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**NATIONAL
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SERTIFIKAAT**

GRADE 12/*GRAAD 12*

MATHEMATICS P1/*WISKUNDE V1*

NOVEMBER 2018

MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS: 150

PUNTE: 150

**These marking guidelines consist of 18 pages.
*Hierdie nasienriglyne bestaan uit 18 bladsye***

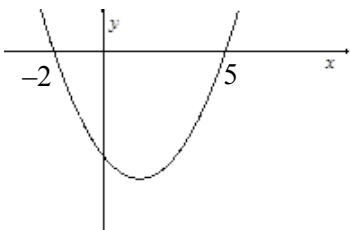
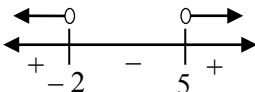
NOTE:

- If a candidate answers a question TWICE, only mark the FIRST attempt.
- Consistent Accuracy applies in all aspects of the marking memorandum.

LET WEL:

- Indien 'n kandidaat 'n vraag TWEE keer beantwoord, merk slegs die EERSTE poging.
- Volgehoue akkuraatheid is op ALLE aspekte van die nasienriglyne van toepassing.

QUESTION/VRAAG 1

1.1.1	$x^2 - 4x + 3 = 0$ $(x - 3)(x - 1) = 0$ $x = 3$ or $x = 1$	✓ factors/correct sub in formula ✓ $x = 3$ ✓ $x = 1$ (3)
1.1.2	$5x^2 - 5x + 1 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{5 \pm \sqrt{25 - 4(5)(1)}}{2(5)}$ $= \frac{5 \pm \sqrt{5}}{10}$ $x = 0,72$ or $x = 0,28$	✓ substitution into the correct formula ✓ $x = 0,72$ ✓ $x = 0,28$ (3)
1.1.3	$x^2 - 3x - 10 > 0$ $(x - 5)(x + 2) > 0$ OR/OF   $x < -2$ or $x > 5$	✓ factors/ critical values ✓✓ $x < -2$ or $x > 5$ (3)
1.1.4	$3\sqrt{x} = x - 4$ $9x = x^2 - 8x + 16$ $x^2 - 17x + 16 = 0$ $(x - 16)(x - 1) = 0$ $x = 16$ or $x = 1$ NA	✓ squaring both sides ✓ $x^2 - 17x + 16 = 0$ ✓ factors ✓ answer with selection (4)

	OR/OF $3x^{\frac{1}{2}} = x - 4$ $x - 3x^{\frac{1}{2}} - 4 = 0$ $\left(x^{\frac{1}{2}} - 4\right)\left(x^{\frac{1}{2}} + 1\right) = 0$ $x^{\frac{1}{2}} = 4 \quad \text{or} \quad x^{\frac{1}{2}} = -1$ $x = 16 \quad \text{NA}$	OR/OF ✓ standard form ✓ recognize $x = \left(x^{\frac{1}{2}}\right)^2$ ✓ factors ✓ answer with selection (4)
1.2	$2y + 9x^2 = -1 \dots\dots (1)$ $3x - y = 2 \dots\dots (2)$ $y = 3x - 2 \dots\dots (3)$ $2(3x - 2) + 9x^2 = -1$ $6x - 4 + 9x^2 = -1$ $9x^2 + 6x - 3 = 0$ $3x^2 + 2x - 1 = 0$ $(3x - 1)(x + 1) = 0$ $x = \frac{1}{3} \quad \text{or} \quad x = -1$ $y = -1 \quad \text{or} \quad y = -5$ OR/OF $2y + 9x^2 = -1 \dots\dots (1)$ $3x - y = 2 \dots\dots (2)$ $x = \frac{y + 2}{3}$ $2y + 9\left(\frac{y + 2}{3}\right)^2 = -1$ $2y + 9\left(\frac{y^2 + 4y + 4}{9}\right) = -1$ $2y + y^2 + 4y + 4 + 1 = 0$ $y^2 + 6y + 5 = 0$ $(y + 5)(y + 1) = 0$ $y = -1 \quad \text{or} \quad y = -5$ $x = \frac{1}{3} \quad \text{or} \quad x = -1$	✓ $y = 3x - 2$ ✓ substitution ✓ standard form ✓ factors ✓ both x values ✓ both y values OR/OF ✓ $x = \frac{y + 2}{3}$ ✓ substitution ✓ standard form ✓ factors ✓ both y values ✓ both x values (6)

