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GRADE/GRAAD 12

SEPTEMBER 2017

**MATHEMATICS P1/WISKUNDE V1
MEMORANDUM**

MARKS/PUNTE: 150

Hierdie memorandum bestaan uit 13 bladsye./
This memorandum consists of 13 pages.

NOTE/LET OP:

- If a candidate answered a question TWICE, mark the FIRST attempt ONLY.
Indien 'n kandidaat 'n vraag TWEE keer beantwoord het, merk SLEGS die EERSTE poging.
- Consistent accuracy applies in ALL aspects of the memorandum.
Volgehoue akkuraatheid geld deurgaans in ALLE aspekte van die memorandum.
- If a candidate crossed out an attempt of a question and did not redo the question, mark the crossed-out attempt.
Indien 'n kandidaat 'n poging vir 'n vraag deurgetrek het en nie die vraag weer beantwoord het nie, merk die poging wat deurgetrek is.
- The mark for substitution is awarded for substitution into the correct formula.
Die punt vir substitusie word toegeken vir substitusie in die korrekte formule.

QUESTION 1/VRAAG 1

1.1	$2x(x + 1) - 7(x + 1) = 0$ $(x + 1)(2x - 7) = 0$ $x = -1 \quad \text{or / of} \quad x = \frac{7}{2}$	✓ factors/faktore ✓ x-value/waarde ✓ x-value/waarde (3)
1.2	$x^2 - 5x - 1 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $x = \frac{-(-5) \pm \sqrt{(-5)^2 - 4(1)(-1)}}{2(1)}$ $x = 5,19 \quad \text{or} \quad x = -0,19$	✓ substitution into correct formula/substitusie in korrekte formule ✓✓ x-values/waardes (3)
1.3	$4x^2 + 1 \geq 5x$ $4x^2 - 5x + 1 \geq 0$ $(4x - 1)(x - 1) \geq 0$ $\begin{array}{c c c} + & & - \\ \hline & \frac{1}{4} & 1 \\ \hline & & + \end{array}$ $x \leq \frac{1}{4} \quad \text{or/ of} \quad x \geq 1$	✓ standard form/standaard vorm ✓ factors/faktore ✓ $x \leq \frac{1}{4}$ ✓ $x \geq 1$ (4)
1.4	$5^{4x+3} \cdot 100^{-2x+1} = 50\,000$ $5^{4x+3} \cdot (5^2 \cdot 2^2)^{-2x+1} = 50\,000$ $5^{4x+3} \cdot 5^{-4x+2} \cdot 2^{-4x+2} = 50\,000$ $5^5 \cdot 2^{-4x} \cdot 2^2 = 50\,000$ $2^{-4x} = 2^2$ $-4x = 2$ $x = -\frac{1}{2}$	✓ 5^{-4x+2} ✓ 2^{-4x+2} ✓ $-4x = 2$ ✓ answer/antwoord (4)

<p>1.5</p>	<p>$x = 2y$(1) $x^2 + 2x - y - y^2 = 36$.....(2)</p> <p>$x = 2y$ sub into (2)/vervang in (2) $(2y)^2 + 2(2y) - y - y^2 = 36$ $4y^2 + 4y - y - y^2 = 36$ $3y^2 + 3y - 36 = 0$ $y^2 + y - 12 = 0$ $(y - 3)(y + 4) = 0$ $y = 3$ or $y = -4$</p> <p>$x = 6$ or $x = -8$</p>	<p>✓ substitution/<i>vervanging</i></p> <p>✓ standard form/<i>standaardvorm</i></p> <p>✓ factors/<i>faktore</i></p> <p>✓ y – values/<i>y – waardes</i></p> <p>✓ x – values/<i>x – waardes</i></p> <p>(5)</p>
<p>1.6</p>	<p>$x^2 - kx + k - 1 = 0$ $\Delta = b^2 - 4ac$ $\Delta = (-k)^2 - 4(1)(k - 1)$ $\Delta = k^2 - 4k + 4$ $\Delta = (k - 2)^2$ $\Delta \geq 0$ roots are real and rational(perfect square)</p>	<p>✓ substitution/<i>vervanging</i></p> <p>✓ simplification/<i>vereenvoudiging</i></p> <p>✓ $(k - 2)^2$</p> <p>✓ conclusion/<i>gevolgtrekking</i></p> <p>(4)</p>
<p>[23]</p>		

