right]_0^{0.5}$ $= \left(\frac{(-1,5)^4}{4} + (-1,5)^3 + \frac{5}{8}(-1,5)^2 - \frac{3}{2}(-1,5) \right)$ $- \left(\frac{(-2)^4}{4} + (-2)^3 + \frac{5}{8}(-2)^2 - \frac{3}{2}(-2) \right)$ $+ \left(\frac{(0,5)^4}{4} + (0,5)^3 + \frac{5}{8}(0,5)^2 - \frac{3}{2}(0,5) \right)$ $A = \left(\frac{99}{64} - \frac{3}{2} \right) + \frac{29}{64}$ $\therefore \text{Shaded / Arseerde Area} = \frac{1}{2}$		✓ Area Rule / Reël A ✓ Area Rule / Reël A ✓ Integral / Integraal CA ✓ Substitution / Vervanging CA ✓ Substitution / Vervanging CA ✓ Substitution / Vervanging CA ✓ Simplification / Vereenvoudiging CA ✓ Area CA (8)
			[15]
			TOTAL/TOTAAL: 150