QUESTION/VRAAG 2

2.1.1	42	✓ answer (1)
2.1.2	$2a = 6$ $a = 3$ $T_n = 3n^2 - 8n + 7$ OR/OF $2a = 6$ $a = 3$ $T_n = 3n^2 + bn + c$ $T_1 : 3 + b + c = 2$ $T_2 : 12 + 2b + c = 3$ $T_2 - T_1 : b = -8$ Subst. in (1): $-8 + c = -1$ $c = 7$ $T_n = 3n^2 - 8n + 7$	$3a + b = 1$ $3(3) + b = 1$ $b = -8$ $a + b + c = 2$ $(3) + (-8) + c = 2$ $c = 7$ $T_n = an^2 + bn + c$ OR/OF $a = 3$ $b = -8$ $c = 7$ $T_n = an^2 + bn + c$ (4)
2.1.3	$T_{20} = 3(20)^2 - 8(20) + 7$ $= 1047$	✓ substitution ✓ answer (2)
2.2	$T_n = -7n + 42$ $-7n + 42 = -140$ $-7n = -182$ $n = 26$	✓ $T_n = -7n + 42$ ✓ $-7n + 42 = -140$ ✓ $n = 26$ (3)
2.3	$S_n = \frac{n}{2}(a + l)$ $S_n = \frac{n}{2}(35 - 7n + 42)$ $S_n = \frac{n}{2}(-7n + 77)$ $S_n = -\frac{7}{2}n^2 + \frac{77}{2}n$ $-\frac{7}{2}n^2 + \frac{77}{2}n = 3n^2 - 8n + 7$ $13n^2 - 93n + 14 = 0$ $(n - 7)(13n - 2) = 0$ $n = 7$ or $n = \frac{2}{13}$ NA $\therefore n = 7$	OR/OF $S_n = \frac{n}{2}[2a + (n - 1)d]$ $S_n = \frac{n}{2}(70 - 7n + 7)$ ✓ $S_n = \frac{n}{2}(35 - 7n + 42)$ or $S_n = \frac{n}{2}(70 - 7n + 7)$ ✓ simplification of S_n ✓ equating ✓ standard form ✓ factors ✓ answer with selection (6)
		[16]

QUESTION/VRAAG 3

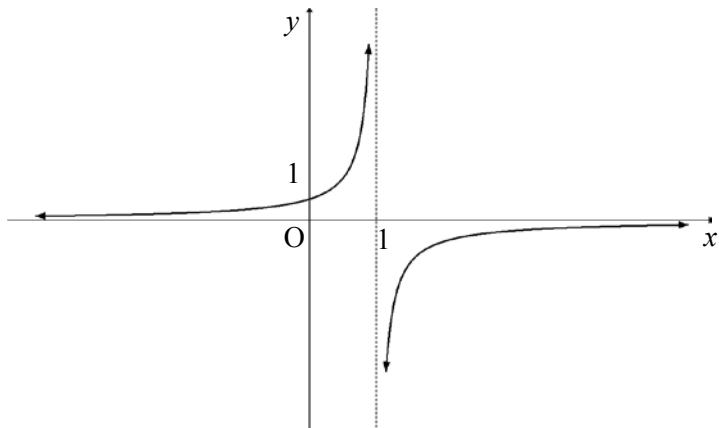
3.1	$r = \frac{1}{2} \text{ and } S_{\infty} = 6$ $S_{\infty} = \frac{a}{1-r}$ $6 = \frac{a}{1-\frac{1}{2}}$ $a = 3$	✓ substitution ✓ answer (2)
3.2	$T_n = ar^{n-1}$ $T_8 = 3\left(\frac{1}{2}\right)^7$ $T_8 = \frac{3}{128}$	✓✓ $T_8 = 3\left(\frac{1}{2}\right)^7$ (2)
3.3	$\sum_{k=1}^n 3(2)^{1-k} = 5,8125$ $3 + \frac{3}{2} + \frac{3}{4} + \dots = 5,8125$ $S_n = \frac{a(1-r^n)}{1-r} = 5,8125$ $\frac{3\left[1 - \left(\frac{1}{2}\right)^n\right]}{1 - \frac{1}{2}} = 5,8125$ $6\left[1 - \left(\frac{1}{2}\right)^n\right] = 5,8125$ $\left(\frac{1}{2}\right)^n = \frac{1}{32} = 0,03125$ $2^{-n} = 2^{-5} \quad \text{or} \quad n \log \frac{1}{2} = \log \frac{1}{32}$ $n = 5 \quad \quad \quad n = 5$	✓ $r = \frac{1}{2}$ ✓ substitution ✓ simplification ✓ answer (4)