QUESTION 2/VRAAG 2

<p>2.1.1</p>	<p>$T_n = 4n - 1$ $483 = 4n - 1$ $484 = 4n$ $n = 121$ 121 terms in series/ <i>121 terme in reeks</i></p>	<p>✓ $T_n = 4n - 1$</p> <p>✓ equating/<i>gelykstelling</i> 483</p> <p>✓ answer/<i>antwoord</i></p> <p>(3)</p>
<p>2.1.2</p>	<p>$\sum_{n=1}^{121} (4n - 1)$</p>	<p>✓✓ answer/<i>antwoord</i></p> <p>(2)</p>
<p>2.2.1</p>	<p>$(t - 3) - (2t - 4) = (8 - 2t) - (t - 3)$ $-t + 1 = -3t + 11$ $2t = 10$ $t = 5$</p>	<p>✓ setting up equation/<i>opstel van vergelyking</i></p> <p>✓ simplification/<i>vereenvoudig</i></p> <p>✓ answer/<i>antwoord</i></p> <p>(3)</p>
<p>2.2.2</p>	<p>...; ...; ... 6; 2; -2; ...; ...; ...</p> <p>$T_{10} = 6$ or /of $T_n = -4n + 46$ $a + 9d = 6$ $T_1 = -4(1) + 46$ $a + 9(-4) = 6$ $T_1 = 42$ $a = 42$</p>	<p>✓ numerical values of $T_{10}; T_{11}; T_{12}$/<i>numeriese waardes van $T_{10}; T_{11}; T_{12}$</i></p> <p>✓ difference / <i>verskil</i> -4</p> <p>✓ a-value/<i>a-waarde</i></p> <p>(3)</p>

2.3	$ar^2 + ar^3 = -4$ $a + ar = -1$ $\frac{ar^2(1+r) = -4}{a(1+r) = -1}$ $\therefore r^2 = 4$ $\therefore r = \pm 2$ $a + a(2) = -1$ $\therefore a + 2a = -1$ $3a = -1$ $a = -\frac{1}{3}$ <p>First three terms: $-\frac{1}{3}; -\frac{2}{3}; -\frac{4}{3}$ <i>Eerste drie terme:</i></p>	<p>✓✓ setting of equations/ <i>opstel van vergelykings</i></p> <p>✓ common factor/<i>gemene faktor</i></p> <p>✓ $r = 2$</p> <p>✓ value of a/<i>waarde van a</i></p> <p>✓ first three terms/<i>eerste drie terme ry</i></p> <p style="text-align: right;">(6)</p>
		[17]

QUESTION 3/VRAAG 3

3.1	<p>41 ; 43 ; 47 ; 53 ; 61 ; 71 ; 83 ; 97 ; 113 ; 131</p> $\begin{array}{cccccccc} 2 & 4 & 6 & 8 & 10 & 12 & 14 & 16 & 18 \\ & 2 & 2 & 2 & 2 & 2 & 2 & 2 & 2 \end{array}$ $2a = 2 \quad a + b = 2 \quad a + b + c = 41$ $a = 1 \quad b = -1 \quad c = 41$ $\therefore T_n = n^2 - n + 41$	<p>✓ 2nd difference/ <i>tweede verskil</i></p> <p>✓ $a = 1$</p> <p>✓ $b = -1$</p> <p>✓ $c = 41$</p> <p>✓ $T_n = n^2 - n + 41$</p> <p style="text-align: right;">(5)</p>
3.2	$T_{41} = 41^2 - 41 + 41$ $T_{41} = 1681$ <p>Factors of 1681: 1 ; 41 and 1681 Faktore van 1681 : 1 ; 41 en 1681</p> <p>1681 is not a prime number/ <i>1681 is nie 'n priemgetal nie</i></p>	<p>✓ $T_{41} = 1681$</p> <p>✓ factors / <i>faktore</i></p> <p>✓ conclusion/ <i>gevolgtrekking</i></p> <p style="text-align: right;">(3)</p>
3.3	<p>Consider the unit digits only/<i>kyk na die ene syfers alleenlik.</i></p> <p>1 ; 3 ; 7 ; 3 ; 1 ; 1 ; 3 ; 7 ; 3 ; 1 ;</p> <p>groups of 5/ <i>groepe van 5</i></p> $\begin{array}{r} 49999998 \\ \underline{\quad 5} \\ 9999999,6 \end{array}$ $0,6 \times 5 = 3$ <p>$T_{49999998}$ will end in 7/ <i>sal met 'n 7 eindig</i></p>	<p>✓ unit digits/<i>ene syfers</i></p> <p>✓ groups of 5/ <i>groepe van 5</i></p> <p>✓ conclusion/ <i>gevolgtrekking</i></p> <p style="text-align: right;">(3)</p>
		[11]

