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**NATIONAL
SENIOR CERTIFICATE/
NASIONALE
SENIOR SERTIFIKAAT**

GRADE/GRAAD 12

SEPTEMBER 2016

**MATHEMATICS P1/WISKUNDE V1
MEMORANDUM**

MARKS/PUNTE: 150

This memorandum consists of 16 pages./
Hierdie memorandum bestaan uit 16 bladsye.

NOTE:

- If a candidate answered a question TWICE, mark the FIRST attempt ONLY.
- Consistent accuracy applies in ALL aspects of the memorandum.
- If a candidate crossed out an attempt of a question and did not redo the question, mark the crossed-out attempt.
- The mark for substitution is awarded for substitution into the correct formula.

LET OP:

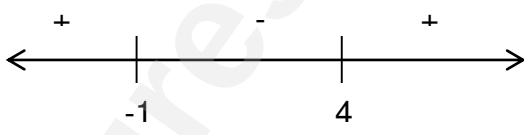
- Indien 'n kandidaat 'n vraag TWEE keer beantwoord het, merk SLEGS die EERSTE poging.
- Volgehoue akkuraatheid geld deurgaans in ALLE aspekte van die memorandum.
- Indien 'n kandidaat 'n poging vir 'n vraag deurgetrek het en nie die vraag weer beantwoord het nie, merk die poging wat deurgetrek is.
- Die punt vir substitusie word vir substitusie in die korrekte formule toegeken.

QUESTION 1/VRAAG 1

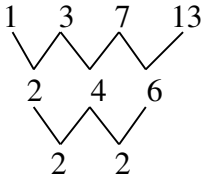
1.1.1	$x^2 - 4x - 12 = 0$ $(x - 6)(x + 2) = 0$ $x = 6$ or/of $x = -2$	✓ standard form/standaard vorm ✓ $x = 6$ (CA applies) ✓ $x = -2$ (CA applies) (3)
1.1.2	$3x^2 + 2x - 6 = 0$ $x = \frac{-(2) \pm \sqrt{(2)^2 - 4(3)(-6)}}{2(3)}$ $x = \frac{-2 \pm \sqrt{76}}{6}$ $x = -1,79$ or/of $x = 1,12$	Penalise 1 mark for incorrect rounding off. Penaliseer 1 punt vir verkeerde afronding. ✓ substitution/substitusie ✓ $x = -1,79$ ✓ $x = 1,12$ (3)
1.1.3	$3^{x^2-1} = \frac{27^{-x}}{3}$ $3^{x^2-1} = 3^{-3x-1}$ $\therefore x^2 - 1 = -3x - 1$ $x^2 + 3x = 0$ $x(x + 3) = 0$ $x = 0$ or/of $x = -3$ OR/OF $3^{x^2-1} = \frac{27^{-x}}{3}$ $3^{x^2-1} \cdot 3 = 27^{-x}$ $3^{x^2-1+1} = 3^{-3x}$ $\therefore x^2 = -3x$ $x^2 + 3x = 0$ $x(x + 3) = 0$ $x = 0$ or/of $x = -3$	✓ 3^{-3x-1} ✓ equating exponents/ gelykstelling van eksponente ✓ factors/faktore ✓ both x-values/beide x-waardes ✓ $x^2 - 1 + 1 = -3x$ ✓ equating exponents/ gelykstelling van eksponente ✓ factors/faktore ✓ both x-values/beide x-waardes. (4)

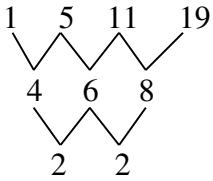
1.2.1	$1 + \frac{1}{x} = 0$ $\frac{x+1}{x} = 0$ $x = -1$ or/of $x = 0$	✓ $x = -1$ ✓ $x = 0$ (2)
1.2.2	$\frac{x - \frac{1}{x}}{1 + \frac{1}{x}} = 1$ $x - \frac{1}{x} = 1 + \frac{1}{x}$ $x^2 - 1 = x + 1$ $x^2 - x - 2 = 0$ $(x + 1)(x - 2) = 0$ $x = -1$ or/of $x = 2$ $x = 2$ only/alleenlik	✓ manipulation of equation/ <i>manipulasie van vergelyking</i> ✓ standardform/standaard <i>vorm</i> ✓ factors/ faktore ✓ both x -values/beide x - <i>waardes</i> ✓ choosing $x = 2$ /keuse van $x = 2$ (5) [17]

