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GRADE/GRAAD 12

JUNE/JUNIE 2023

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

MARKS/PUNTE: 150

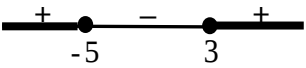
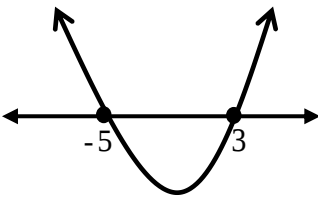
This marking guideline consists of 15 pages./
Hierdie nasienriglyn bestaan uit 15 bladsye.

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(CA) 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 vir substitusie in die korrekte formule toegeken.

QUESTION 1/VRAAG 1

1.1.1	$x^2 - 9 = 0$ $(x+3)(x-3) = 0$ $x+3 = 0$ or/of $x-3 = 0$ $x = -3$ or/of $x = 3$ OR / OF $x^2 - 9 = 0$ $x^2 = 9$ $x = \pm\sqrt{9}$ $x = \pm 3$ OR / OF $x^2 - 9 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{-(0) \pm \sqrt{(0)^2 - 4(1)(-9)}}{2(1)}$ $= \frac{\pm\sqrt{36}}{2}$ $x = -3$ or / of $x = 3$ Answers only – Full marks <i>Slegs antwoorde - Volpunte</i>	OR / OF ✓ factors / <i>faktore</i> ✓ both answers / <i>beide antwoorde</i> ✓ correct substitution into correct formula / <i>korrekte vervanging in korrekte formule</i> ✓ both answers / <i>beide antwoorde</i> (2)
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1.1.2	$x - 5 + \frac{2}{x} = 0$ $x^2 - 5x + 2 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $x = \frac{-(-5) \pm \sqrt{(-5)^2 - 4(1)(2)}}{2(1)}$ $x = \frac{5 \pm \sqrt{17}}{2}$ $\therefore x = 4,56 \text{ or/of } x = 0,44$ Penalise 1 mark for incorrect rounding off. / Penaliseer 1 punt vir verkeerde afronding.	✓ standard form / <i>standaardvorm</i> ✓ substitution / <i>vervanging</i> ✓✓ x-values / <i>waardes</i> (4)
1.1.3	$x = 1 + \sqrt{7 - x}$ $x - 1 = \sqrt{7 - x}$ $(x - 1)^2 = (\sqrt{7 - x})^2$ $x^2 - 2x + 1 = 7 - x$ $x^2 - x - 6 = 0$ $(x + 2)(x - 3) = 0$ $\therefore x \neq -2 \text{ or / of } x = 3$	✓ isolating surd / <i>isoleer wortelvorm</i> ✓ square both sides / <i>kwadreer beide kante</i> ✓ standard form / <i>standaardvorm</i> ✓ factors / <i>faktore</i> ✓ selection / <i>keuse</i> (5)
1.1.4	$x^2 + 2x - 15 \geq 0$ $(x + 5)(x - 3) \geq 0$ critical values/kritieke waardes $x = -5 \text{ or/of } x = 3$   $x \leq -5 \text{ or/of } x \geq 3, x \in \mathbf{R}$ OR/OF $x \in (-\infty; -5] \text{ or/of } x \in [3; \infty), x \in \mathbf{R}$	✓ critical values / <i>kritieke waardes</i> ✓✓ $x \leq -5 \text{ or/of } x \geq 3, x \in \mathbf{R}$ (accuracy / <i>akkuraatheid</i>) OR/OF $x \in (-\infty; -5] \text{ or/of } x \in [3; \infty), x \in \mathbf{R}$ (3)

