basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE/ *NASIONALE SENIOR SERTIFIKAAT*

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GRADE 12/*GRAAD 12*

MATHEMATICS P1/*WISKUNDE V1*

NOVEMBER 2024

MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS/*PUNTE*: 150

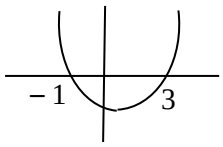
These marking guidelines consist of 17 pages.
Hierdie nasienriglyne bestaan uit 17 bladsye.

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

LET WEL:
- *Indien 'n kandidaat 'n vraag TWEE keer beantwoord, sien slegs die EERSTE poging na.*
- *Volgehoue akkuraatheid is DEURGAANS op ALLE aspekte van die nasienriglyne van toepassing.*

QUESTION 1/*VRAAG* 1

1.1.1	$x(x-3)=0$ $x=0$ or $x=3$	✓ $x=0$ ✓ $x=3$ (2)
1.1.2	$2x^2-4x+1=0$ $x=\dfrac{-(-4)\pm\sqrt{(-4)^2-4(2)(1)}}{2(2)}$ $x=1{,}71$ or $x=0{,}29$ Answer only: $\frac{4}{4}$	✓ standard form ✓ correct substitution in correct formula ✓ answer ✓ answer (4)
1.1.3	$x^2-2x-3>0$ $(x-3)(x+1)>0$ CV: $x=3$ or $x=-1$  Answer only: $\frac{3}{4}$ $x<-1$ or $x>3$ **OR/*OF*** $x\in(-\infty;-1)\cup(3;\infty)$	✓factors ✓ critical values ✓✓ answer (4)
1.1.4	$2^{2x}-2^{x+2}-32=0$ $2^{2x}-2^2.2^x-32=0$ $(2^x-8)(2^x+4)=0$ $2^x=8$ or $2^x\neq-4$ $2^x=2^3$ no solution $x=3$ Answer only: $\frac{1}{5}$	✓use of exponential law ✓factors ✓ $2^x=8$ ✓ $2^x\neq-4$ ✓ answer (5)
1.1.5	$\sqrt{-2x+4}-x=2$ $\sqrt{-2x+4}=2+x$ $\left(\sqrt{-2x+4}\right)^2=(2+x)^2$ $-2x+4=4+4x+x^2$ $x^2+6x=0$ $x(x+6)=0$ $x=0$ or $x\neq-6$	✓ isolating the root ✓ squaring both sides ✓ standard form ✓ answers with selection (4)

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1.2	$y = 3 - 2x$ … (1) $y^2 + xy = 2$ … (2) Subs (1) into (2): $(3-2x)^2 + (3-2x)x = 2$ $4x^2 - 12x + 9 - 2x^2 + 3x - 2 = 0$ $2x^2 - 9x + 7 = 0$ $(2x-7)(x-1) = 0$ $x = \frac{7}{2}$ or $x = 1$ $y = -4$ $y = 1$ **OR/*OF*** $x = \frac{3-y}{2}$ … (1) $y^2 + xy = 2$ … (2) Subs (1) into (2): $y^2 + \left(\frac{3-y}{2}\right)y = 2$ $2y^2 + 3y - y^2 - 4 = 0$ $y^2 + 3y - 4 = 0$ $(y+4)(y-1) = 0$ $y = -4$ or $y = 1$ $x = \frac{7}{2}$ or $x = 1$	✓ eq 1 ✓ substitution ✓ standard form ✓ both *x*-values ✓ both *y*-values (5) **OR/*OF*** ✓ eq 1 ✓ substitution ✓ standard form ✓ both *y*-values ✓ both *x*-values (5)
1.3	Product = $\frac{3}{2}\times\frac{4}{3}\times\frac{5}{4}\times\ldots\times\frac{n}{n-1}\times\frac{n+1}{n} = \frac{n+1}{2}$ The product will be an integer value when $n + 1$ is divisible by 2 i.e. $n \in \{3;5;7;\ldots\}$ Therefore, n must be an odd number, greater than 2. **OR/*OF*** For $n = 2$ the product is $\frac{3}{2}$ For $n = 3$ the product is $\left(\frac{3}{2}\right)\left(\frac{4}{3}\right) = 2$ For $n = 4$ the product is $\left(\frac{3}{2}\right)\left(\frac{4}{3}\right)\left(\frac{5}{4}\right) = \frac{5}{2}$ For $n = 5$ the product is $\left(\frac{3}{2}\right)\left(\frac{4}{3}\right)\left(\frac{5}{4}\right)\left(\frac{6}{5}\right) = 3$ $n \in \{3;5;7;\ldots\}$ Therefore, n must be an odd number, greater than 2.	✓ $\frac{3}{2}\times\frac{4}{3}\times\frac{5}{4}\times\ldots\times\frac{n+1}{n}$ ✓ statement $\left(\frac{n+1}{2}\right)$ ✓ n is odd for $n > 2$ (3) **OR/*OF*** ✓ generation of the four products ✓ identifying the pattern when n is odd ✓ n is odd for $n > 2$ (3)
		[27]