QUESTION 4/VRAAG 4

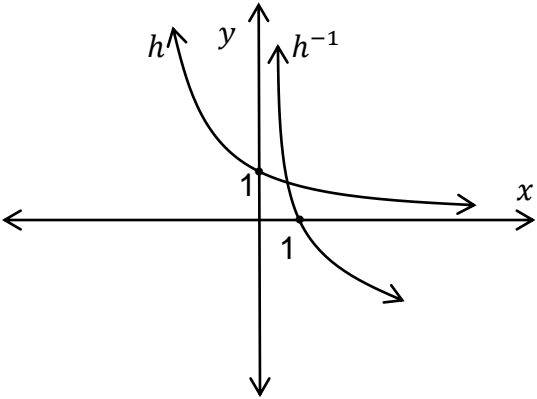
<p>4.1.1</p>	$A = P(1 + i)^n$ $A = 500\,000 \left(1 + \frac{7,2}{1200}\right)^{12n}$ $A = 500\,000(1.006)^{12n}$	<p>✓ sub into formula/ <i>vervang in formule</i> ✓ 12n (2)</p>
<p>4.1.2</p>	$A = 500\,000(1.006)^{12n}$ $A = 500\,000(1.006)^{12 \times 5}$ $A = R\,715\,894.21$	<p>✓ $n = 60$ ✓ answer/ <i>antwoord</i> (2)</p>
<p>4.1.3</p>	$A = P(1 + i)^n$ $10\,000\,000 = 500\,000(1.006)^{12n}$ $12n = \frac{\log 2}{\log 1.006}$ $12n = 115.8707581$ $n = 9,66 \text{ years}$ <p>Will exceed R1 000 000 in 10 years. <i>Sal R1 000 000 oorskry in 10 jaar.</i></p>	<p>✓ setting up equation/<i>opstel van vergelyking</i> ✓ using logs/ <i>gebruik van log</i> ✓ conclusion/<i>gevolgtrekking</i> (3)</p>
<p>4.2.1</p>	$P_v = \frac{10\,000 \left[1 - \left(1 + \frac{15}{1200}\right)^{-36}\right]}{\frac{15}{1200}}$ $P_v = R288\,472,67$ <p><i>deposit/o = R350 000 – R288 472,67</i> <i>deposit/o = R61 527,33</i></p>	<p>✓ i and/<i>en</i> n ✓ sub into P_v formula/ <i>vervang in P_v formule</i> ✓ $P_v = R288\,472,67$ ✓ subtracting/<i>af trekking</i> ✓ answer/<i>antwoord</i> (5)</p>
<p>4.2.2</p>	$350\,000 = \frac{x \left[1 - \left(1 + \frac{18,5}{1200}\right)^{-60}\right]}{\frac{18,5}{1200}}$ $x = R\,8\,983,17$	<p>✓ $i = \frac{18,5}{1200}$ ✓ $n = -60$ ✓ substitution/<i>substitusie</i> ✓ answer/<i>antwoord</i> (4)</p>
		<p>[16]</p>