3.4	$\sum_{k=1}^{20} 3(2)^{1-k} = p$ $3 + \frac{3}{2} + \frac{3}{4} + \dots + 3 \cdot 2^{-19} = p$ $\sum_{k=1}^{20} 24(2)^{-k}$ $= 12 + 6 + 3 + \dots + 24 \cdot 2^{-20}$ $= 4 \left(3 + \frac{3}{2} + \frac{3}{4} + \dots + 3 \cdot 2^{-19} \right)$ $= 4p$ OR/OF $\sum_{k=1}^{20} 3(2)^{1-k} = p$ $\sum_{k=1}^{20} 6(2)^{-k} = p$ $\therefore \sum_{k=1}^{20} 24(2)^{-k} = 4p$ OR/OF $\sum_{k=1}^{20} 24(2)^{-k} = \sum_{k=1}^{20} 4 \times 3 \times 2(2)^{-k}$ $= 4 \sum_{k=1}^{20} 3 \times 2(2)^{-k}$ $= 4 \sum_{k=1}^{20} 3 \times (2)^{1-k} = 4p$ OR/OF $S_{20} = \frac{3 \left(\left(\frac{1}{2} \right)^{20} - 1 \right)}{\frac{1}{2} - 1} = 6 = p$ $S_{20} = \frac{12 \left(\left(\frac{1}{2} \right)^{20} - 1 \right)}{\frac{1}{2} - 1} = 24$ $24 = 4 \times 6 = 4p$	✓ expansion ✓ expansion ✓ answer (3) OR/OF ✓ $\sum_{k=1}^{20} 6(2)^{-k} = p$ ✓ $\sum_{k=1}^{20} 4 \times 6(2)^{-k}$ ✓ $4p$ (3) OR/OF ✓ $\sum_{k=1}^{20} 4 \times 3 \times 2(2)^{-k}$ ✓ $4 \sum_{k=1}^{20} 3 \times 2(2)^{-k}$ ✓ $4p$ (3) OR/OF ✓ substitution and answer ✓ substitution and answer ✓ $4p$ (3)
		[11]

QUESTION/VRAAG 4

4.1	Yes For every x -value there is only one corresponding y value OR/OF One to one mapping (vertical line test)	✓ answer ✓ reason (2)
4.2	$R(-12; -6)$	✓ answer (1)
4.3	$f(x) = ax^2$ substitute $(-6; -12)$ $-12 = a(-6)^2$ $a = \frac{-1}{3}$	✓ substitution ✓ answer (2)
4.4	$f: y = -\left(\frac{1}{3}\right)x^2$ $f^{-1}: x = -\left(\frac{1}{3}\right)y^2$ $y^2 = -3x$ $y = \pm\sqrt{-3x}$ Only $y = -\sqrt{-3x}$ and $x \leq 0$	✓ swapping x and y ✓ $y^2 = -3x$ ✓ $y = -\sqrt{-3x}$ (3)
		[8]