QUESTION 2/VRAAG 2

2.1	$x - y = 3$; $xy = 28$ $x - y = 3 \dots \dots \dots (1)$ $xy = 28 \dots \dots \dots (2)$ From/ <i>vanaf</i> (1) $x = y + 3$ Substitute in (2)/ <i>vervang in</i> (2) $y(y + 3) = 28$ $y^2 + 3y - 28 = 0$ $(y - 4)(y + 7) = 0$ $y = 4$ or / of $y = -7$ $x = 7$ or/of $x = -4$ OR/OF From/ <i>vanaf</i> (1) $y = x - 3$ Substitute in (2)/ <i>vervang in</i> (2) $x(x - 3) = 28$ $x^2 - 3x - 28 = 0$ $(x + 4)(x - 7) = 0$ $x = -4$ or / of $x = 7$ $y = -7$ or / of $y = 4$	✓ $x = y + 3$ ✓ substitute in (2)/<i>vervang in</i> (2) ✓ standard form/<i>standaardvorm</i> ✓ factors/<i>faktore</i> ✓ y-values/<i>y-waardes</i> ✓ x-values/<i>x-waardes</i> ✓ $y = x - 3$ ✓ substitute in (2)/<i>vervang in</i> (2) ✓ standard form/<i>standaardvorm</i> ✓ factors/<i>faktore</i> ✓ x-values/<i>x-waardes</i> ✓ y-values/<i>y-waardes</i> (6)
2.2	$x^2 \leq 4 + 3x$; $x > 0$ $x^2 - 3x - 4 \leq 0$ $(x + 1)(x - 4) \leq 0$  Solution/ <i>Oplossing</i> $-1 \leq x \leq 4$ But/ <i>maar</i> $x > 0$ $0 < x \leq 4$	✓ standard form/<i>standaardvorm</i> ✓ factors/<i>faktore</i> ✓ solution/<i>oplossing</i> $-1 \leq x \leq 4$ ✓ final answer/<i>finale antwoord</i> $0 < x \leq 4$ (4) [10]

QUESTION 3/VRAAG 3

3.1	 $T_n = an^2 + bn + c$ $2a = 2$ $a = 1$ $3a + b = 2$ $3 + b = 2$ $b = -1$ $a + b + c = 1$ $1 - 1 + c = 1$ $c = 1$ $T_n = n^2 - n + 1$ Row/Ry 80 Term 1 $T_{80} = 80^2 - 80 + 1$ $T_{80} = 6321$	$\checkmark a = 1$ $\checkmark b = -1$ $\checkmark c = 1$ $\checkmark T_n = n^2 - n + 1$ $\checkmark 6321$ (5)
3.2	Row 80/Ry 80 6321 6323 6325 6327 ... $S_n = \frac{n}{2}[2(a) + (n-1)d]$ $S_{80} = \frac{80}{2}[2(6321) + (80-1)(2)] \text{ Row 80/Ry 80}$ $S_{80} = 512000$ OR/OF Row/Ry 80 Term 80 $T_{80} = 6321 + (79 \times 2)$ $T_{80} = 6479$ $S_n = \frac{n}{2}[a + l]$ $S_{80} = \frac{80}{2}[6321 + 6479] \text{ Row 80/Ry 80}$ $S_{80} = 512000$	$\checkmark n = 80$ $\checkmark d = 2$ $\checkmark$ sub into correct formula/ vervang in korrekte formule $\checkmark$ answer/antwoord (4) $\checkmark$ calculating term 80 of row 80/bepaling van term 80 van ry 80 $\checkmark 6479$ $\checkmark$ sub into correct formula/ vervang in korrekte formule $\checkmark$ answer/antwoord (4)

	OR/OF  $2a = 2$ $a = 1$ $3a + b = 4$ $3 + b = 4$ $b = 1$ $a + b + c = 1$ $1 + 1 + c = 1$ $c = -1$ $T_n = n^2 + n - 1$ $T_n = n^2 + n - 1$ $T_{80} = 80^2 + 80 - 1$ $T_{80} = 6479$ $S_n = \frac{n}{2}[a + l]$ $S_{80} = \frac{80}{2}[6321 + 6479]$ Row 80/Ry 80 $S_{80} = 512000$	✓ $T_n = n^2 + n - 1$ ✓ $T_{80} = 6479$ ✓ sub into formula/sub in korrekte formule ✓ answer/antwoord (4) [9]
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QUESTION 4/VRAAG 4

