



education

Department of
Education
FREE STATE PROVINCE

**PREPARATORY EXAMINATION
*VOORBEREIDENDE EKSAMEN***

GRADE/GRAAD 12

**MATHEMATICS P1
*WISKUNDE V1***

SEPTEMBER 2022

MARKS/PUNTE: 150

**MARKING GUIDELINES
*NASIENRIGLYNE***

**These marking guidelines consists of 16 pages.
*Hierdie nasienriglyne bestaan uit 16 bladsye.***

NOTE:

- If a candidate answered a question TWICE, mark only the FIRST attempt.
- If a candidate has crossed out an attempt to answer a question and did not redo it, mark the crossed-out version.
- Consistent accuracy applies in ALL aspects of the marking memorandum. Stop marking at the second calculation error.
- Assuming answers/values in order to solve a problem is NOT acceptable.

NOTA:

- *As 'n kandidaat 'n vraag TWEE KEER beantwoord, sien slegs die EERSTE poging na.*
- *As 'n kandidaat 'n antwoord van 'n vraag doodtrek en nie oordoen nie, sien die doodgetrekte poging na.*
- *Volgehoue akkuraatheid word in ALLE aspekte van die nasienriglyne toegepas. Hou op nasien by die tweede berekeningsfout.*
- *Om antwoorde/waardes te aanvaar om 'n probleem op te los, word NIE toegelaat NIE.*

QUESTION 1/VRAAG 1

1.1.1	$3x^2 - 5x - 2 = 0$ $(3x+1)(x-2) = 0$ $\therefore x = -\frac{1}{3} \text{ or } x = 2$	✓ factors ✓ answers (2)
1.1.2	$3x - 4 = \frac{2}{x}$ $3x^2 - 4x - 2 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $x = \frac{-(-4) \pm \sqrt{(-4)^2 - 4(3)(-2)}}{2(3)}$ $x = \frac{4 \pm \sqrt{40}}{6}$ $x = 1,72 \text{ or } x = -0,39$ OR/OF $3x^2 - 4x - 2 = 0$ $x^2 - \frac{4}{3}x = \frac{2}{3}$ $x^2 - \frac{4}{3}x + \left(-\frac{1}{2} \times \frac{4}{3}\right)^2 = \frac{2}{3} + \left(-\frac{1}{2} \times \frac{4}{3}\right)^2$ $\left(x - \frac{2}{3}\right)^2 = \frac{10}{9}$ $x = \frac{2 \pm \sqrt{10}}{3}$ $x = 1,72 \text{ or } x = -0,39$	✓ standard form ✓ substitution into correct formula ✓ $x = 1,72$ ✓ $x = -0,39$ (4) OR/OF ✓ standard form ✓ $\left(x - \frac{2}{3}\right)^2 = \frac{10}{9}$ ✓ $x = 1,72$ ✓ $x = -0,39$ (4)
1.1.3	$x^2 - 8x + 16 > 0$ $(x-4)^2 > 0$ $\therefore x \in R; x \neq 4$	✓ factors ✓ critical value ✓ answer (3)

1.1.4	$\sqrt{5x-1} = 2x-1$ $5x-1 = 4x^2 - 4x + 1$ $0 = 4x^2 - 9x + 2$ $0 = (4x-1)(x-2)$ $\therefore x = \frac{1}{4} (N/A \text{ or/of } x = 2)$	✓ $5x-1 = 4x^2 - 4x + 1$ ✓ standard form ✓ factors ✓ answer with selection (4)
1.1.5	$3^{x+1} + m \cdot 3^x = 2m + 6$ $3^x \cdot 3 + m \cdot 3^x = 2m + 6$ $3^x(3+m) = 2(m+3)$ $3^x = 2$ $\therefore x = \log_3 2$ $x = 0,63$	✓ $2(m+3)$ ✓ $3^x(3+m)$ ✓ $3^x = 2$ ✓ answer (4)
1.2	$2x + y = -1$ and/en $y^2 + 3yx + 2 = 0$ $y = -1 - 2x$ Subt/ $y = -1 - 2x$ into/in $y^2 + 3yx + 2 = 0$ verv $(-1-2x)^2 + 3x(-1-2x) + 2 = 0$ $1 + 4x + 4x^2 - 3x - 6x^2 + 2 = 0$ $2x^2 - x - 3 = 0$ $(2x-3)(x+1) = 0$ $x = \frac{3}{2}$ or/of $x = -1$ $\therefore y = -4$ or/of $y = 1$ OR/OF $2x + y = -1$ and/en $y^2 + 3yx + 2 = 0$ $\therefore x = \frac{-1-y}{2}$ $y^2 + 3y\left(\frac{-1-y}{2}\right) + 2 = 0$ $2y^2 - 3y - 3y^2 + 4 = 0$ $y^2 + 3y - 4 = 0$ $(y+4)(y-1) = 0$ $\therefore y = -4$ or $y = 1$ $x = \frac{3}{2}$ or $x = -1$	✓ $y = -1 - 2x$ ✓ substitution ✓ standard form ✓ factors ✓ both x values ✓ both y values OR/OF ✓ $x = \frac{-1-y}{2}$ ✓ substitution ✓ standard form ✓ factors ✓ both y values ✓ both x values (6) (6)
		[23]