QUESTION/VRAAG 5

5.1	Domain: $x \in R; x \neq 1$ OR/OF $x \in (-\infty; 1) \cup (1; \infty)$	✓ answer (1)
5.2	$x = 1$ $y = 0$	✓ $x = 1$ ✓ $y = 0$ (2)
5.3		✓ y intercept ✓ vertical asymptote ✓ shape (3)
5.4	$x \geq 0; x \neq 1$ OR/OF $0 \leq x < 1$ or $x > 1$ OR/OF $x \in [0; 1) \cup (1; \infty)$	✓ $x \geq 0$ ✓ $x \neq 1$ OR/OF ✓ $0 \leq x < 1$ ✓ $x > 1$ (2)
		[8]

QUESTION/VRAAG 6

6.1	$y = mx + c$ $m = \frac{5-1}{4-0}$ $m = 1$ $c = 1$ $g(x) = x + 1$ OR/OF $y = mx + c$ $5 = m(4) + 1$ $m = 1$ $g(x) = x + 1$	✓ substitution into gradient formula ✓ y-intercept (0 ; 1) (2) OR/OF ✓ substitute (4 ; 5) ✓ c = 1 (2)
6.2	$x^2 - 2x - 3 = 0$ $(x+1)(x-3) = 0$ $x = -1$ or $x = 3$ A(-1 ; 0) B(3 ; 0)	✓ y = 0 ✓ factors ✓ x-values (3)
6.3	$x = \frac{-1+3}{2}$ or $x = \frac{-b}{2a} = \frac{-(-2)}{2(1)}$ or $f'(x) = 2x - 2 = 0$ $x = 1$ $f(x) = x^2 - 2x - 3$ $y = (1)^2 - 2(1) - 3$ or $y = (x^2 - 2x + (-1)^2) - 3 - 1$ $y = -4$ $y \geq -4$ or $[-4; \infty)$	✓ x -value ✓ substitution/ completing the square ✓ answer (3)
6.4.1	MN: $y = (x^2 - 2x - 3) - (x + 1)$ $= x^2 - 3x - 4$ $6 = x^2 - 3x - 4$ $0 = x^2 - 3x - 10$ $0 = (x-5)(x+2)$ $x = 5$ or $x = -2$ OT = 2 or OT = 5 NA	✓ $x^2 - 3x - 4$ ✓ substituting $y = 6$ ✓ values of x ✓ OT = 2 (4)
6.4.2	$y = x + 1$ substitute $x = -2$ $= (-2) + 1$ $= -1$ N(-2 ; -1)	✓ substituting $x = -2$ ✓ answer (2)

6.5	$f'(x) = 2x - 2$ $2x - 2 = 1$ $x = \frac{3}{2}$ $f\left(\frac{3}{2}\right) = \frac{-15}{4}$ $y + \frac{15}{4} = 1\left(x - \frac{3}{2}\right)$ or $-\frac{15}{4} = \frac{1}{2} + c$ $y = x - \frac{21}{4}$ OR/OF $x^2 - 2x - 3 = x + p$ $x^2 - 2x - 3 - x - p = 0$ This equation will have equal roots, therefore: $b^2 - 4ac = 0$ $(-3)^2 - 4(1)(-3 - p) = 0$ $9 + 12 + 4p = 0$ $p = \frac{-21}{4}$ $y = x - \frac{21}{4}$	$\checkmark f'(x) = 2x - 2$ $\checkmark 2x - 2 = 1$ $\checkmark x = \frac{3}{2}$ $\checkmark f\left(\frac{3}{2}\right) = \frac{-15}{4}$ $\checkmark$ answer (5) OR/OF $\checkmark$ equating $\checkmark$ equal roots $\checkmark$ substitution $\checkmark$ simplification $\checkmark$ answer (5)
6.6	$k < \frac{-21}{4}$	$\checkmark$ answer (1)
		[20]