1.2	$y + 2x = 3$(1) $y^2 - y = 3x^2 - 5x$(2) <i>From / Vanaf</i> (1): $y = -2x + 3$(3) (3) into/in (2): $(-2x + 3)^2 - (-2x + 3) = 3x^2 - 5x$ $4x^2 - 12x + 9 + 2x - 3 = 3x^2 - 5x$ $4x^2 - 12x + 9 + 2x - 3 - 3x^2 + 5x = 0$ $x^2 - 5x + 6 = 0$ $(x - 2)(x - 3) = 0$ $x = 2$ or/of $x = 3$ $y = -1$ or/of $y = -3$ OR / OF $y + 2x = 3$(1) $y^2 - y = 3x^2 - 5x$(2) $x = \frac{3 - y}{2}$(3) Subst./ Verv. (3) into / in (2): $y^2 - y = 3\left(\frac{3 - y}{2}\right)^2 - 5\left(\frac{3 - y}{2}\right)$ $y^2 - y = 3\left(\frac{9 - 6y + y^2}{4}\right) - 5\left(\frac{3 - y}{2}\right)$ $y^2 - y = \frac{27 - 18y + 3y^2}{4} + \frac{-15 + 5y}{2}$ $4y^2 - 4y - 27 + 18y - 3y^2 + 30 - 10y = 0$ $y^2 + 4y + 3 = 0$ $(y + 1)(y + 3) = 0$ $y = -1$ or / of $y = -3$ $x = 2$ or / of $x = 3$	✓ $y = -2x + 3$ ✓ substitution / vervanging ✓ standard form / standaardvorm ✓ factors / faktore ✓ x-values / waardes ✓ y-values / waardes OR / OF ✓ $x = \frac{3 - y}{2}$ ✓ substitution / vervanging ✓ standard form / standaardvorm ✓ factors / faktore ✓ y-values / waardes ✓ x-values / waardes (6)
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1.3	$\sqrt[n]{\frac{10^n + 2^{n+2}}{5^{2n} + 4(5^n)}}$ $= \left[\frac{2^n \times 5^n + 2^n \cdot 2^2}{5^n \cdot 5^n + 4(5^n)} \right]^{\frac{1}{n}}$ $= \left[\frac{2^n(5^n + 4)}{5^n(5^n + 4)} \right]^{\frac{1}{n}}$ $= \left[\left(\frac{2}{5} \right)^n \right]^{\frac{1}{n}}$ $= \frac{2}{5}$	✓ $\frac{2^n \times 5^n + 2^n \cdot 2^2}{5^n \cdot 5^n + 4(5^n)}$ ✓ factors / faktore ✓ changing surd to exponent / verandering van wortel na eksponent ✓ answer / antwoord (4)
		[24]

QUESTION 2/VRAAG 2

2.1.1	$r = \frac{T_3}{T_2} = \frac{6x}{12}$ $= \frac{x}{2}$	✓ answer / antwoord (1)
2.1.2	$-1 < r < 1$ $-1 < \frac{x}{2} < 1$ $-2 < x < 2$	✓ substitution / vervanging ✓ answer / antwoord (2)
2.1.3	$x = 4 \Rightarrow a = 6 \text{ \& } r = 2$ $S_{15} = \frac{a(r^{15} - 1)}{r - 1}$ $= \frac{6(2^{15} - 1)}{2 - 1}$ $= 196602$	✓ values of a and r / waardes van a en r ✓ substitution / vervanging ✓ answer / antwoord (3)
2.2	$T_1 = 6(2)^{-1} = 3$ $T_2 = 6(2)^{-2} = \frac{3}{2}$ $\therefore r = \frac{1}{2}$ $S_{\infty} = \frac{a}{1 - r}$ $= \frac{3}{1 - \frac{1}{2}}$ $= 6$	✓ values of a and r / waardes van a en r ✓ substitution / vervanging ✓ answer / antwoord (3)

2.3.1	$S_{15} = -(15)^2 + 8(15)$ $= -105$	✓ substitution / <i>vervanging</i> ✓ answer / <i>antwoord</i> (2)
2.3.2	$T_{15} = S_{15} - S_{14}$ $= -105 - (-84)$ $= -21$	✓ method / <i>metode</i> ✓ answer / <i>antwoord</i> (2)
2.3.3	$T_1 = S_1 = 7$ $S_2 = -(2)^2 + 8(2) = 12$ $\therefore T_2 = 5$ $\Rightarrow d = -2$ $a + (n-1)d = T_n$ $7 + (n-1)(-2) = -169$ $7 - 2n + 2 = -169$ $-2n = -178$ $n = 89$ OR / OF $S_n - S_{n-1} = T_n$ $-n^2 + 8n - [-(n-1)^2 + 8(n-1)] = -169$ $-n^2 + 8n - [-n^2 + 2n - 1 + 8n - 8] = -169$ $-n^2 + 8n + n^2 - 2n + 1 - 8n + 8 = -169$ $-2n = -178$ $n = 89$	$a + 14d = -21$ $7 + 14d = -21$ $14d = -28$ $d = -2$ ✓ $T_2 = 5$ OR / OF $14d = -28$ ✓ $d = -2$ ✓ substitution / <i>vervanging</i> ✓ answer / <i>antwoord</i> OR / OF ✓ formula / <i>formule</i> ✓ substitution / <i>vervanging</i> ✓ simplification / <i>vereenvoudiging</i> ✓ answer / <i>antwoord</i> (4)
		[17]

