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Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE NASIONALE SENIOR SERTIFIKAAT

GRADE 12/GRAAD 12

TECHNICAL MATHEMATICS P1/TEGNIJSE WISKUNDE V1

NOVEMBER 2021

MARKING GUIDELINES/NASIENRIGLYNE

MARKS/PUNTE: 150

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
SF	Substitution in correct formula/Vervanging in korrekte formule

**These marking guidelines consist of 21 pages.
Hierdie nasienriglyne bestaan uit 21 bladsye.**

NOTE:

- If a candidate answers a question TWICE, only mark the FIRST attempt.
- The method of consistent accuracy marking must be applied to all aspects of the marking guideline where applicable as indicated with the marking code **CA**.
- If a candidate strikes off a response to a question and does not attempt the question again, then the struck off question should be marked.
- # Shows questions where Tolerance Range will be applied:
3.3.2 ; 5.2 ; 5.3.2 ; 9.2

LET WEL:

- Indien 'n kandidaat 'n vraag TWEE keer beantwoord, sien slegs die EERSTE poging na.
- Die metode van volgehoue akkuraatheid-nasien moet waar moontlik op alle aspekte van die nasienriglyne toegepas word soos aangedui deur die nasienkode **CA**.
- Indien 'n kandidaat 'n antwoord deurhaal en nie poog om die vraag weer te beantwoord dan moet die deurgehaalde antwoord gemerk word.
- # Toon vrae waar Toleransie Wydte (Verdraagsaamheids omvang) toegepas word:
3.3.2 ; 5.2 ; 5.3.2 ; 9.2

QUESTION/VRAAG 1

1.1.1	$2x(x + 3) = 0$ $x = 0$ or/of $x = -3$	$\checkmark x = 0$ A $\checkmark x = -3$ A (2)
1.1.2	$x(x + 9) = 12$ $x^2 + 9x - 12 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{-(9) \pm \sqrt{(9)^2 - 4(1)(-12)}}{2(1)}$ $= \frac{-9 \pm \sqrt{129}}{2}$ $\therefore x \approx 1,18$ or/of $x \approx -10,18$	$\checkmark$ standard form/standaardvorm A $\checkmark$ SF CA $\checkmark \checkmark$ each x -value/elke waarde CA R (4)
1.1.3	$x(6 - x) \geq 0$ Critical values/kritiese waardes: 0 and 6 $\therefore 0 \leq x \leq 6$ OR/OF $x \in [0; 6]$ OR/OF $x \geq 0$ and/en $x \leq 6$ 	$\checkmark$ both critical values/ albei kritiese waardes A $\checkmark$ notation/notasie A $\checkmark$ number line representation/ getallelyn voorstelling CA Note: Award full marks if ONLY the correct number line representation is shown. <i>Nota: Ken vol punte toe SLEGS as korrekte getallelyn getoon word</i> (3)