QUESTION 5/VRAAG 5

5.1	$A(-3; 0)$	✓ answer/antwoord (1)
5.2	$f(x) = x^2 + 3x$ $x = -\frac{b}{2a}$ $x = -\frac{3}{2}$ $f\left(-\frac{3}{2}\right) = \left(-\frac{3}{2}\right)^2 + 3\left(-\frac{3}{2}\right)$ $= \frac{9}{4} - \frac{9}{2}$ $P\left(-\frac{3}{2}; -\frac{9}{4}\right)$	✓ $x = -\frac{3}{2}$ ✓ substitution/ vervanging ✓ answer/ antwoord (3)
5.3	$f(-5) = 10$ and / en $f(-3) = 0$ $m = \frac{10 - 0}{-5 - (-3)}$ $m = -5$	✓ calculating $f(-5)$ and $f(-3)$ <i>bepaling van $f(-5)$ en $f(-3)$</i> ✓ substitution/substitusie ✓ m -value/waarde (3)
5.4	$x < -3$ or / of $x > 0$	✓✓ answer/ antwoord (2)
5.5	$P\left(-\frac{3}{2}; -\frac{9}{4}\right)$ $\left(-\frac{3}{2} - 2; -\frac{9}{4}\right)$ $\left(-\frac{1}{2}; -\frac{9}{4}\right)$ or/of $f(x - 2) = (x - 2)(x - 2 + 3)$ $f(x - 2) = x^2 - x - 2$ $x = -\frac{(-1)}{2(1)}$ $x = -\frac{1}{2}$	✓✓ answer/ antwoord ✓ $f(x - 2) = x^2 - x - 2$ ✓ $x = -\frac{1}{2}$ (2)

<p>5.6</p> $LM = -\frac{1}{2}x + 2 - (x^2 + 3x)$ $LM = -\frac{1}{2}x + 2 - x^2 - 3x$ $LM = -x^2 - \frac{7}{2}x + 2$ $LM = -\left(x^2 + \frac{7}{2}x - 2\right)$ $LM = -\left[\left(x + \frac{7}{4}\right)^2 - \frac{81}{16}\right]$ $LM = -\left(x + \frac{7}{4}\right)^2 + \frac{81}{16}$ <p>OR/OF</p> $LM = -\frac{1}{2}x + 2 - (x^2 + 3x)$ $LM = -\frac{1}{2}x + 2 - x^2 - 3x$ $LM = -x^2 - \frac{7}{2}x + 2$ $\frac{dLM}{dx} = -2x - \frac{7}{2}$ $-2x - \frac{7}{2} = 0$ $x = -\frac{7}{4}$ $y = -\left(-\frac{7}{4}\right)^2 - \frac{7}{2}\left(-\frac{7}{4}\right) + 2$ $y = \frac{81}{16}$ $\therefore LM = -\left(x + \frac{7}{4}\right)^2 + \frac{81}{16}$ <p>OR/OF</p> $x = -\frac{b}{2a}$ $x = -\frac{-\frac{7}{2}}{2(-1)}$ $x = -\frac{7}{4}$ $y = -\left(-\frac{7}{4}\right)^2 - \frac{7}{2}\left(-\frac{7}{4}\right) + 2$ $y = \frac{81}{16}$ $\therefore LM = -\left(x + \frac{7}{4}\right)^2 + \frac{81}{16}$	<p>✓ $g(x) - f(x)$</p> <p>✓ standard form/<i>standaardvorm</i></p> <p>✓ completing the square/ <i>voltooiing van kwadraat</i></p> <p>✓ answer/<i>antwoord</i></p> <p>✓ $g(x) - f(x)$</p> <p>✓ standard form/<i>standaardvorm</i></p> <p>✓ $x = -\frac{7}{4}$</p> <p>✓ $y = \frac{81}{16}$</p> <p>✓ $g(x) - f(x)$</p> <p>✓ standard form/<i>standaardvorm</i></p> <p>✓ $x = -\frac{7}{4}$</p> <p>✓ $y = \frac{81}{16}$</p>	
		(4)
		[15]

QUESTION 6/VRAAG 6

6.1		✓ shape / vorm ✓ y – intercept/ y – afsnit ✓ point on graph/punt op grafiek (3)
6.2	$q(x) = 2^x$	✓ answer/antwoord (1)
6.3	$h^{-1}x = 2^{-y}$ $-y = \frac{\log x}{\log 2}$ $y = -\frac{\log x}{\log 2} / y = -\log_2 x / y = \log_{\frac{1}{2}} x$	✓ interchange x and y <i>ruil x en y</i> ✓ equation/vergeliking (2)
6.4	$y \geq 0 ; y \in R$	(1)
6.5	See 7.2.1/ sien 7.2.1	✓✓ shape and x-intercept/vorm <i>en x-afsnit</i> (2)
6.6	$\log_{\frac{1}{2}} x = -3$ $\left(\frac{1}{2}\right)^{-3} = x$ $x = 8$ $\therefore 0 < x \leq 8$	✓ $x = 8$ ✓ $0 < x \leq 8$ (2)
		[11]