QUESTION 2/VRAAG 2

2.1.1 (a)	$T_n = -25 + 4n$ $\therefore -25 + 4n > 0$ $n > \frac{25}{4}$ $\therefore n = 7$ $T_7 = -21 + 6(4) = 3$	Answer only: Full marks/ Slegs antwoorde: Volpunte $\checkmark -25 + 4n > 0$ $\checkmark T_7 = 3$ (2)
2.1.1 (b)	$T_n = a + (n-1)d$ $91 = -21 + (n-1)4$ $91 = -21 + 4n - 4$ $4n = 116$ $\therefore n = 29$ There are 29 terms in the series./Daar is 29 terme in die reeks	$\checkmark d = 4$ $\checkmark$ subst into the correct formula $\checkmark$ answer (3)
2.1.2	$S_n = \frac{n}{2} [2a + (n-1)d]$ $= \frac{29}{2} [2(-21) + (29-1)4]$ $= 1015$	$\checkmark$ Subst. into the correct formula $\checkmark$ answer (2)
2.2.1	$T_1 = 19$ and/en $T_2 = 7$	$\checkmark T_1 = 19$ $\checkmark T_2 = 7$ (2)
2.2.2	$2a = 4$ $a = 2$ $3(2) + b = -12$ $b = -18$ $2 - 18 + c = 19$ $c = 35$ $\therefore T_n = 2n^2 - 18n + 35$	$\checkmark a = 2$ $\checkmark b = -18$ $\checkmark c = 35$ (3)
2.2.3	$T_n = 2n^2 - 18n + 35$ $139 = 2n^2 - 18n + 35$ $0 = 2n^2 - 18n - 104$ $0 = n^2 - 9n - 52$ $0 = (n-13)(n+4)$ $\therefore n = 13$ or/of $n = -4$ (invalid/ongeldig)	$\checkmark T_n = 139$ $\checkmark$ standard form $\checkmark$ factors $\checkmark$ answer with selection (4)
		[16]

QUESTION 3/VRAAG 3

3.1.1	$r = \frac{m}{3}$ $-1 < r < 1$ $-1 < \frac{m}{3} < 1$ $-3 < m < 3$	$\checkmark r = \frac{m}{3}$ $\checkmark -1 < \frac{m}{3} < 1$ $\checkmark \text{ answer}$ (3)
3.1.2	$S_{\infty} = \frac{a}{1-r}$ $\frac{27}{7} = \frac{3}{1-\frac{m}{3}}$ $27 - 9m = 21$ $9m = 6$ $\therefore m = \frac{2}{3}$	$\checkmark \text{ substitution into the correct formula}$ $\checkmark \text{ answer}$ (2)
3.2	$\sum_{x=2}^p 3(2)^{x-1} = 6 + 12 + 24 + \dots = 1530.$ Geometric series with/<i>Geometriese reeks met</i> $a = 6$ and/<i>en</i> $r = 2$ $1530 = \frac{6(2^n - 1)}{2 - 1}$ $255 = 2^n - 1$ $256 = 2^n$ $2^8 = 2^n$ $\therefore n = 8$ $\therefore p = 9$	$\checkmark \text{ Expansion to 3 terms}$ $\checkmark \text{ substitution into the correct formula.}$ $\checkmark n = 8$ $\checkmark \text{ answer } p = 9$ (4)
		[9]