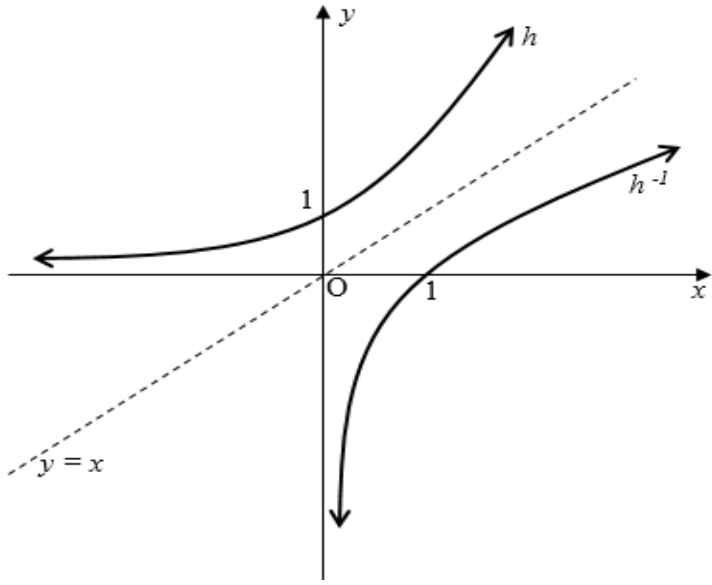
QUESTION 3/VRAAG 3

3.1	$95 ; 72 ; y ; 32 ; \dots$ $-23 ; y - 72 ; 32 - y ; \dots$ (first diff. / eerste verskille) $y - 49 ; -2y + 104$ $\therefore y - 49 = -2y + 104$ $3y = 153$ $y = 51$	✓ equating 2 nd differences / gelykstel van 2 ^{de} verskille ✓ answer / antwoord (2)
3.2	$\begin{array}{ccccccc} 95 & ; & 72 & ; & 51 & ; & 32 \\ & -23 & ; & -21 & ; & -19 & \\ & & 2 & ; & 2 & & \end{array}$ $2a = 2 \quad 3(1) + b = -23 \quad 1 - 26 + c = 95$ $a = 1 \quad b = -26 \quad c = 120$ $T_n = n^2 - 26n + 120$	✓ 2 nd difference / 2 ^{de} verskil ✓ $a = 1$ ✓ $b = -26$ ✓ $c = 120$ (4)
3.3	$T_{22} = (22)^2 - 26(22) + 120$ $= 32$	✓ answer / antwoord (1)
3.4	$n^2 - 26n + 120 = 1040$ $n^2 - 26n - 920 = 0$ $(n - 46)(n + 20) = 0$ $n = 46$ or / of $n \neq -20$ OR / OF $n^2 - 26n + 120 = 1040$ $n^2 - 26n - 920 = 0$ $n = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{-(-26) \pm \sqrt{(-26)^2 - 4(1)(-920)}}{2(1)}$ $\therefore n = 46$ or / of $n \neq -20$	✓ equating / gelykstel ✓ standard form / standaardvorm ✓ factors / faktore ✓ answer / antwoord OR / OF ✓ equating / gelykstel ✓ standard form / standaardvorm ✓ substitution / vervanging ✓ answer / antwoord (4)
		[11]