4.1.1	$T_{10} = S_{10} - S_9$ $T_{10} = 10(11)(12) - 9(10)(11)$ $T_{10} = 330$	✓ setting up of equation/ <i>opstel van vergelyking</i> ✓ substitution/ <i>vervanging</i> ✓ answer/ <i>antwoord</i> (3)
4.2	$p ; 3p ; 5p ; \dots \dots \dots$ $d = 2p$ $S_n = \frac{n}{2} [2a + (n-1)d]$ $S_p = \frac{p}{2} [2p + (p-1)2p]$ $S_p = \frac{p}{2} (2p + 2p^2 - 2p)$ $S_p = p^3$ OR/OF $a = p$ $l = 2p^2 - p$ $S_n = \frac{n}{2} [a + l]$ $S_p = \frac{p}{2} [p + 2p^2 - p]$ $S_p = p^3$	✓ first three terms/ <i>eerste drie terme</i> ✓ $d = 2p$ ✓ substitution/ <i>vervanging</i> ✓ answer/ <i>antwoord</i> (4) ✓ $a = p$ ✓ $l = 2p^2 - p$ ✓ substitution/ <i>vervanging</i> ✓ answer/ <i>antwoord</i> (4) [7]

QUESTION 5/VRAAG 5

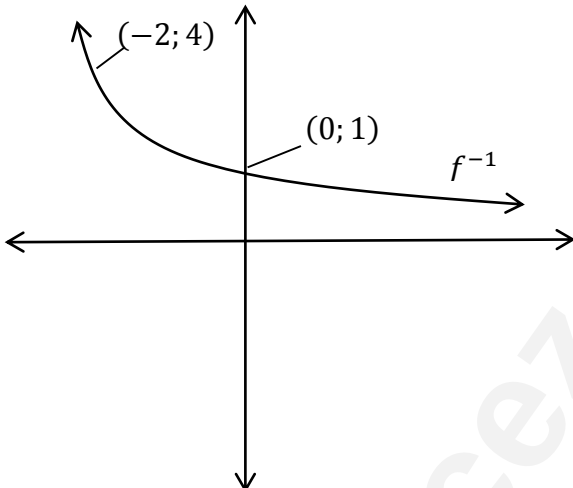
5.1	$r = \frac{x+2}{x}$ $T_3 = \frac{(x+2)^2}{x}$ Answer only/antwoord <i>alleenlik</i> $\frac{2}{2}$	✓ ratio/verhouding ✓ answer/antwoord (2)
5.2	$S_\infty = \frac{a}{1-r}$ $-8 = \frac{x}{1-\frac{(x+2)}{x}}$ $-8 = \frac{x^2}{x-x-2}$ $x^2 = 16$ $x = \pm 4$ -1 mark for (±) -1 punt vir (±)	✓ substitution/vervanging ✓ simplification/ <i>vereenvoudiging</i> ✓ $x^2 = 16$ ✓ both answers/beide <i>antwoorde</i> (4) [6]