QUESTION/VRAAG 7

7.1.1	$F = \frac{x[(1+i)^n - 1]}{i}$ $15\,000 \left[\left(1 + \frac{0,088}{4} \right)^{16} - 1 \right]$ $F = \frac{0,088}{4}$ $F = R283\,972,28$	✓ $\frac{0,088}{4}$ and $n = 16$ ✓ substitution into correct formula ✓ answer (3)
7.1.2	$A = R283\,972,28 - 100\,000 \left(1 + \frac{0,088}{4} \right)^4$ $= R\,174\,877,60$ OR/OF Amount at end of 3 years: $F = \frac{15\,000 \left[\left(1 + \frac{0,088}{4} \right)^{12} - 1 \right]}{0,088} - 100\,000$ $= R103\,459,12$ Amount at end of 4 years: $P(1+i)^n + \frac{x[(1+i)^n - 1]}{i}$ $= 103\,459,12 \left(1 + \frac{0,088}{4} \right)^4 + \frac{15000 \left[\left(1 + \frac{0,088}{4} \right)^4 - 1 \right]}{0,088}$ $= R\,174\,877,60$	✓ future value – amount including interest ✓ $100\,000 \left(1 + \frac{0,088}{4} \right)^4$ ✓ answer (3) OR/OF ✓ R15 000 including interest – R100 000 ✓ $\left(1 + \frac{0,088}{4} \right)^4$ on P and x in F_v ✓ method (3)
7.2.1	$P = \frac{x[1 - (1+i)^{-n}]}{i}$ $1\,500\,000 = \frac{x \left[1 - \left(1 + \frac{0,105}{12} \right)^{-12 \times 20} \right]}{0,105}$ $x = R14\,975,70$	✓ $i = \frac{0,105}{12}$ ✓ $n = 240$ ✓ substitution into correct formula ✓ answer (4)

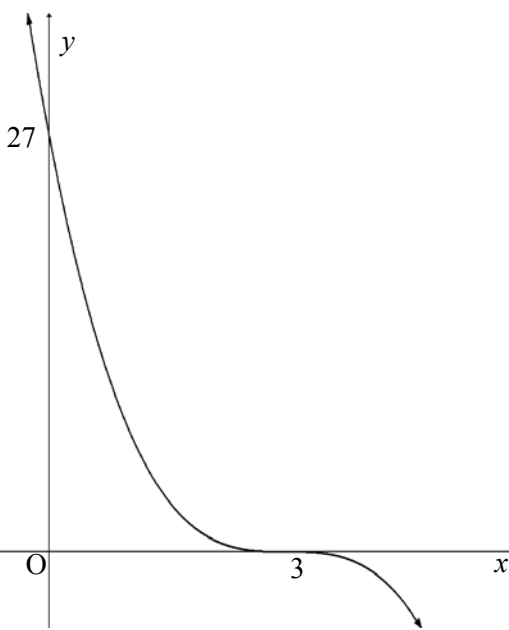
7.2.2	$P = \frac{x[1 - (1 + i)^{-n}]}{i}$ $P = \frac{14\,975,70 \left[1 - \left(1 + \frac{0,105}{12} \right)^{-12 \times 8} \right]}{\frac{0,105}{12}}$ $P = R969\,927,74$ OR/OF Balance outstanding = A – F $= 1\,500\,000 \left(1 + \frac{0,105}{12} \right)^{144} - \frac{14\,975,70 \left[\left(1 + \frac{0,105}{12} \right)^{144} - 1 \right]}{\frac{0,105}{12}}$ $= R5\,259\,229,61 - R4\,289\,302,47$ $= R969\,927,14$	✓ R14 975,70 in P_v-formula ✓✓ $n = 96$ ✓ substitution into correct formula ✓ answer (5) OR/OF ✓ $n = 144$ in A-formula ✓ $n = 144$ in F_v-formula ✓ R14 975,70 ✓ A – F ✓ answer (5)
		[15]