1.2	$x = 1 - 2y$ and/en $3x^2 = 3 + x + y$ $3(1 - 2y)^2 = 3 + (1 - 2y) + y$ $3 - 12y + 12y^2 = 4 - y$ $12y^2 - 11y - 1 = 0$ $(12y + 1)(y - 1) = 0$ OR/OF $y = \frac{-(-11) \pm \sqrt{(-11)^2 - 4(12)(-1)}}{2(12)}$ $\therefore y = -\frac{1}{12} \approx -0,08$ or/of $y = 1$ $x = 1 - 2(-\frac{1}{12})$ or/of $x = 1 - 2(1)$ $\therefore x = \frac{7}{6} \approx 1,17$ or/of $x = -1$ OR/OF $y = \frac{1-x}{2}$ and/en $3x^2 = 3 + x + y$ $3x^2 = 3 + x + \frac{1-x}{2}$ $6x^2 = 6 + 2x + 1 - x$ $6x^2 - x - 7 = 0$ $(6x - 7)(x + 1) = 0$ OR/OF $x = \frac{-(-1) \pm \sqrt{(-1)^2 - 4(6)(-7)}}{2(6)}$ $\therefore x = \frac{7}{6} \approx 1,17$ or/of $x = -1$ $y = \frac{1 - \frac{7}{6}}{2}$ or/of $y = \frac{1 - (-1)}{2}$ $\therefore y = -\frac{1}{12} \approx -0,08$ or/of $y = 1$ OR/OF $x = 1 - 2y$ (1) and / en $3x^2 - 3 - x = y$ (2) Sub/verv (2) into/in (1) $x = 1 - 2(3x^2 - 3 - x)$ $x = 1 - 6x^2 + 6 - 2x$ $6x^2 - x - 7 = 0$ $(6x - 7)(x + 1) = 0$ OR/OF $x = \frac{-(-1) \pm \sqrt{(-1)^2 - 4(6)(-7)}}{2(6)}$ $\therefore x = \frac{7}{6} \approx 1,17$ or/of $x = -1$ $\therefore y = -\frac{1}{12} \approx -0,08$ or/of $y = 1$	✓ substitution/vervanging A ✓ S CA ✓ correct standard form/ korrekte standaard vorm CA ✓ factors/formula / faktore/formule. CA ✓ both y-values/-waardes CA ✓ both x-values/-waardes CA OR/OF ✓ substitution/ vervanging A ✓ S CA ✓ correct standard form/ korrekte standaardvorm CA ✓ factors/form./faktore/form. CA ✓ both x-values/-waarde CA ✓ both y-values/-waardes CA OR/OF ✓ substitution/ vervanging A ✓ S CA ✓ correct standard form/ korrekte standaardvorm CA ✓ factors/form./faktore/form. CA ✓ both x-values/-waarde CA ✓ both y-values/-waardes CA NPR (6)
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1.3.1	$T = 2\pi \sqrt{\frac{L}{g}}$ $\frac{T}{2\pi} = \sqrt{\frac{L}{g}}$ $\left(\frac{T}{2\pi}\right)^2 = \left(\frac{L}{g}\right)^2$ $L = g \cdot \left(\frac{T}{2\pi}\right)^2$ OR/OF $T = 2\pi \sqrt{\frac{L}{g}}$ $(T)^2 = \left(2\pi \sqrt{\frac{L}{g}}\right)^2$ $T^2 = 4\pi^2 \frac{L}{g}$ $L = \frac{g T^2}{4\pi^2}$	✓ M squaring both sides/ kwadreer beide kante A ✓ L subject/ onderwerp A OR/OF ✓ M squaring both sides/ kwadreer beide kante A ✓ L subject/ onderwerp A (2)
1.3.2	$L = g \cdot \left(\frac{T}{2\pi}\right)^2$ $L = 9,8 \cdot \left(\frac{1,74}{2\pi}\right)^2$ $L = 0,75m$ OR/OF $L = \frac{g T^2}{4\pi^2}$ $L = \frac{(9,8)(1,74)^2}{4\pi^2}$ $L = 0,75m$ OR/OF	✓ SF CA ✓ value of/waarde van <i>L</i> CA OR/OF ✓ SF CA ✓ value of/waarde van <i>L</i> CA OR/OF

	$T = 2\pi \sqrt{\frac{L}{g}}$ $1,74 = 2\pi \sqrt{\frac{L}{9,8}}$ $L = 9,8 \cdot \left(\frac{1,74}{2\pi}\right)^2$ $L = 0,75m$	✓ SF A ✓ value of/waarde van L CA NPR NPU (2)																																						
1.4.1	$1101100_2 - 11100_2 = 1010000_2$	✓ 1010000₂ A Note: No penalty if base 2 is omitted. Nota: geen penaliseering indien basis 2 uitgelaat is (1)																																						
1.4.2	<table><tr><td>2⁶</td><td>2⁵</td><td>2⁴</td><td>2³</td><td>2²</td><td>2¹</td><td>2⁰</td></tr><tr><td>1</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td></tr></table> = 64 + 16 = 80 OR/OF <table><tr><td>2⁶</td><td>2⁵</td><td>2⁴</td><td>2³</td><td>2²</td><td>2¹</td><td>2⁰</td><td></td></tr><tr><td>1</td><td>1</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>=108</td></tr><tr><td></td><td></td><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td><td>=28</td></tr></table> = 108 – 28 = 80	2 ⁶	2 ⁵	2 ⁴	2 ³	2 ²	2 ¹	2 ⁰	1	0	1	0	0	0	0	2 ⁶	2 ⁵	2 ⁴	2 ³	2 ²	2 ¹	2 ⁰		1	1	0	1	1	0	0	=108			1	1	1	0	0	=28	✓ M CA ✓ decimal value/desimale waarde CA OR/OF ✓ M A ✓ decimal value/desimale waarde CA AO: full marks/ vol punte (2) [22]
2 ⁶	2 ⁵	2 ⁴	2 ³	2 ²	2 ¹	2 ⁰																																		
1	0	1	0	0	0	0																																		
2 ⁶	2 ⁵	2 ⁴	2 ³	2 ²	2 ¹	2 ⁰																																		
1	1	0	1	1	0	0	=108																																	
		1	1	1	0	0	=28																																	