QUESTION 6/VRAAG 6

6.1	$A = P(1 - i)^n$ $A = 635000 \left(1 - \frac{15}{100}\right)^5$ $A = 281\,752,87$	✓ $i = \frac{15}{100}$ and/en $n = 5$ ✓ sub into correct formula/ vervanging in korrekte formule ✓ answer/antwoord (3)
6.2.1	$P_v = \frac{x[1 - (1 + i)^{-n}]}{i}$ $50000 = \frac{x \left[1 - \left(1 + \frac{16,75}{1200}\right)^{-48}\right]}{\frac{16,75}{1200}}$ $x = R\,1\,436,29$	✓ $i = \frac{16,75}{1200}$ ✓ $n = -48$ ✓ sub into correct formula/ vervanging in korrekte formule ✓ answer/antwoord (4)
6.2.2	$P_v = \frac{x[1 - (1 + i)^{-n}]}{i}$ $P_v = \frac{1436,29 \left[1 - \left(1 + \frac{16,75}{1200}\right)^{-18}\right]}{\frac{16,75}{1200}}$ $P_v = R22\,721,97704$ $P_v = R22\,722$ OR/OF Outstanding balance/Uitstaande balans (OB) $OB = 50000 \left(1 + \frac{16,75}{1200}\right)^{30} - \left[\frac{1436,29 \left[\left(1 + \frac{16,75}{1200}\right)^{30} - 1 \right]}{\frac{16,75}{1200}} \right]$ $OB = R\,22722,14$ $OB = R22722$	✓ $n = -18$ ✓ $i = \frac{16,75}{1200}$ ✓ substitution/substitusie ✓ answer/antwoord ✓ rounding/afroonding (5) ✓ $n = 30$ ✓ $i = \frac{16,75}{1200}$ ✓ sub into both formulae/ vervang in beide formules ✓ answer/antwoord ✓ rounding/afroonding (5)
6.3	$A = P(1 + i)^n$ $A = 2x \text{ and/en } P = x$ $2x = x \left(1 + \frac{14,75}{100}\right)^n$ $n = \frac{\log 2}{\log \left(1 + \frac{14,75}{100}\right)}$ $n = 5.04 \text{ years/jare}$	✓ $A = 2x$ and/en $P = x$ ✓ sub into correct formula/ vervanging in korrekte formule ✓ using of logs/gebruik van logaritmes ✓ answer/antwoord (4) [16]

QUESTION 7/VRAAG 7

7.1.1	$x = 0$	✓ answer/antwoord (1)
7.1.2	$x > -2$; $x \neq 0$	✓ $x > -2$ ✓ $x \neq 0$ (2)
7.1.3	$y = -4$	✓ answer/antwoord (1)
7.1.4	$y = b^x - 4$ $5 = b^2 - 4$ $b^2 = 9$ $b = \pm 3$ $y = 3^x - 4$	✓ sub of/van -4 ✓ sub of point (2;5)/ vervanging van punt (2;5) ✓ $b = \pm 3$ ✓ answer with correct b value/ antwoord met korrekte b waarde (4)
7.1.5	$x = -2$ $y = -1$	✓ $x = -2$ ✓ $y = -1$ (2)
7.1.6	$y = \frac{a}{x+2} - 1$ $-3 = \frac{a}{0+2} - 1$ $a = -4$ $y = \frac{-4}{x+2} - 1$	✓ sub of asymptotes/ vervanging van asimptote ✓ sub of point/vervanging van punt (0;-3) ✓ $a = -4$ (3)
7.1.7	$y = x + 2 - 1$ $y = x + 1$ $y = -(x + 2) - 1$ $y = -x - 3$	✓ $y = x + 1$ ✓ $y = -(x + 2) - 1$ ✓ $y = -x - 3$ (3)

7.2.1	$y = \log_{\frac{1}{2}} x$ $f^{-1} : x = \log_{\frac{1}{2}} y$ $y = \left(\frac{1}{2}\right)^x$ OR/OF $y = 2^{-x}$	✓ swopping of x and y / omruiling van x en y ✓ answer/antwoord
		(2)
7.2.2		✓ Shape/vorm ✓ y-intercept/y-afsnit ✓ any other correct point/ enige ander korrekte punt
		(3)
7.2.3	$g(x) = \left(\frac{1}{2}\right)^{-x}$ OR/OF $g(x) = 2^x$	✓✓ Answer/antwoord ✓✓ Answer/antwoord
		(2)
7.2.4	$x > 1$	✓✓ $x > 1$
		(2)
		[25]