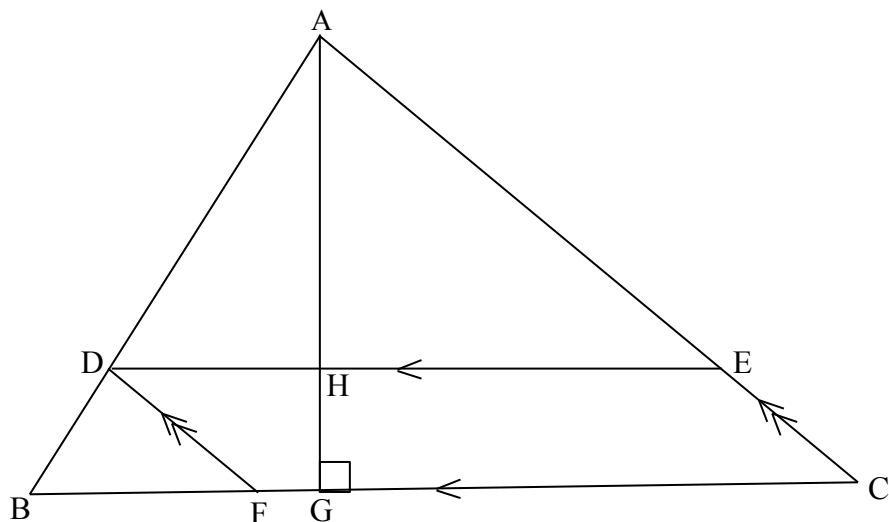
QUESTION/VRAAG 8

8.1	$f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{x^2 + 2xh + h^2 - 5 - x^2 + 5}{h}$ $= \lim_{h \rightarrow 0} \frac{h(2x + h)}{h}$ $= \lim_{h \rightarrow 0} (2x + h)$ $= 2x$ OR/OF $f(x+h) = (x+h)^2 - 5$ $= x^2 + 2xh + h^2 - 5$ $f(x+h) - f(x) = x^2 + 2xh + h^2 - 5 - (x^2 - 5)$ $= 2xh + h^2$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{2xh + h^2}{h}$ $= \lim_{h \rightarrow 0} \frac{h(2x + h)}{h}$ $= \lim_{h \rightarrow 0} (2x + h)$ $= 2x$	✓ $x^2 + 2xh + h^2 - 5$ ✓ simplification ✓ factorisation ✓ $\lim_{h \rightarrow 0} (2x + h)$ ✓ $2x$ (5) OR/OF ✓ $x^2 + 2xh + h^2 - 5$ ✓ simplification ✓ factorisation ✓ $\lim_{h \rightarrow 0} (2x + h)$ ✓ $2x$ (5)
8.2.1	$y = 3x^3 + 6x^2 + x - 4$ $\frac{dy}{dx} = 9x^2 + 12x + 1$	✓ $9x^2$ ✓ $12x$ ✓ 1 (3)
8.2.2	$y(x-1) = 2x(x-1)$ $y = \frac{2x(x-1)}{x-1} \text{ if } x \neq 1$ $y = 2x$ $\frac{dy}{dx} = 2$	✓ $y(x-1)$ ✓ $2x(x-1)$ ✓ $y = 2x$ ✓ answer (4)
		[12]

QUESTION/VRAAG 9

9.1.1	$g(x) = (x+5)(x-x_1)^2$ $20 = 5(x_1)^2$ $x_1^2 = 4$ $x_1 = 2$ $g(x) = (x+5)(x-2)^2$ $g(x) = (x+5)(x^2 - 4x + 4)$ $g(x) = x^3 + x^2 - 16x + 20$	$\checkmark (x+5)$ $\checkmark$ repeated root $\checkmark x_1 = 2$ $\checkmark g(x) = (x+5)(x^2 - 4x + 4)$ (4)
9.1.2	$g(x) = x^3 + x^2 - 16x + 20$ $g'(x) = 3x^2 + 2x - 16$ $3x^2 + 2x - 16 = 0$ $(3x+8)(x-2) = 0$ $x = \frac{-8}{3}$ or $x = 2$ $R\left(\frac{-8}{3}; \frac{1372}{27}\right)$ or $R(-2,67; 50,81)$ $P(2; 0)$	$\checkmark$ derivative $\checkmark$ equating to zero $\checkmark$ factors $\checkmark$ co-ordinates of R $\checkmark$ co-ordinates of P (5)
9.1.3	$g''(x) = 6x + 2$ $g''(0) = 2$ $\therefore$ concave up OR/OF $g''(x) = 6x + 2$ $6x + 2 = 0$ $x = -\frac{1}{3}$ is the point of inflection $\therefore$ concave up	$\checkmark g''(x) = 6x + 2$ $\checkmark g''(0) = 2$ $\checkmark$ conclusion (3) OR/OF $\checkmark g''(x) = 6x + 2$ $\checkmark x = -\frac{1}{3}$ $\checkmark$ conclusion (3)