QUESTION/VRAAG 2

2.1.1	Non-real/ <i>nie-reël</i>	✓ non-real/ <i>nie-reël</i> (1)
2.1.2	Real, rational, equal <i>Reëel, rasionaal, gelyk</i>	✓ Real, rational, equal/ <i>Reëel, rasionaal, gelyk</i> A (1)
2.2	$-x^2 + 2qx - 4 = 0$ OR/OF $x^2 - 2qx + 4 = 0$ $b^2 - 4ac < 0$ $(2q)^2 - 4(-1)(-4) < 0$ OR/OF $(-2q)^2 - 4(1)(4) < 0$ $4q^2 - 16 < 0$ $q^2 - 4 < 0$ $(q-2)(q+2) < 0$ $-2 < q < 2$ OR/OF $q \in (-2; 2)$ OR/OF $q > -2$ and $q < 2$	✓ $\Delta < 0$ A ✓ SF A ✓ end points and correct notation/ <i>eindpunte en</i> <i>korrekte notasie</i> CA (3) [5]

QUESTION/VRAAG 3

3.1.1	$(81a^{-8})^{-\frac{3}{4}}$ $= (3^4 a^{-8})^{-\frac{3}{4}}$ $= 3^{-3} a^6 \text{ OR/OF } \frac{1}{27} a^6 \text{ OR / OF } \frac{a^6}{27}$	✓ Prime base or exponential property/ <i>priembasis of eksponensiële eienskap</i> A ✓ 3^{-3} CA ✓ a^6 A AO: 2 marks/punte (3)
3.1.2	$\log_2 16 + \log_3 4^0$ $= \log_2 2^4 + \log_3 1$ $= 4\log_2 2 + \log_3 1$ $= 4(1) + 0$ $= 4$ OR/OF $\log_2 16 + \log_3 4^0$ $= \log_2 2^4 + 0\log_3 4$ $= 4\log_2 2 + 0\log_3 4$ $= 4(1) + 0$ $= 4$ OR/OF $\log_2 16 + \log_3 4^0$ $= \frac{\log 16}{\log 2} + \frac{\log 4^0}{\log 3}$ $= \frac{\log 2^4}{\log 2} + \frac{\log 1}{\log 3}$ $= \frac{4\log 2}{\log 2} + \frac{0}{\log 3}$ $= 4 + 0$ $= 4$	✓ $\log_2 2^4$ A ✓ $\log_3 1$ A ✓ $\log_2 2 = 1$ CA ✓ 4 CA OR/OF ✓ $\log_2 2^4$ A ✓ $4\log_2 2 + 0\log_3 4$ A ✓ $\log_2 2 = 1$ CA ✓ 4 CA OR/OF ✓ $\frac{\log 2^4}{\log 2}$ A ✓ $\frac{\log 1}{\log 3}$ A ✓ $\frac{4\log 2}{\log 2}$ CA ✓ 4 CA AO: 3 marks/punte (4)