QUESTION 7/VRAAG 7

7.1	$d = 5$ $p = 2$	$\checkmark d = 5$ $\checkmark p = 2$	(2)
7.2	$y = \frac{5-x}{x-2}$ $y = \frac{-(x-2)+3}{(x-2)}$ $y = \frac{3}{x-2} - 1$	$\checkmark y = \frac{5-x}{x-2}$ $\checkmark y = \frac{-(x-2)+3}{(x-2)}$	(2)
7.3	$A(5; 0)$ $y = x - 3$ $x = y + 3$ $A'(0 + 3; 5 - 3)$ $A'(3; 2)$	$\checkmark x = 3$ $\checkmark y = 2$	(2)
			[6]

QUESTION 8/VRAAG 8

8.1	$f(x) = -2x^2 + p$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{-2(x+h)^2 + p - (-2x^2 + p)}{h}$ $= \lim_{h \rightarrow 0} \frac{-2(x^2 + 2xh + h^2) + p + 2x^2 - p}{h}$ $= \lim_{h \rightarrow 0} \frac{-2x^2 - 4xh - 2h^2 + p + 2x^2 - p}{h}$ $= \lim_{h \rightarrow 0} \frac{-4xh - 2h^2}{h}$ $= \lim_{h \rightarrow 0} \frac{h(-4x - 2h)}{h}$ $= \lim_{h \rightarrow 0} (-4x - 2h)$ $= -4x$ <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p>Answer ONLY: 0 marks/ SLEGS antwoord: 0 punte</p> </div> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p>Penalise 1 mark for incorrect use of formula. Must show $f'(x)$. <i>Penaliseer 1 punt vir verkeerde gebruik van formule. Moet $f'(x)$ toon.</i></p> </div>	<p>✓ formula/formule</p> <p>✓ substitution of/substitusie van (x + h)</p> <p>✓ simplification to/ vereenvoudiging na (-4xh - 2h²)</p> <p>✓ common factor/gemene faktor</p> <p>✓ answer/antwoord</p> <p style="text-align: right;">(5)</p>
8.2	$D_x \left[4\sqrt[3]{x} + \frac{1}{3x} + 2 \right]$ $D_x \left[4x^{\frac{1}{3}} + \frac{1}{3}x^{-1} + 2 \right]$ $= \frac{4}{3}x^{-\frac{2}{3}} - \frac{1}{3}x^{-2}$ <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p>Penalise 1 mark for incorrect notation. / <i>Penaliseer 1 punt vir verkeerde notasie.</i></p> </div>	<p>✓ $4x^{\frac{1}{3}}$ ✓ $\frac{1}{3}x^{-1}$</p> <p>✓ $\frac{4}{3}x^{-\frac{2}{3}}$ ✓ $-\frac{1}{3}x^{-2}$</p> <p style="text-align: right;">(4)</p>
[9]		