9.2		✓ y – intercept of a cubic graph ✓ point of inflection and stationary point, $x = 3$ ✓ concave up for $x < 3$ and concave down for $x > 3$ (3)
		[15]

QUESTION/VRAAG 10

10.1	$\frac{AH}{HG} = \frac{3}{2}$	✓ answer (1)
10.2	Area of a parallelogram = base $\times$ $\perp$ height Area = $\frac{3}{5}(5-t) \cdot \frac{2}{5}t$ Area = $\frac{6}{25}(5-t)t$ $A(t) = -\frac{6}{25}t^2 + \frac{6}{5}t$ $A'(t) = -\frac{12}{25}t + \frac{6}{5}$ $-\frac{12}{25}t + \frac{6}{5} = 0$ $12t - 30 = 0$ $t = \frac{30}{12}$ or $\frac{5}{2}$	✓ $\frac{2}{5}t$ ✓ $\frac{3}{5}(5-t)$ ✓ $A(t) = -\frac{6}{25}t^2 + \frac{6}{5}t$ ✓ $-\frac{12}{25}t + \frac{6}{5}$ ✓ answer (5)
		[6]

QUESTION/VRAAG 11

11.1.1	$7^5 = 16\,807$	✓✓ answer (2)
11.1.2	$7 \times 6 \times 5 \times 4 \times 3$ $= \frac{7!}{2!} = 2520$	✓ $7 \times 6 \times 5 \times 4 \times 3$ or $\frac{7!}{2!}$ ✓ answer (2)
11.2	$2 \times 7 \times 1 = 14$	✓✓✓ $2 \times 7 \times 1$ (3)
		[7]

QUESTION/VRAAG 12

12.1	$P(A \text{ or } B) = P(A) + P(B)$ $0,74 = 0,45 + y$ $y = 0,29$	✓ $P(A \text{ or } B) = P(A) + P(B)$ ✓ substitution ✓ answer (3)
12.2	Let the number of mystery gift bags = x The total number of bags = $4x$ $\left(\frac{x}{4x}\right) \times \left(\frac{x-1}{4x-1}\right) = \frac{7}{118}$ $\frac{1}{4} \times \frac{x-1}{4x-1} = \frac{7}{118}$ $\frac{x-1}{4x-1} = \frac{28}{118}$ $118x - 118 = 112x - 28$ $x = 15$	✓ $4x$ ✓ $\left(\frac{x}{4x}\right)$ or $\left(\frac{1}{4}\right)$ ✓ $\left(\frac{x-1}{4x-1}\right)$ ✓ $\frac{1}{4} \times \frac{x-1}{4x-1}$ ✓ equating to $\frac{7}{118}$ ✓ answer (6)

	OR/OF $P(\text{gift and gift}) = P(\text{gift at first draw}) \times P(\text{gift at second draw})$ $\frac{7}{118} = \frac{1}{4} \times P(\text{gift at second draw})$ $P(\text{gift at second draw}) = \frac{7}{118} \div \frac{1}{4}$ $= \frac{14}{59}$ Therefore: $P(\text{gift at first draw}) = \frac{15}{60}$ And: 15 bags had mystery gifts inside	OR/OF $\checkmark \frac{1}{4}$ $\checkmark \frac{1}{4} \times P(\text{gift at 2}^{\text{nd}} \text{ draw})$ $\checkmark \frac{7}{118} = \frac{1}{4} \times P(\text{gift at 2}^{\text{nd}} \text{ draw})$ $\checkmark \frac{14}{59}$ $\checkmark \frac{15}{60}$ $\checkmark$ answer (6)
		[9]

TOTAL/TOTAAL: 150