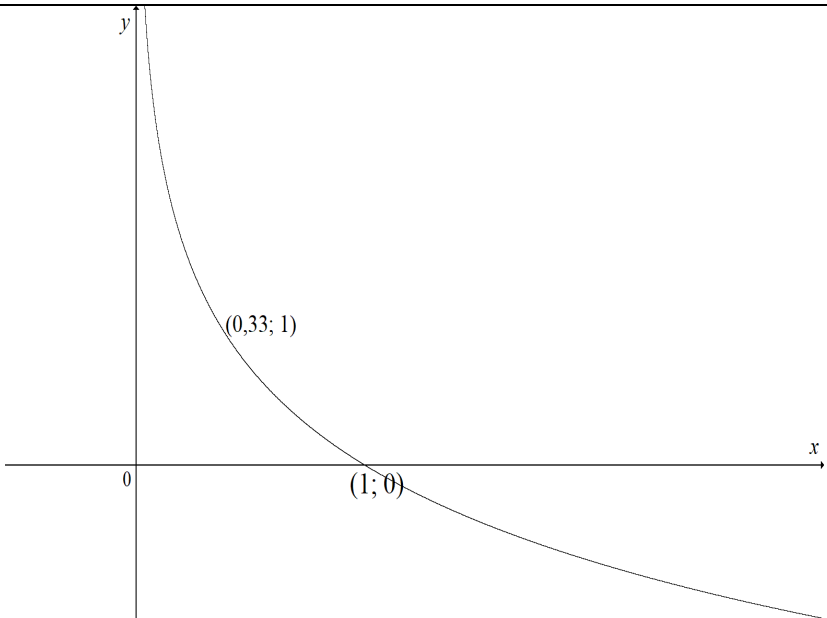
QUESTION 4/VRAAG 4

4.1	$\frac{m-5+m+3}{2} = 2$ $2m-2=4$ $2m=6$ $\therefore m=3$	$\checkmark \frac{m-5+m+3}{2} = 2$ $\checkmark \text{ answer}$
4.2	The roots of f are -2 and 6/die wortels van f is -2 en 6 $y = a(x-x_1)(x-x_2)$ $y = a(x+2)(x-6)$ $15 = a(1+2)(1-6)$ $15 = -15a$ $\therefore a = -1$ $y = -1(x^2 - 4x - 12)$ $y = -x^2 + 4x + 12$	$\checkmark y = a(x+2)(x-6)$ $\checkmark \text{ subst } (1;15)$ $\checkmark a = -1$ $\checkmark \text{ answer}$
4.3	$f(2) = -(2)^2 + 4(2) + 12$ $f(2) = 16$ $\therefore TP(2;16)$ Range/waardeversameling $g: y \leq 12$ or/of $y \in (-\infty; 12]$	$\checkmark f(2) = 16$ $\checkmark \text{ critical value}$ $\checkmark \text{ notation}$
		[9]

QUESTION 5/VRAAG 5

5.1	$T(0;3)$	✓ x coordinate ✓ y coordinate (2)
5.2	$g(x) = 5x^2 + 10x + 3$ $g'(x) = 10x + 10$ $0 = 10x + 10$ OR $x = -\frac{b}{2a}$ $x = -\frac{10}{2(5)}$ $\therefore x = -1$ $y = 5(-1)^2 + 10(-1) + 3 = -2$ $P(-1; -2)$	✓ method ✓ x value ✓ substitution ✓ answer (4)
5.3	$f(x) = \frac{5}{x+1} - 2$	✓ substitution of p ✓ substitution of (2)
5.4.1	$g(x) = 5x^2 + 10x + 3.$ $g'(x) = 10x + 10$ $g'(0) = 10$ $y - y_1 = m(x - x_1)$ $y - 3 = 10(x - 0)$ $\therefore y = 10x - 10$	✓ $g'(x) = 10x + 10$ ✓ substitute $g'(0) = 10$ ✓ answer (3)
5.4.2	$y = x + c$ $-2 = -1 + c$ $\therefore c = -1$ $y = x - 1$	✓ $y = x + c$ ✓ substitute $(-1; -2)$ ✓ equation (3)
5.5	$0 = \frac{5}{x+1} - 2$ $2 = \frac{5}{x+1}$ $2x + 2 = 5$ $\therefore x = \frac{3}{2}$ $R\left(\frac{3}{2}; 0\right)$ $x \geq \frac{3}{2}$	✓ equate $f(x) = 0$ ✓ $x = \frac{3}{2}$ ✓✓ answer (4)
		[18]