3.1.3	$\sqrt{50x^{10}} \times \sqrt{18x^{-4}}$ $= \sqrt{900x^6}$ $= 30x^3$ OR/OF $\sqrt{50x^{10}} \times \sqrt{18x^{-4}}$ $= \sqrt{25 \times 2x^{10}} \times \sqrt{9 \times 2x^{-4}}$ $= 5\sqrt{2}x^5 \times 3\sqrt{2}x^{-2}$ $= 30x^3$	$\checkmark$ Product of the surds/ <i>produk van wortelvorm</i> A $\checkmark$ 30 CA $\checkmark$ x^3 CA OR/OF $\checkmark$ Product of perfect squares and prime number/ <i>produk van volkome vierkante en priem getalle</i> A $\checkmark$ 30 CA $\checkmark$ x^3 CA (3)
3.2	$\log_3(x+2) = 2 + \log_3 x$ $\log_3(x+2) - \log_3 x = 2$ $\log_3 \frac{x+2}{x} = 2$ $\frac{x+2}{x} = 3^2 \quad \text{OR/OF} \quad \log_3 \frac{x+2}{x} = 2\log_3 3$ $x+2 = 9x$ $x = \frac{1}{4} \quad \text{OR/OF} \quad x = 0,25$ OR/OF $\log_3(x+2) = 2 + \log_3 x$ $\log_3(x+2) = 2\log_3 3 + \log_3 x$ $\log_3(x+2) = \log_3 9 + \log_3 x$ $\log_3(x+2) = \log_3 9x$ $x+2 = 9x$ $x = \frac{1}{4} \quad \text{OR/OF} \quad x = 0,25$	$\checkmark$ log property/log-eienskap A $\checkmark$ exponential/log form/eksponensiële /log vorm CA $\checkmark$ S CA $\checkmark$ x – value/waarde CA OR/OF $\checkmark$ log property/log-eienskap A $\checkmark$ log property/log-eienskap A $\checkmark$ S CA $\checkmark$ x – value/waarde CA (4)
3.3.1	$ z = r = \sqrt{x^2 + y^2}$ $2\sqrt{5} = \sqrt{(p)^2 + (4)^2}$ $20 = p^2 + 16$ $p^2 = 4 \quad \text{OR / OF} \quad (p+2)(p-2) = 0 \quad \text{OR / OF} \quad p = \pm \sqrt{4}$ $p = \pm 2$ $\therefore p = -2, \theta \in (90^\circ; 180^\circ)$	$\checkmark$ SF A $\checkmark$ S CA $\checkmark$ S CA $\checkmark$ – 2 CA (4)

3.3.2 #	$\tan \theta = \frac{y}{x} \quad \text{OR/OF} \quad \cos \theta = \frac{x}{r}$ $\tan \theta = \frac{4}{-2} \quad \text{OR/OF} \quad \cos \theta = \frac{-2}{2\sqrt{5}}$ ref. angle / verw. hoek = 63,43° $\theta = 180^\circ - 63,43^\circ = 116,57^\circ \quad \text{OR/OF} \quad 2,03 \text{ rad}$ $\therefore z = 2\sqrt{5} \text{ cis } 116,57^\circ \quad \text{OR/OF}$ $\therefore z = 2\sqrt{5} \text{ cis } 2,03 \text{ rad}$ OR/OF $\sin \theta = \frac{y}{r}$ $\sin \theta = \frac{4}{2\sqrt{5}}$ ref. angle / verw. hoek = 63,43° $\theta = 180^\circ - 63,43^\circ = 116,57^\circ \quad \text{OR/OF} \quad 2,03 \text{ rad}$ $\therefore z = 2\sqrt{5} \text{ cis } 116,57^\circ \quad \text{OR/OF}$ $\therefore z = 2\sqrt{5} \text{ cis } 2,03 \text{ rad}$	✓ ref. angle/verw. hoek CA ✓ value of/ waarde van θ CA ✓ z in polar form/polêre vorm CA OR/OF ✓ ref. angle / verw. hoek A ✓ value of/ waarde van θ CA ✓ z in polar form/polêre vorm CA (3)
3.4	$2m - ni - 6i = -3i(4i + 5)$ $2m - ni = -12i^2 - 15i + 6i$ $2m - ni = -12(-1) - 9i$ $2m - ni = 12 - 9i$ $\therefore 2m = 12$ $m = 6$ $\therefore -ni = -9i$ $n = 9$ OR/OF $2m - ni - 6i = -3i(4i + 5)$ $2m - (n + 6)i = -12i^2 - 15i$ $2m - (n + 6)i = -12(-1) - 15i$ $2m - (n + 6)i = 12 - 15i$ $\therefore 2m = 12$ $m = 6$ $\therefore -(n + 6)i = -15i$ $n = 9$	✓ Product/ produk A ✓ substituting i^2 with -1/ vervang i^2 met -1 A ✓ value of/ waarde van m CA ✓ value of/ waarde van n CA OR/OF ✓ Product/ produk A ✓ substituting i^2 with -1/ vervang i^2 met -1 A ✓ value of/ waarde van m CA ✓ value of/ waarde van n CA