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QUESTION/*VRAAG* 2

2.1.1	$S_n = \frac{n}{2}[2a + (n-1)d]$ $S_{20} = \frac{20}{2}[2(7) + (20-1)(5)]$ $S_{20} = 1\,090$	✓ substitution ✓ answer (2)
2.1.2	$T_n = 7 + (n-1)(5)$ $T_n = 5n + 2$ $S_{75} - S_{20} = 14\,400 - 1\,090 = 13\,310$ $\sum_{n=1}^{75}(5n+2) - \sum_{n=1}^{20}(5n+2) = 13\,310$ $\therefore \sum_{n=21}^{75}(5n+2) = 13\,310$ **OR/*OF*** $T_{21} + T_{22} + T_{23} + ... + T_{75} = 14\,400 - 1\,090$ $107 + 112 + 117 + \ldots. = 13\,310$ $T_n = 102 + 5n$ $\therefore \sum_{1}^{55}(5n+102) = 13\,310$	✓ general term ✓ $S_{75} - S_{20}$ ✓ $\sum_{n=21}^{75}$ ✓ = 13 310 (4) **OR/*OF*** ✓ $S_{75} - S_{20}$ ✓ general term ✓ $\sum_{n=1}^{55}$ ✓ = 13 310 (4)
2.2.1	$T_n = 2n - 1$ 98th first difference = 2(98) – 1 = 195 Quadratic: $T_{98} = 9\,632 - 195$ = 9 437	✓answer ✓method ✓answer (3)
2.2.2	28 ; 29 ; 32 1 3 5 7 2 2 2 $3a + b = 1$ $2a = 2$ $3(1) + b = 1$ $a = 1$ $b = -2$ $9a + 3b + c = 32$ $T_3 = 1(3)^2 - 2(3) + c = 32$ $c = 29$ **OR/*OF*** $1 - 2 + c = 28$ $c = 29$ $\therefore T_n = n^2 - 2n + 29$	✓ second difference ✓ $a = 1$ ✓ $b = -2$ ✓ method to calculate c ✓ $c = 29$ (5)
		[14]