QUESTION 8/VRAAG 8

8.1	$x = -3$	✓ $x = -3$ (1)
8.2	$y = a(x + 3)^2 - 5$ $4 = a(9) - 5$ $9a = 9$ $a = 1$ $y = x^2 + 6x + 9 - 5$ $y = x^2 + 6x + 4$ $a = 1$ and/en $b = 6$	✓ sub of turning point $(-3; 5)$ /substitusie van draaipunt $(-3; 5)$ ✓ sub of $(0; 4)$ /vervanging van $(0; 4)$ ✓ simplification/vereenvoudiging (3)
8.3	$\Delta = b^2 - 4ac$ $\Delta = 36 - 4(1)(4)$ $\Delta = 20$ <i>Roots are Irrational and Unequal /</i> <i>Wortels is Irrasionaal en ongelyk</i>	✓ $\Delta = 20$ ✓ irrational/irrasionaal ✓ unequal/ongelyk (3)
8.4	$g(x) = 2x$ $x^2 + 6x + 4 = 2x$ $x^2 + 4x + 4 = 0$ $(x + 2)^2 = 0$ $x = -2$ $g(-2) = -4$ Point/punt $(-2; -4)$ OR/OF $f(x) = x^2 + 6x + 4$ $f'(x) = 2x + 6$ and/en $m = 2$ $2x + 6 = 2$ $2x = -4$ $x = -2$ $y = -4$ Point/punt $(-2; -4)$	✓ $g(x) = 2x$ ✓ equating equations/ gelykstelling van vergelykings ✓ $x = -2$ ✓ $y = -4$ ✓ derivative/afgeleide $f'(x) = 2x + 6$ ✓ equating to gradient of g / gelykstelling aan gradiënt van g . ✓ x -value/ x -waarde ✓ y -value/ y -waarde (4) [11]

QUESTION 9/VRAAG 9

9.1	$f(x) = 3x^2 - 1$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{3(x+h)^2 - 1 - (3x^2 - 1)}{h}$ $= \lim_{h \rightarrow 0} \frac{3(x^2 + 2xh + h^2) - 1 - 3x^2 + 1}{h}$ $= \lim_{h \rightarrow 0} \frac{3x^2 + 6xh + 3h^2 - 1 - 3x^2 + 1}{h}$ $= \lim_{h \rightarrow 0} \frac{6xh}{h}$ $= 6x$ Answer ONLY: 0 marks SLEGS antwoord: 0 punte Penalise 1 mark for incorrect use of formula. Must show $f'(x)$. Penaliseer 1 punt vir verkeerde gebruik van formule. Moet $f'(x)$ toon.	✓ formula/formule ✓ substitution of/substitusie van $(x+h)$ ✓ simplification/vereenvoudiging $3x^2 + 6xh + 3h^2 - 1 - 3x^2 + 1$ ✓ $= \lim_{h \rightarrow 0} \frac{6xh}{h}$ ✓ answer/antwoord (5)
9.2.1	$y = 5x^2 + \sqrt{x}$ $y = 5x^2 + x^{\frac{1}{2}}$ $\frac{dy}{dx} = 10x + \frac{1}{2}x^{-\frac{1}{2}}$ Penalise 1 mark for incorrect notation. Penaliseer 1 punt vir verkeerde notasie.	✓ $x^{\frac{1}{2}}$ ✓ $10x$ ✓ $\frac{1}{2}x^{-\frac{1}{2}}$ (3)
9.2.2	$D_x \left[\frac{6x-4}{3x} \right]$ $D_x \left[\frac{6x}{3x} - \frac{4}{3x} \right]$ $D_x \left[2 - \frac{4}{3}x^{-1} \right]$ $= \frac{4}{3}x^{-2}$ or/of $\frac{4}{3x^2}$	✓ 2 ✓ $-\frac{4}{3}x^{-1}$ ✓ answer/antwoord (3)
9.2.3	$m = s'(t) = 3t^2$ $t^2 \geq 0$ $3t^2 \geq 0$ $\therefore$ no value of t will make $s'(t)$ negative. $\therefore$ geen waarde van t sal $s'(t)$ negatief maak nie.	✓ derivative/afgeleide ✓ $3t^2 \geq 0$ (2)

[13]