4.1.2		h : ✓ shape/vorm A ✓ y- int./afsn CA ✓ asymptote/ asimptote CA k: ✓ shape/vorm A ✓ x & y int../afsn CA ✓ Turning point/ draaipt CA (6)
4.1.3	$p(x) = \frac{a}{x} + q \quad \text{and/en} \quad (-1; 8)$ $q = 5$ $8 = \frac{a}{-1} + 5$ $\therefore a = -3$	✓ value of/ waarde van q A ✓ SF A ✓ value of/ waarde van a CA (3)
4.2.1	$C(5; 0)$	✓ x-value at/waarde by C A ✓ y-value at/ waarde by C A (2)
4.2.2	$D(0; -10)$ and/en $B(0; -5)$ $\therefore BD = -5 - (-10) = 5 \text{ units / eenhede}$	✓ coordinates of/ koördinate van B & D CA ✓ length of/ lengte van BD CA AO: Full marks/Volpunte (2)
4.2.3	$f(x) = -\sqrt{25 - x^2}$ OR/OF $f(x) = -\sqrt{5^2 - x^2}$	✓ equation/vergelyking CA (1)
4.2.4	$3 < x < 5$ OR/OF $x \in (3; 5)$ OR/OF $x > 3$ and $x < 5$	✓ critical values/ kritiese waardes CA ✓ correct notation/ korrekte notasie A (2)
		[24]

QUESTION/VRAAG 5

5.1.1	$\frac{4}{23} \approx 17,39\%$	✓ 17,39 %	A NPR (1)
5.1.2	$A = P(1 + in)$ $A = R63\,150 \left(1 + \frac{4}{23} \times 7\right)$ OR/OF $R63\,150 (1 + 17,39\% \times 7)$ $\approx R140\,028,26$ OR/OF $\approx R140\,022,50$ $SI / ER = P \times i \times n$ $= R63\,150 \times \frac{4}{23} \times 7$ OR/OF $= R63\,150 \times 17,39\% \times 7$ $\approx R76\,878,26$ OR/OF $\approx R76\,872,50$ $\therefore A \approx R63\,150 + R76\,878,26$ OR/OF $R63\,150 + R76\,872,50$ $\approx R140\,028,26$ OR/OF $\approx R140\,022,50$	✓ SF ✓ R140028,26 OR/OF ✓ SF ✓ R140028,26	A CA A CA NPR (2)
5.2 #	$A = P(1 - i)^n$ $R274\,000 = R726\,900(1 - 15,8\%)^n$ $\frac{2\,740}{7\,269} = (1 - 15,8\%)^n$ $n = \frac{\log\left(\frac{2\,740}{7\,269}\right)}{\log(0,842)}$ $n \approx 5,67$ $\therefore n > 5,67$ years/jare	✓ SF ✓ S ✓ log form/vorm ✓ value of/ waarde van n	A CA CA CA (4)
5.3.1	$A = P(1 + i)^n$ $= R25\,000 (1 + 2,8\%)^4$ $= R27\,919,81$	✓ SF ✓ R 27 919,81	A CA (2)