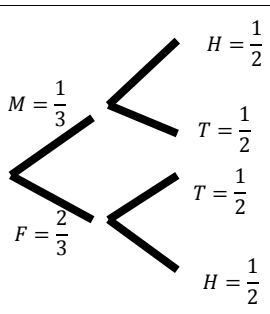
QUESTION 9/VRAAG 9

<p>9.1</p>	$f(x) = (x - 1)^2(x + 3)$ $f(x) = x^3 + x^2 - 5x + 3$ $f'(x) = 3x^2 + 2x - 5$ $3x^2 + 2x - 5 = 0$ $(3x + 5)(x - 1) = 0$ $x = -\frac{5}{3} \text{ or / of } x = 1$ $f(1) = 0$ $f\left(-\frac{5}{3}\right) = \frac{256}{27}$	<p>✓ $f(x) = x^3 + x^2 - 5x + 3$</p> <p>✓ $f'(x) = 0$</p> <p>✓ factors/faktore</p> <p>✓ x-values/waardes</p> <p>✓ y-values/waardes</p> <p style="text-align: right;">(5)</p>
<p>9.2</p>		<p>✓ shape / vorm</p> <p>✓ x - intercepts/x - afsnitte</p> <p>✓ y - intercept/y - afsnit</p> <p>✓ stationary points/draaipunte</p> <p style="text-align: right;">(4)</p>
<p>9.3</p>	$f''(x) = 6x + 2$ $6x + 2 = 0$ $x = -\frac{1}{3}$ $y = \frac{128}{27} / 4,74 / 4 \frac{20}{27}$	<p>✓ $f''(x) = 6x + 2$</p> <p>✓ $x = -\frac{1}{3}$</p> <p>✓ $y = \frac{128}{27} / 4,74 / 4 \frac{20}{27}$</p> <p style="text-align: right;">(3)</p>
<p>9.4</p>	$0 < k < \frac{256}{27}$	<p>✓✓ answer</p> <p style="text-align: right;">(2)</p>
<p>9.5</p>	$f'(x) = 3x^2 + 2x - 5$ $3x^2 + 2x - 5 = -5$ $3x^2 + 2x = 0$ $x(3x + 2) = 0$ $x = 0 \text{ or/of } x = -\frac{2}{3}$ $f\left(-\frac{2}{3}\right) = \frac{175}{27}$ $y = -5x + c$ $\frac{175}{27} = -5\left(-\frac{2}{3}\right) + c$ $c = \frac{85}{27}$ $y = -5x + \frac{85}{27}$	<p>✓ $f'(x) = -5$</p> <p>✓ factors/ faktore</p> <p>✓ $x = -\frac{2}{3}$</p> <p>✓ $f\left(-\frac{2}{3}\right) = \frac{175}{27}$</p> <p>✓ substitution/vervanging</p> <p>✓ answer/antwoord</p> <p style="text-align: right;">(6)</p>
		<p>[20]</p>

QUESTION 10/VRAAG 10

10.1	$243 = 2(x \times 2x) + 2(2x \times h) + 2(x \times h)$ $243 = 4x^2 + 4xh + 2xh$ $243 = 4x^2 + 6xh$ $h = \frac{243 - 4x^2}{6x}$ $h = \frac{81}{2x} - \frac{2x}{3}$	✓TSA equation and sub/ TOA <i>vergelyking met vervanging</i> ✓simplification/ <i>vereenvoudiging</i> (2)
10.2	$V = 2x \times x \times \left(\frac{81}{2x} - \frac{2x}{3}\right)$ $V = 81x - \frac{4}{3}x^3$	✓ sub into volume formula/ <i>vervang in volume formule</i> (1)
10.3	$\frac{dV}{dx} = 81 - 4x^2$ $81 - 4x^2 = 0$ $x^2 = \frac{81}{4}$ $x = \frac{9}{2} = 4.5$	✓ $81 - 4x^2$ ✓ $81 - 4x^2 = 0$ ✓ $x^2 = \frac{81}{4}$ ✓answer/ <i>antwoord</i> (4)
		[7]

QUESTION 11/VRAAG 11

11.1	$9 \times 9 \times 9 \times 5 \times 4 = 14580$	$\checkmark 9 \times 9 \times 9$ $\checkmark 5 \times 4$ $\checkmark 14580$ (3)
11.2.1	$\frac{12!}{2! \cdot 2!} = 119750400$	$\checkmark 12!$ $\checkmark 2! \cdot 2!$ $\checkmark 119750400$ (3)
11.2.2	$\frac{\frac{10!}{2!}}{119750400} = \frac{1}{66} = 0,015$	$\checkmark \frac{10!}{2!}$ $\checkmark 119750400$ \checkmark answer/antwoord (3) [9]
11.3.1		\checkmark first branch with values/ <i>eerste tak met waardes</i> \checkmark top part of second branch with values / <i>boonste gedeelte</i> van tweede tak met waardes \checkmark bottom part of second branch with values / <i>onderste gedeelte</i> van tweede tak met waardes (3)
11.3.2	$P(F) = \frac{2}{3}$	$\checkmark P(F) = \frac{2}{3}$ (1)
11.3.3	$P(M/H) = \frac{1}{3} \times \frac{1}{2}$ $P(M/H) = \frac{1}{6}$	$\checkmark \checkmark P(M/H) = \frac{1}{6}$ (2)
		[15]
		TOTAL/TOTAAL: 150