QUESTION 10/VRAAG 10

10.1	$f(x) = x^3 - x^2 - 8x + 12$ $(x - 2)(x^2 + x - 6) = 0$ $(x - 2)(x - 2)(x + 3) = 0$ $x = 2$ or/of $x = 2$ or/of $x = -3$ $A(-3; 0)$ OR/OF $ \begin{array}{r} x^2 - 4x + 4 \quad \overline{) \quad x^3 - x^2 - 8x + 12} \\ \underline{x^3 - 4x^2 + 4x} \\ 3x^2 - 12x + 12 \\ \underline{3x^2 - 12x + 12} \\ 0 \end{array} $ $f(x) = (x^2 - 4x + 4)(x + 3)$ $A(-3; 0)$	$\checkmark (x - 2) \quad \checkmark (x^2 + x - 6)$ $\checkmark (x - 2)(x + 3)(x - 2)$ $\checkmark$ coordinates of A $(-3; 0)$ / <i>koördinate van A $(-3; 0)$</i> $\checkmark x^2 - 4x + 4$ $\checkmark \checkmark x + 3$ $\checkmark$ coordinates of A $(-3; 0)$ / <i>koördinate van A $(-3; 0)$</i> (4)
10.2	$f'(x) = 3x^2 - 2x - 8 = 0$ $(3x + 4)(x - 2) = 0$ $x = -\frac{4}{3}$ or/of $x = 2$ $f\left(-\frac{4}{3}\right) = \left(-\frac{4}{3}\right)^3 - \left(-\frac{4}{3}\right)^2 - 8\left(-\frac{4}{3}\right) + 12$ $B\left(-\frac{4}{3}; \frac{500}{27}\right)$	$\checkmark f'(x) \quad \checkmark f'(x) = 0$ $\checkmark$ factors/faktore $\checkmark$ correct x value/korrekte x <i>waarde $x = -\frac{4}{3}$</i> $\checkmark y = \frac{500}{27}$ (5)
10.3	$f''(x) = 6x - 2$ $6x - 2 = 0$ $x = \frac{1}{3}$ OR/OF $x = \frac{-\frac{4}{3} + 2}{2}$ $x = \frac{1}{3}$	$\checkmark f''(x) = 6x - 2$ $\checkmark x = \frac{1}{3}$ (2) $\checkmark$ finding x value of midpoint/ <i>bepaal van x waarde van</i> <i>middelpunt</i> $\checkmark x = \frac{1}{3}$ (2)
10.4	$x < -\frac{4}{3}$ or/of $x > 2$	$\checkmark x < -\frac{4}{3}$ $\checkmark x > 2$ (2)
10.5	$y = k ; k < 0$ Only one Real Root/Net <i>een</i> reële wortel	$\checkmark$ answer/antwoord (2)

QUESTION 11/VRAAG 11

11.1	$D(0) = 3 + \frac{1}{2}(0)^2 - \frac{1}{4}(0)^3$ $D(0) = 3 \text{ m}$	✓ $D(0) = 3 \text{ m}$ (1)
11.2	$D'(t) = t - \frac{3}{4}t^2$ $D'(3) = 3 - \frac{3}{4}(3)^2$ $= 3 - \frac{27}{4}$ $= -\frac{15}{4} \text{ m/h / m/u}$	✓ $D'(t)$ ✓ $D'(3)$ ✓ $-\frac{15}{4}$ or/of -3.75 (3)
11.3	Decreasing/ <i>veminderend</i>	✓ decreasing/ <i>vermindering</i> (1)
11.4	$D'(t) = 0$ $t - \frac{3}{4}t^2 = 0$ $4t - 3t^2 = 0$ $t(4 - 3t) = 0$ $t = 0$ or/of $t = \frac{4}{3}$ $\frac{4}{3} = 1\text{h}20\text{min}$ Time: at 08h00 or 9h20 / <i>Tyd: 08h00 of 9h20</i>	✓ $D'(t) = 0$ ✓ factors/ <i>faktore</i> ✓ t – values / t – waardes ✓ answer/ <i>antwoord</i> (4) [9]

QUESTION 12/VRAAG 12

12.1	12.1.1	$P(A') = 1 - P(A)$ $= 1 - 0,35$ $= 0,65$	✓ $P(A') = 1 - P(A)$ ✓ answer/antwoord (2)
	12.1.2	$P(A \text{ and } B) = 0$ $P(A \text{ en } B) = 0$	✓ answer/antwoord (1)
	12.1.3	$P(A \text{ or } B) = 0,35 + 0,52$ $= 0,87$	✓ $P(A \text{ or } B) = P(A) + P(B)$ ✓ answer/antwoord (2)
12.2	12.2.1	$6! = 720$	✓ $6!$ or/of 720 (1)
	12.2.2	$4!$ $= 24$	✓ $4!$ ✓ 24 (2)
	12.2.3	$\frac{2! \cdot 5!}{6!} = \frac{240}{720} = \frac{1}{3}$ OR/OF 0,333	✓ $2!$ ✓ $5!$ ✓ $6!$ ✓ answer/antwoord (4) [12]
			TOTAL/TOTAAL: 150