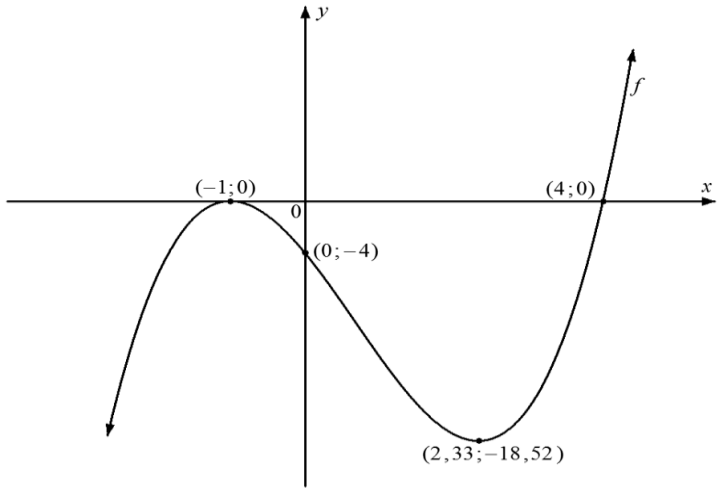
5.3.2	Value of investment after 27 months/ <i>Waarde van belegging na 27 maande</i>	
#	$A = P(1+i)^n$ $= R15\,000 \left(1 + \frac{5,98\%}{12}\right)^{27}$ $\approx R17\,154,59482$ Value of investment after 21 months/ <i>Waarde van belegging na 21 maande</i> $P = R17\,154,59482 + R6\,823,54 \approx R23\,978,13482$ Value of investment after 7 quarters/ <i>Waarde van belegging na 7 kwartale</i> $= R23\,978,13482 \left(1 + \frac{7,78\%}{4}\right)^7$ $\approx R27\,439,55$ $\therefore R27\,439,55 < R27\,919,81$ He will not have enough money/ <i>hy sal nie genoeg geld hê nie</i>	$\checkmark \left(1 + \frac{5,98\%}{12}\right)^{27} \quad \mathbf{A}$ $\checkmark \text{value of/ waarde van } A \quad \mathbf{CA}$ $\checkmark \mathbf{M} \text{ adding/ byvoeging } R6\,823,54 \quad \mathbf{A}$ $\checkmark \left(1 + \frac{7,78\%}{4}\right)^7 \quad \mathbf{A}$ $\checkmark \text{value of/ waarde van } A \quad \mathbf{CA}$ $\checkmark \text{conclusion/ gevolgtrekking} \quad \mathbf{CA}$
OR/OF		OR/OF
		$\checkmark \left(1 + \frac{5,98\%}{12}\right)^{27} \quad \mathbf{A}$ $\checkmark \left(1 + \frac{7,78\%}{4}\right)^7 \quad \mathbf{A}$ $\checkmark \mathbf{M} \quad \mathbf{A}$ $\checkmark \left(1 + \frac{7,78\%}{4}\right)^7 \quad \mathbf{A}$ $\checkmark \approx R27\,439,55 \quad \mathbf{CA}$ $\checkmark \text{conclusion/gvlgtr} \quad \mathbf{CA}$
OR/OF		OR/OF
		$\checkmark \left(1 + \frac{5,98\%}{12}\right)^{27} \quad \mathbf{A}$ $\checkmark \mathbf{M} \quad \mathbf{A}$ $\checkmark \mathbf{M} \quad \mathbf{A}$ $\checkmark \left(1 + \frac{7,78\%}{4}\right)^7 \quad \mathbf{A}$ $\checkmark \approx R27\,439,55 \quad \mathbf{CA}$ $\checkmark \text{conclusion/gvlgtr} \quad \mathbf{CA}$
		(6)
		Conclusion without calculation: 0 marks/ Gevolgtrekking sonder berekening gee: 0 punte
		[15]

QUESTION/VRAAG 6

6.1	$f(x) = -3x$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{-3(x+h) - (-3x)}{h}$ $= \lim_{h \rightarrow 0} \frac{-3x - 3h + 3x}{h}$ $= \lim_{h \rightarrow 0} \frac{-3h}{h}$ $= \lim_{h \rightarrow 0} (-3)$ $\therefore f'(x) = -3$	✓ definition/definisie A ✓ SF CA ✓ S CA ✓ S CA ✓ -3 CA AO: 1 mark/ punt Penalty of one mark for incorrect notation <i>Penaliseer een punt indien notasie foutief is.</i>
		(5)
6.2.1	$D_x[p^3x^2 - 7x + 10]$ $= 2p^3x - 7$	✓ $2p^3x$ A ✓ -7 A
		(2)
6.2.2	$y = \frac{x - 3x^2}{x^7}$ $y = x^{-6} - 3x^{-5}$ $\frac{dy}{dx} = -6x^{-7} + 15x^{-6}$	✓ S A ✓ $-6x^{-7}$ CA ✓ $15x^{-6}$ CA
		(3)
6.2.3	$f(x) = \sqrt[3]{x^2} + 5x^4$ $f(x) = x^{\frac{2}{3}} + 5x^4$ $\therefore f'(x) = \frac{2}{3}x^{-\frac{1}{3}} + 20x^3$	✓ $x^{\frac{2}{3}}$ A ✓ $\frac{2}{3}x^{-\frac{1}{3}}$ CA ✓ $20x^3$ A
		(3)