QUESTION 6/VRAAG 6

6.1	$y = \left(\frac{1}{3}\right)^x$ $k = \left(3^{-1}\right)^{-2}$ $k = 9$	✓ subst $A(-2; k)$ ✓ answer (2)
6.2	$g^{-1}: x = \left(\frac{1}{3}\right)^y$ $y = \log_{\frac{1}{3}} x$ or/of $y = -\log_3 x$	✓ swop x and y ✓ answer (2)
6.3		✓ shape ✓ x intercepts ✓ any point (3)
6.4	$-2 < x \leq 7$	✓✓ answer (2)
		[9]

QUESTION 7/VRAAG 7

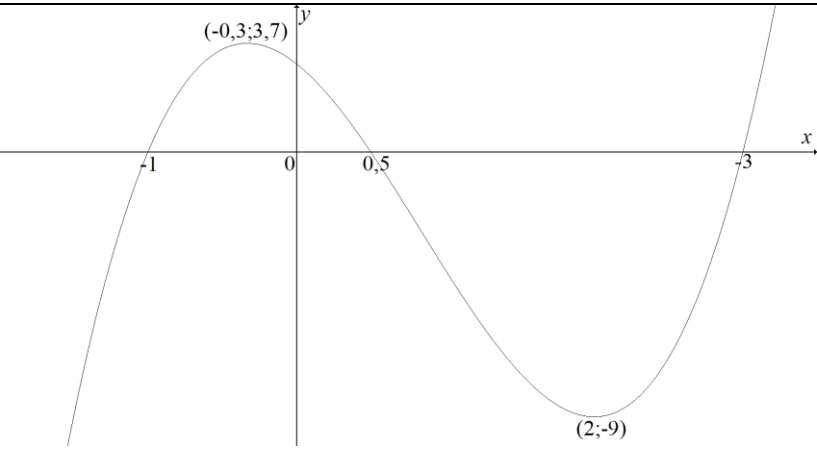
7.1	$A = P(1-i)^n$ $R90\,000 = R200\,000(1-0,09)^n$ $\frac{9}{20} = (0,91)^n$ $\therefore n = \log_{0,91} \left(\frac{9}{20} \right)$ $n = 8,47$ It will take 8 years and 6 months/<i>Dit sal 8 jaar en 6 maande neem</i>	✓ substitution into the correct formula ✓ correct use of logs ✓ answer (3)
7.2	Amount in the account/<i>Bedrag in die rekening</i> $= R3500 \left(1 + \frac{0,07}{4} \right)^8 \left(1 + \frac{0,08}{12} \right)^{36} + R5\,700 \left(1 + \frac{0,08}{12} \right)^{24}$ $= R11\,793,19$ OR/OF $A = P(1+i)^n$ $= R3500 \left(1 + \frac{0,07}{4} \right)^8$ $= R4\,021,08624$ $4\,021,08624 \left(1 + \frac{0,08}{12} \right)^{12} = R4354,834415$ $A = R4354,834415 + R5\,700 = R10\,054,83442$ $A = R10\,054,83442 \left(1 + \frac{0,08}{12} \right)^{24}$ $A = R11\,793,19$	✓ $R3500 \left(1 + \frac{0,07}{4} \right)^8$ ✓ $\left(1 + \frac{0,08}{12} \right)^{36}$ ✓ $+ R5\,700 \left(1 + \frac{0,08}{12} \right)^{24}$ ✓ answer (4) OR/OF ✓ $R3500 \left(1 + \frac{0,07}{4} \right)^8$ ✓ $4\,021,08624 \left(1 + \frac{0,08}{12} \right)^{12}$ ✓ $R10\,054,83442 \left(1 + \frac{0,08}{12} \right)^{24}$ ✓ answer (4)

7.3.1	Balance/<i>Balans</i> = R6 200 000 $\times$ 0,65 = R4 030 000 $P = \frac{x \left[1 - (1+i)^{-n} \right]}{i}$ $R4030\,000 = \frac{x \left[1 - \left(1 + \frac{0,15}{12} \right)^{-240} \right]}{\frac{0,15}{12}}$ $\therefore x = R53\,066,62$	✓ R6 200 000 $\times$ 0,65 ✓ $i = \frac{0,15}{12}$ and $n = 240$ ✓ substitution into the correct formula ✓ answer (4)
7.3.2	Balance outstanding/<i>Balans uitstaande</i> = $\frac{R53\,066,62 \left[1 - \left(1 + \frac{0,15}{12} \right)^{-12 \times 14} \right]}{\frac{0,15}{12}}$ $= R3718\,650,55$ OR/OF Balance = A-F <i>Balans</i> $= P(1+i)^n - \frac{x[(1+i)^n - 1]}{i}$ $= 4\,030\,000 \left(1 + \frac{0,15}{12} \right)^{72} - \frac{53\,066,62 \left[\left(1 + \frac{0,15}{12} \right)^{72} - 1 \right]}{\frac{0,15}{12}}$ $= R3\,718\,650,55$	✓ $n = 12 \times 14 = 168$ ✓ substitution into the correct formula ✓ answer (3) OR/OF ✓ $n = 12 \times 6 = 72$ ✓ substitution into the correct formula ✓ answer (3)
		[14]