QUESTION 4/VRAAG 4

4.1	$S(0;3)$	✓✓ answer / antwoord (2)
4.2.1	$x = -\frac{b}{2a} = -\frac{10}{2(-5)}$ $y = 5(-1)^2 + 10(-1) + 3$ $x = -1$ $y = -2$ $T(-1; -2)$	✓ method /metode ✓ x-coordinate / x-koördinaat ✓ substitution / vervanging ✓ y-coordinate / y-koördinaat (4)
4.2.2	$p = 1$ and / en $q = -2$	✓ $p = 1$ ✓ $q = -2$ (2)
4.2.3	$\frac{5}{x+1} - 2 = 0$ $\therefore x = \frac{3}{2}$ $\Rightarrow \text{OR} = 1,5 \text{ units / eenhede}$	✓ equating to 0 / stel gelyk aan 0 ✓ answer / antwoord (2)
4.2.4	$y \geq -2$; $y \in \square$	✓✓ answer / antwoord (2)
4.3.1	$m = 10x + 10$ $y - y_1 = m(x - x_1)$ $= 10(0) + 10$ $y - 3 = 10(x - 0)$ $= 10$ $y = 10x + 3$	✓ $m = 10$ ✓ substitution into eqn of line / vervanging in verg. van lyn ✓ answer / antwoord (3)
4.3.2	$y = (x+1) - 2$ $y = x + k$ $y = x - 1$ OR / OF $-2 = -1 + k$ $k = -1$ $\therefore y = x - 1$	✓ substitution / vervanging ✓ answer / antwoord (2)
4.4	$x \geq \frac{3}{2}$	✓✓ answer / antwoord (A) (2)
		[19]

QUESTION 5/VRAAG 5

5.1	$h(x) = a^x$ $\frac{1}{2} = a^{-1}$ $\therefore a = 2$	✓ substitution / vervanging ✓ answer / antwoord (2)
5.2	$y = 2^x$ $x = 2^y$ $\therefore h^{-1}(x) : y = \log_2 x$	✓ interchanging x and y / omruil van x en y ✓ answer / antwoord (2)
5.3		✓ y-intercept for h / y-afsnit vir h ✓ shape and asymptote of h vorm en asimptoot van h ✓ x-intercept for h^{-1} / x-afsnit vir h^{-1} ✓ shape and asymptote of h^{-1} vorm en asimptoot van h^{-1} (4)
5.4	$x > 0 ; x \in \square$	✓ answer / antwoord (1)
5.5	$x > 2 ; x \in \square$ OR / OF $\log_2 x > 1$ $\therefore x > 2$ (algebraically/algebraïes)	✓ answer / antwoord OR / OF ✓ answer / antwoord (1)
5.6.1	$t(x) = \left(\frac{1}{2}\right)^x - 1$ $= 2^{-x} - 1$ $\Rightarrow$ reflection about the y -axis / refleksie om die y -as shift of 1 unit down / skuif van 1 eenheid af	✓ reflection / refleksie ✓ shift / skuif (2)
5.6.2	$y = -1$	✓ answer / antwoord (1)
		[13]