6.3.1	$m = -9$	✓ value of/ waarde van m A (1)
6.3.2	$y = x^2 + 3x - 2$ $\frac{dy}{dx} = 2x + 3$ $2x + 3 = -9$ $2x = -12$ $\therefore x = -6$ $y = (-6)^2 + 3(-6) - 2$ $\therefore y = 16$ $(-6; 16)$	✓ derivative of / afgeleide van y A ✓ equat.deriv/ verg. afgeleide $= -9$ CA ✓ value of/ waarde van x CA ✓ value of/ waarde van y CA (4)
6.3.3	$g(x) = x^2 + 3x - 2$ $g(x) = (-2)^2 + 3(-2) - 2 = -4$ $g(x) = (3)^2 + 3(3) - 2 = 16$ Ave. grad./Gem grad = $\frac{y_2 - y_1}{x_2 - x_1}$ $= \frac{16 - (-4)}{3 - (-2)}$ $= \frac{20}{5}$ $= 4$ OR/OF $g(x) = x^2 + 3x - 2$ Ave. grad./Gem grad = $\frac{g(x_2) - g(x_1)}{x_2 - x_1}$ $= \frac{[(3)^2 + 3(3) - 2] - [(-2)^2 + 3(-2) - 2]}{3 - (-2)}$ $= \frac{16 - (-4)}{3 - (-2)}$ $= \frac{20}{5}$ $= 4$	✓ both values of/ beide waardes van y A ✓ M subst. into Ave. gradient Formula/verv in gem grad vorm CA ✓ m_{ave} value/ waarde CA OR/OF ✓ M subst. into Ave. gradient Formula/verv. in gem grad vorm A ✓ both values of/ beide waardes van y CA ✓ m_{ave} value/ waarde CA (3)
		[21]

QUESTION/VRAAG 7

7.1	$f(x) = x^3 - 2x^2 - 7x - 4$ $y = -4$ OR/OF $(0; -4)$	✓ y-intercept/ afsnit A (1)
7.2	$f(4) = (4)^3 - 2(4)^2 - 7(4) - 4$ $= 0$ $\therefore (x - 4)$ is a factor of/ is 'n faktor van $f(x)$	✓ substitution/ vervanging A ✓ 0 A (2)
7.3	x-intercepts/afsnitte; $y = 0$ $(x - 4)(x^2 + 2x + 1) = 0$ $(x - 4)(x + 1)(x + 1) = 0$ $\therefore x = -1$ or $x = 4$ OR/OF $(x + 1)(x^2 - 3x - 4) = 0$ $(x + 1)(x - 4)(x + 1) = 0$ $\therefore x = -1$ or $x = 4$	✓ quadratic factor/ kwadr. faktor A ✓ factors/ faktore CA ✓ x-intercepts/ afsnitte CA OR/OF ✓ quadratic factor/ kwadr faktor A ✓ factors/ faktore CA ✓ x-intercepts/ afsnitte CA AO: Full marks/Volpunte (3)
7.4	$f'(x) = 3x^2 - 4x - 7 = 0$ $(3x - 7)(x + 1) = 0$ OR/OF $x = \frac{-(-4) \pm \sqrt{(-4)^2 - 4(3)(-7)}}{2(3)}$ $\therefore x = \frac{7}{3}$ or/of $x = -1$ $f\left(\frac{7}{3}\right) = \left(\frac{7}{3}\right)^3 - 2\left(\frac{7}{3}\right)^2 - 7\left(\frac{7}{3}\right) - 4 = -\frac{500}{27} \approx -18,52$ $\therefore \left(\frac{7}{3}; -\frac{500}{27}\right)$ and /en $(-1; 0)$ OR/OF $(2,33; -18,52)$ and /en $(-1; 0)$	✓ derivative/afgeleide A ✓ equating derivative to 0/ stel afgeleide gelyk aan 0 A ✓ factors/formula/faktore CA ✓ both values of /beide waardes van x CA ✓ both values of /beide waardes van y CA (5)
7.5		✓ shape /vorm A ✓ y-intercept/ afsnit CA ✓ both x-intercepts/ beide x-afsnitte CA ✓ both turning points/ beide draaipunte CA (4)

7.6	$-1 < x < \frac{7}{3}$	OR/OF	$-1 < x < 2,33$	✓ crit. values/ <i>krit. waarde</i>	CA
				✓ correct notation / <i>korrek notasie</i>	A
		OR/OF		OR/OF	
	$x \in \left(-1; \frac{7}{3}\right)$	OR/OF	$x \in (-1; 2,33)$	✓ crit. values/ <i>krit. waarde</i>	CA
				✓ correct notation / <i>korrek notasie</i>	A
		OR/OF		OR/OF	
	$x > -1$ and/en $x < \frac{7}{3}$	OR/OF	$x > -1$ and/en $x < 2,33$	✓ crit. values/ <i>krit. waarde</i>	CA
				✓ correct notation / <i>korrek notasie</i>	A
					(2)
					[17]