QUESTION 8/VRAAG 8

8.1.1	$f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{-(x+h)^2 + 3 - (-x^2 + 3)}{h}$ $= \lim_{h \rightarrow 0} \frac{-x^2 - 2xh - h^2 + 3 + x^2 - 3}{h}$ $= \lim_{h \rightarrow 0} \frac{-2xh - h^2}{h}$ $= \lim_{h \rightarrow 0} \frac{h(-2x - h)}{h}$ $= \lim_{h \rightarrow 0} (-2x - h)$ $= -2x$	✓ $f(x+h) = -x^2 - 2xh - h^2 + 3$ ✓ $f(x+h) - f(x) = -2xh - h^2$ ✓ substitution ✓ $\frac{h(-2x - h)}{h}$ ✓ answer (5)
8.1.2	$f(x) = -x^2 + 3$ $f'(x) = -2x$ $\therefore 12 = -2x$ $x = -6$ $\therefore y = -(-6)^2 + 3 = 33$ $A(-6; 33)$	✓ $12 = -2x$ ✓ x value ✓ y value (3)
8.2.1	$D_x \left[\sqrt[3]{x^2} - \frac{3}{x} + \pi \right]$ $D_x [x^{\frac{2}{3}} - 3x^{-1} + \pi]$ $\therefore = \frac{2}{3} x^{-\frac{1}{3}} + 3x^{-2}$	✓ $x^{\frac{2}{3}} - 3x^{-1}$ ✓ $\frac{2}{3} x^{-\frac{1}{3}}$ ✓ $+3x^{-2}$ (3)
8.2.2	$y = \frac{2x^2 - x - 6}{2x + 3}$ $y = \frac{(2x + 3)(x - 2)}{2x + 3}$ $y = x - 2$ $\therefore \frac{dy}{dx} = 1$	✓ factors ✓ answer (2)
		[13]

QUESTION 9/VRAAG 9

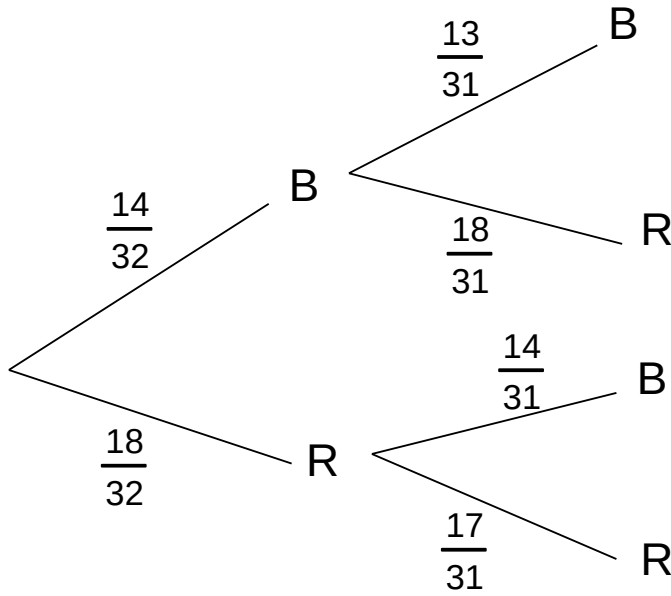
9.1	$0 = 2x^3 - 5x^2 - 4x + 3$ $0 = (x+1)(2x^2 - 7x + 3)$ $0 = (x+1)(2x-1)(x-3)$ $\therefore x = -1 \text{ or/of } x = \frac{1}{2} \text{ or/of } x = 3$	✓ linear factor ✓ quadratic factor ✓ all 3 linear factors ✓ answers (4)
9.2	$f(x) = 2x^3 - 5x^2 - 4x + 3$ $f'(x) = 6x^2 - 10x - 4$ $0 = 3x^2 - 5x - 2$ $0 = (3x+1)(x-2)$ $x = -\frac{1}{3} \text{ or } x = 2$ $f\left(-\frac{1}{3}\right) = 2\left(-\frac{1}{3}\right)^3 - 5\left(-\frac{1}{3}\right)^2 - 4\left(-\frac{1}{3}\right) + 3 = \frac{100}{27}$ $f(2) = 2(2)^3 - 5(2)^2 - 4(2) + 3 = -9$ $\therefore$ The turning points are $\left(-\frac{1}{3}; \frac{100}{27}\right)$ and/en $(2; -9)$ <i>Die draaipunte is $\left(-\frac{1}{3}; \frac{100}{27}\right)$ and/en $(2; -9)$</i>	✓ $f'(x) = 6x^2 - 10x - 4$ ✓ $f'(x) = 0$ ✓ factors ✓ both x values ✓ both y values (5)
9.3		✓ shape ✓ turning points ✓ x and y intercepts (3)
9.4	$f'(x) = 6x^2 - 10x - 4$ $f''(x) = 12x - 10$ $12x - 10 > 0$ $\therefore x > \frac{5}{6}$	✓ $f''(x) = 12x - 10$ ✓ $12x - 10 > 0$ ✓ answer (3)