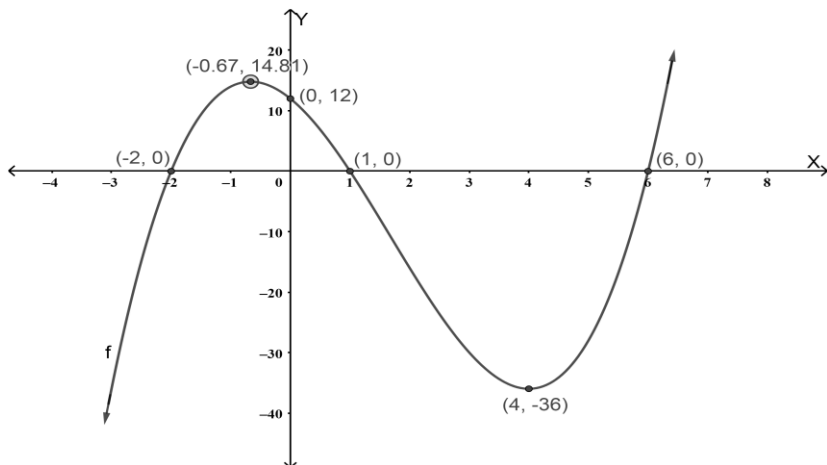
QUESTION 6/VRAAG 6

6.1	$A = P(1-i)^n$ $A = 980\,000(1-9,2\%)^7$ $A = R498\,685,82$	✓ formula / formule ✓ substitution / vervanging ✓ answer / antwoord (3)
6.2	$A = P(1+i)^n$ $20\,020,28 = 13\,500(1+8,2\%)^n$ $1,4829837037 = 1,082^n$ $\therefore n = \log_{(1,082)} [1,4829837037]$ $n = 5 \text{ years / jaar}$	✓ substitution / vervanging ✓ simplification / vereenvoudiging ✓ use of logs / gebruik van logs ✓ answer / antwoord (4)
6.3	Amount in savings account / <i>Bedrag in spaarrekening</i> : $= 3500 \left(1 + \frac{0,07}{4}\right)^8 \left(1 + \frac{0,08}{12}\right)^{36} + 5700 \left(1 + \frac{0,08}{12}\right)^{24}$ $= R11793,19$ OR / OF $A_1 = 3500 \left(1 + \frac{7\%}{4}\right)^8 = R4\,021,08624$ $A_2 = 4\,021,08624 \left(1 + \frac{8\%}{12}\right)^{12} = R4\,354,834415$ $A_3 = 4\,354,83441 + 5\,700 = R10\,054,834415$ Final Amount / <i>Finale Bedrag</i> $= 10\,054,83441 \left(1 + \frac{8\%}{12}\right)^{24}$ $= R11793,19$	✓ $n = 8$ and / en $i = 0,07/4$ ✓ substitution / vervanging ✓ $n = 36$ and / en $i = 0,08/12$ ✓ substitution / vervanging ✓ addition / optelling ✓ answer / antwoord OR / OF ✓ $n = 8$ and / en $i = 0,07/4$ ✓ substitution / vervanging ✓ $n = 12$ and / en $i = 0,08/12$ ✓ addition / optelling ✓ substitution / vervanging ✓ answer / antwoord (6)
		(6)
		[13]

QUESTION 7/VRAAG 7

7.1	$f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{5 - 2(x+h)^2 - (5 - 2x^2)}{h}$ $= \lim_{h \rightarrow 0} \frac{5 - 2x^2 - 4xh - 2h^2 - 5 + 2x^2}{h}$ $= \lim_{h \rightarrow 0} \frac{-4xh - 2h^2}{h}$ $= \lim_{h \rightarrow 0} \frac{h(-4x - 2h)}{h}$ $= \lim_{h \rightarrow 0} (-4x - 2h)$ $= -4x$ Answer ONLY: 0 marks SLEGS antwoord: 0 punte	Penalise 1 mark for incorrect notation in this question Penaliseer 1 punt vir verkeerde notasie in hierdie vraag ✓ $5 - 2x^2 - 4xh - 2h^2$ ✓ simplification / vereenvoudiging ✓ factorisation / faktorisering (dividing by h / deel deur h) ✓ answer / antwoord (4)
7.2.1	$f(x) = 2x^5 - 7\sqrt{x} + \frac{1}{x}$ $= 2x^5 - 7x^{\frac{1}{2}} + x^{-1}$ $f'(x) = 10x^4 - \frac{7}{2}x^{-\frac{1}{2}} - x^{-2}$ $= 10x^4 - \frac{7}{2\sqrt{x}} - \frac{1}{x^2}$	✓ $2x^5 - 7x^{\frac{1}{2}} + x^{-1}$ ✓ $10x^4$ ✓ $-\frac{7}{2}x^{-\frac{1}{2}}$ ✓ $-x^{-2}$ (4)
7.2.2	$\frac{d}{dx} \left[\frac{2x^2 - x - 6}{2x + 3} \right]$ $\frac{d}{dx} \left[\frac{(2x+3)(x-2)}{(2x+3)} \right]$ $\frac{d}{dx} [x - 2]$ $= 1$	✓ factors / faktore ✓ simplification / vereenvoudiging ✓ answer / antwoord (3)
		[11]