QUESTION/VRAAG 8

8.1	$V = l \times b \times h$ $4000 = x^2 h$ $\therefore h = \frac{4000}{x^2}$	✓ SF	A (1)
8.2	Tot. Surface Area = length $\times$ breadth + 2 $\times$ length $\times$ height + 2 $\times$ breadth $\times$ height Tot. Buite oppervlakte = lengte $\times$ breedte + 2 $\times$ lengte $\times$ height + 2 $\times$ breedte $\times$ height Tot. Surface Area/ Buite Oppervlakte = $x^2 + 2xh + 2xh$ $= x^2 + 4x \left(\frac{4000}{x^2} \right)$ $= x^2 + \frac{16\,000}{x}$ OR/OF Tot. Surface Area = Area of base + (perimeter of base $\times$ height) Tot. Buite Oppervlakte = oppervlakte van die basis + (omtrek van basis $\times$ hoogte) Tot. Surface Area/ Buite Oppervlakte = $x^2 + 4xh$ $= x^2 + 4x \left(\frac{4000}{x^2} \right)$ $= x^2 + \frac{16\,000}{x}$	✓ SF ✓ S OR/OF ✓ SF ✓ S	A CA OR/OF A CA (2)
8.3	$\therefore \text{Tot Surface Area/ Buite Oppervlakte} = x^2 + \frac{16\,000}{x}$ $= x^2 + 16000x^{-1}$ $\frac{d(\text{Tot. Surface Area / Buit. Oppervlakte})}{dx} = 2x - 16000x^{-2}$ $= 2x - \frac{16000}{x^2}$ $2x^3 - 16000 = 0$ $x^3 = 8000$ $x = 20\text{cm}$ $h = \frac{4000}{(20)^2} = 10$	✓ derivative/ afgeleide ✓ S ✓ equating derivative to/ stel afgeleide aan 0 ✓ value of/ waarde van x ✓ value of/waarde van h	A A A CA CA NPU (5) [8]

QUESTION/VRAAG 9

9.1.1	$\int x(x^2 + 6x) dx$ $= \int (x^3 + 6x^2) dx$ $= \frac{x^4}{4} + 2x^3 + C$	$\checkmark$ S A $\checkmark$ $\frac{x^4}{4}$ CA $\checkmark$ $2x^3$ CA $\checkmark$ C A (4)
9.1.2	$\int \left(3^x + \frac{1}{x}\right) dx$ $= \frac{3^x}{\ln 3} + \ln x + C$	$\checkmark$ $\frac{3^x}{\ln 3}$ A $\checkmark$ $\ln x + C$ A (2)
9.2 #	$A = \int_k^4 g(x) dx$ $= \int_k^4 3x^2 dx$ $= x^3 \Big _k^4$ $= (4)^3 - (k)^3$ $\therefore (4)^3 - (k)^3 = 56$ $\therefore k^3 = 8$ $\therefore k = 2$ OR/OF $A = \int_0^4 g(x) dx$ $= \int_0^4 3x^2 dx$ $= x^3 \Big _0^4$ $= (4)^3 - (0)^3 = 64$ $A = \int_0^2 g(x) dx$ $= x^3 \Big _0^2$ $= (2)^3 - (0)^3 = 8$ $\therefore 64 - 8 = 56$ $\therefore k = 2$ OR/OF	$\checkmark$ M Area notation using integrals/ Area-notasie met gebruik van integrale A $\checkmark$ x^3 A $\checkmark\checkmark$ SF CA $\checkmark$ equating area to/ stel oppervl gelyk aan 56 CA $\checkmark$ S CA $\checkmark$ value of / waarde van k CA OR/OF $\checkmark$ M Area notation using integrals/ Area-notasie met gebruik van integrale A $\checkmark$ x^3 A $\checkmark\checkmark$ SF CA $\checkmark$ S CA $\checkmark$ M CA $\checkmark$ value of / waarde van k CA OR/OF

	Trial & Error Method/ <i>Probeer en Trefmetode</i> $A = \int_k^4 g(x) dx$ $= \int_k^4 3x^2 dx$ $= x^3 \Big _k^4$ Let/Laat $k = 1$ $= x^3 \Big _1^4$ $= (4)^3 - (1)^3$ $= 63$ Let/Laat $k = 2$ $= x^3 \Big _2^4$ $= (4)^3 - (2)^3$ $= 56$ $\therefore k = 2$	✓ Area notation using integrals/ <i>Area-notasie met gebruik van integrale</i> M ✓ x^3 A ✓ M CA ✓✓ SF CA ✓ S CA ✓ value of / <i>waarde van k</i> CA (7) [13]
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TOTAL/TOTAAL: 150