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QUESTION/*VRAAG* 3

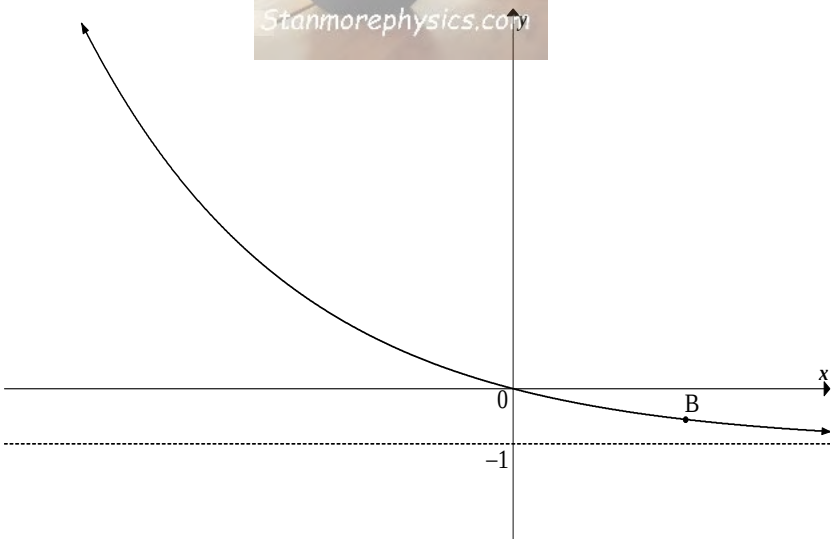
3.1	2nd circle: $\frac{6}{2}=3\text{ cm}$ 3rd circle: $\frac{3}{2}=1{,}5\text{ cm}$ **OR/*OF*** 3rd circle $=6\left(\frac{1}{2}\right)^2=1{,}5$	✓✓ radius 3rd circle (2) **OR/*OF*** ✓✓ radius 3rd circle (2)
3.2	$36\pi\ ;\ 9\pi\ ;\ \frac{9}{4}\pi\ ;\ ...$ $r=\frac{1}{4}\ \ ;\ \ a=36\pi$ $S_{10}=\frac{36\pi\left(\left(\frac{1}{4}\right)^{10}-1\right)}{\frac{1}{4}-1}$ $S_{10}=150{,}80$	✓ a ✓ r ✓ substitution ✓ answer (4)
3.3	$6\ ;\ 3\ ;\ \frac{3}{2}\ldots$ radius $=\frac{1}{2}\left(\frac{3}{128}\right)=\frac{3}{256}$ $\frac{3}{256}=6\left(\frac{1}{2}\right)^{n-1}$ $\frac{1}{512}=\left(\frac{1}{2}\right)^{n-1}$ $\left(\frac{1}{2}\right)^9=\left(\frac{1}{2}\right)^{n-1}$ **or/*of*** $n-1=\log_{\left(\frac{1}{2}\right)}\left(\frac{1}{512}\right)$ $\therefore n-1=9$ $\quad$ $\therefore n-1=9$ $\therefore n=10$ $\quad$ $\therefore n=10$	✓ $\frac{3}{256}$ ✓ equating to radius general term ✓ simplification ✓ answer (4)

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	OR/*OF* $12\ ;\ 6\ ;\ 3\ ;\ \ldots$ $\text{diameter} = \frac{3}{128}$ $\frac{3}{128} = 12\left(\frac{1}{2}\right)^{n-1}$ $\frac{1}{512} = \left(\frac{1}{2}\right)^{n-1}$ $\left(\frac{1}{2}\right)^{9} = \left(\frac{1}{2}\right)^{n-1}$ $\therefore n-1=9$ $\therefore n=10$ **or/*of*** $n-1=\log_{\left(\frac{1}{2}\right)}\left(\frac{1}{512}\right)$ $\therefore n-1=9$ $\therefore n=10$	**OR/*OF*** ✓ $12\left(\frac{1}{2}\right)^{n-1}$ ✓ equating general term of diameter to $\frac{3}{128}$ ✓simplification ✓ answer (4)
		[10]

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QUESTION/*VRAAG* 4

4.1	$f(x) = a^x - 1$ $-\frac{5}{9} = a^2 - 1$ $a^2 = \frac{4}{9}$ $a = \frac{2}{3}$	✓ substitution ✓ answer (2)
4.2	$y > -1$ **OR/*OF*** $y \in (-1\,;\infty)$	✓ answer (1) ✓ answer (1)
4.3		✓(0 ; 0) ✓ asymptote ✓decreasing shape (3)
4.4	$\frac{19}{8} = \left(\frac{2}{3}\right)^x - 1$ $\frac{27}{8} = \left(\frac{2}{3}\right)^x$ $\left(\frac{3}{2}\right)^3 = \left(\frac{3}{2}\right)^{-x}$ $\therefore x = -3$ $\therefore \text{C}\left(-3\,;\frac{19}{8}\right)$ $\text{C}'\left(\frac{19}{8}\,;-3\right)$	✓substitution ✓ answer ✓ answer (3)
		[9]