QUESTION 8/VRAAG 8

8.1	$f'(x) = 3x^2 - 10x - 8 = 0$ $(3x + 2)(x - 4) = 0$ $x = -\frac{2}{3}$ or / of $x = 4$ $y = \frac{400}{27} (14,81)$ or / of $y = -36$ $L\left(-\frac{2}{3}; \frac{400}{27}\right)$ and / en $M(4; -36)$	✓ $f'(x) = 0$ ✓ factors / faktore ✓ x-values / x-waardes ✓ y-values / y-waardes
8.2	$f(x) = x^3 - 5x^2 - 8x + 12 = 0$ $(x - 6)(x - 1)(x + 2) = 0$ $\therefore x = 6 ; x = 1 ; x = -2$	✓ factors / faktore ✓ $x = 1$ ✓ $x = -2$
8.3		✓ x-intercepts / x-afsnitte ✓ y-intercept / y-afsnit ✓ turning points / draaipunte ✓ shape / vorm
8.4	$m = \frac{0 - (-16)}{6 - 2} = 4$ $y - y_1 = m(x - x_1)$ $y - 0 = 4(x - 6)$ $y = 4x - 24$ $\therefore a = 4$ and / en $q = -24$	✓ $a = 4$ ✓ $q = -24$
8.5	$f''(x) = 6x - 10$ $f''(2) = 6(2) - 10$ $= 2 > 0$ $\Rightarrow$ concave up / konkaaf op	✓ $f''(x)$ ✓ substitution / vervanging ✓ conclusion / gevolgtrekking
8.6	$4x - 24 = -36$ $x = -3$ $\therefore -3 \leq x \leq 2$ or / of $x \geq 6$	✓ equating / gelyk stel ✓ $x = -3$ ✓✓ answer / antwoord
		[20]

QUESTION 9/VRAAG 9

9.1	Hourly cost = fuel cost + other costs <i>Uurlikse koste = brandstofkoste + ander koste</i> $= 4x^2 + 1000$ Duration of trip/<i>Tydsduur van reis</i> = $\frac{\text{distance/afstand}}{\text{speed/spoed}} = \frac{500}{x}$ Total cost/<i>Totale koste</i> = (hourly cost/<i>uurlikse koste</i>) $\times$ (number of hours/<i>aantal ure</i>) $C(x) = (4x^2 + 1000) \times \left(\frac{500}{x}\right)$ $= 2000x + \frac{500\,000}{x}$	✓ $4x^2 + 1000$ ✓ $\frac{500}{x}$ ✓ $(4x^2 + 1000) \times \left(\frac{500}{x}\right)$ (3)
9.2	$C'(x) = 2000 - \frac{500\,000}{x^2} = 0$ $2000x^2 - 500\,000 = 0$ $2000x^2 = 500\,000$ $x^2 = 250$ $x = \sqrt{250} = 15,81 \text{ km/h}$	✓ $C'(x)$ ✓ $C'(x) = 0$ ✓ standard form / <i>standaardvorm</i> ✓ simplification / <i>vereenvoudiging</i> ✓ answer / <i>antwoord</i> (5)
		[8]

QUESTION 10/VRAAG 10

10.1	$P(A \text{ or } B) = P(A) + P(B)$ $0,64 = 3P(B) + P(B)$ $0,64 = 4P(B)$ $\therefore P(B) = 0,16$	✓ rule / reël ✓ substitution / vervanging ✓ answer / antwoord (3)
10.2.1	<pre> graph LR Start(()) -- 37% --> Dry((Dry)) Start -- 63% --> Wet((Wet)) Dry -- 12% --> DF((Fall)) Dry -- 88% --> DN((Not Fall)) Wet -- 36% --> WF((Fall)) Wet -- 64% --> WN((Not Fall)) </pre>	✓ 37% and / en 63% ✓ 12% and / en 88% ✓ 36% and / en 64% ✓ outcomes / uitkomst (4)
10.2.2	$(37\% \times 88\%) + (63\% \times 64\%)$ $= 0,7288 \approx \frac{73}{100}$	✓ $(37\% \times 88\%) + (63\% \times 64\%)$ ✓ answer / antwoord (2)
10.3.1	$182 + x + 4 + 30 = 240$ OR / OF $x + 182 = 206$ OR / OF $x + 4 = 28$ $x = 240 - 216$ $x = 24$ $x = 24$ $x = 24$	✓ equation / vergelyking ✓ answer / antwoord (2)
10.3.2	For independent events Vir onafhanklike gebeurtenisse $P(R) \times P(C) = P(R \cap C)$ $P(R \text{ and } C) = \frac{24}{240} = 0,10$ $P(R) \times P(C)$ $= \left(\frac{206}{240}\right) \times \left(\frac{28}{240}\right)$ $= 0,10$ $\therefore$ Yes, the events are independent. Ja, die gebeurtenisse is onafhanklik.	✓ $P(R \cap C) = 0,10$ ✓ $P(R) \times P(C) = 0,10$ ✓ conclusion / gevolgtrekking (3)
		[14]
		TOTAL/TOTAAL: 150