9.5	Let the constant to be added be k/Laat die konstante waar bygetel word k wees $f(2) + k = 0$ $2(2)^3 - 5(2)^2 - 4(2) + 3 + k = 0$ $\therefore k = 9$ The constant to be added is 9/ Die konstante wat bygevoeg moet word is 9.	Answer only: Full marks Slegs antwoorde: volpunte ✓ $f(2) + k = 0$ ✓ answer (2)
		[17]

QUESTION 10/VRAAG 10

10.1	$D(2) = 3 + \frac{1}{2}(2)^2 - \frac{1}{4}(2)^3$ $= 3m$	✓ $D(2)$ ✓ answer (2)
10.2	$D = 3 + \frac{1}{2}t^2 - \frac{1}{4}t^3$ $D'(t) = t - \frac{3}{4}t^2$ $D'(3) = 3 - \frac{3}{4}(3)^2$ $D'(t) = -3,75m/h$	✓ $D'(t)$ ✓ $D'(3)$ ✓ answer (3)
10.3	$0 = t - \frac{3}{4}t^2$ $0 = t\left(1 - \frac{3}{4}t\right)$ $\therefore t = 0(N/A) \text{ or } t = \frac{4}{3}$ Time/Tyd: 08:50	✓ $D'(t) = 0$ ✓ answer (2)
		[7]

QUESTION 11/VRAAG 11

11.1.1	$P(A) = 1 - P(\text{not } A) / (\text{nie } A \text{ nie})$ $P(A) = 1 - 0,45 = 0,55$ $\therefore P(A \text{ or } B) = P(A) + P(B)$ $= 0,55 + 0,35$ $= 0,9$	✓ $P(A) = 0,55$ ✓ substitution ✓ answer (3)
11.1.2	$\therefore P(A \text{ and/en } B) = P(A) \times P(B)$ $= 0,55 \times 0,35$ $= \frac{77}{400} \approx 0,19$	✓ substitution ✓ answer (2)
11.2.1	 $P(\text{both red/beide rooi}) = \frac{18}{32} \times \frac{17}{31} = \frac{153}{496} \approx 0,31$	✓ $\frac{18}{32} \times \frac{17}{31}$ ✓ answer (2)
11.2.2	$P(\text{Red/rooi} \dots \text{Black/swart}) \frac{14}{32} \times \frac{18}{31} = \frac{63}{248} \approx 0,25$	✓ $\frac{18}{32} \times \frac{14}{31}$ ✓ answer (2)
11.3.1	$9! = 362\,880$	✓ answer (1)
11.3.2	$2 \times 2! \times 7! = 20160$	✓ $2 \times 2!$ ✓ answer (2)

11.3.3	All seated in 9! ways./<i>Almal sit op 9! maniere</i> With girls as one unit they can be seated in 4! 6! = 17 280. <i>Met die meisies as een eenheid kan hulle 4! 6! sit</i> $P(\text{all girls seated together}) = \frac{4! \times 6!}{9!} = \frac{17\,280}{362\,880} = \frac{1}{21}$ <i>P(al die meisies sit saam)</i>	✓ 9 ! ✓ 4! × 6! ✓ answer (3)
		[15]

TOTAL/TOTAAL: 150