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QUESTION/*VRAAG* 5

5.1	$p = -1$	✓ $p = -1$ (1)
5.2	$y = x - 3$ $y = 1 - 3$ $y = -2$ Answer only: $\frac{2}{2}$	✓ substitution ✓ answer (2)
5.3	$1 = \frac{a}{0-1} - 2$ $3 = \frac{a}{-1}$ $a = -3$	✓ substitute (0 ; 1) ✓ answer (2)
5.4	$\frac{-3}{x-1} - 2 = 0$ $-3 = 2x - 2$ $2x = -1$ $\therefore x = -\frac{1}{2}$ $x \in \left[-\frac{1}{2}; 1\right)$ **OR/*OF*** $-\frac{1}{2} \leq x < 1$	✓x-intercept ✓✓ answer (3)
5.5	f is reflected in the y-axis, then translated 2 units to the right **OR/*OF*** f is reflected in the x-axis, then translated 4 units down **OR/*OF*** f is reflected about the line $x = 1$ **OR/*OF*** f is reflected about the line $y = -2$	✓ reflection in y-axis ✓ translation 2 units right (2) **OR/*OF*** ✓ reflection in x-axis ✓ translation 4 units down (2) **OR/*OF*** ✓✓ reflection about line $x = 1$ (2) **OR/*OF*** ✓✓ reflection about line $y = -2$ (2)
		[10]

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QUESTION/*VRAAG* 6

6.1	$x = \frac{-4}{2(-1)} = 2$ **OR/*OF*** $f'(x) = -2x + 4 = 0$ $x = 2$ $y = -(2)^2 + 4(2) + 5$ $= 9$ $\therefore B(2\ ;\ 9)$	✓ method for x ✓ value of x ✓ value for y (3)
6.2	$x^2 - 4x - 5 = 0$ $(x-5)(x+1) = 0$ $x = 5$ or $x = -1$ $\therefore A(-1\ ;\ 0)$ Equation of AC: $\frac{8-0}{3+1} = \frac{y-0}{x+1}$ **OR/*OF*** $m = \frac{8-0}{3+1} = 2$ $8x + 8 = 4y$ $y - 0 = 2(x+1)$ $2x + 2 = y$ $y = 2x + 2$	✓ $A(-1;0)$ ✓ method for gradient ✓ substitute point A or C into equation of a straight line (3)
6.3	$EH = -x^2 + 4x + 5 - (2x + 2)$ $EH = -x^2 + 2x + 3$ Max EH at: $-2x + 2 = 0$ **OR/*OF*** $x = \frac{-b}{2a} = \frac{-(-2)}{2(-1)}$ $x = 1$ $x = 1$ Max length of EH $= -(1)^2 + 2(1) + 3$ $= 4$ Answer only: $\frac{1}{4}$	✓ difference ✓ $EH = -x^2 + 2x + 3$ ✓ x - value ✓ length (4)
6.4	$k(x) = f(x+m)$ $= -x^2 - 2mx - m^2 + 4x + 4m + 5$ $k'(x) = -2x - 2m + 4$ $k'(x) = 2$ $-2x - 2m + 4 = 2$ $-2x = 2m - 2$ $x = 1 - m$ Answer only: $\frac{0}{5}$ $k(1-m) = g(1-m)$ $-(1-m)^2 - 2m(1-m) - m^2 + 4(1-m) + 4m + 5 = 2(1-m) + 2$ $-1 + 2m - m^2 - 2m + 2m^2 - m^2 + 4 - 4m + 4m + 5 = 2 - 2m + 2$ $-2m - 4 = 0$ $\therefore m = -2$	✓ $k'(x)$ ✓ $k'(x) = 2$ ✓ $x = 1 - m$ ✓ substitution ✓ answer (5)

	OR/*OF*	**OR/*OF***
	$k(x) = f(x+m) = g(x)$ $-x^2 - 2mx - m^2 + 4x + 4m + 5 = 2x + 2$ $0 = x^2 + (2m-2)x + m^2 - 4m - 3$	✓ equating ✓ simplification
	$\Delta = (2m-2)^2 - 4(1)(m^2 - 4m - 3)$ $\Delta = 4m^2 - 8m + 4 - 4m^2 + 16m + 12$ $\Delta = 8m + 16 = 0$ $\therefore m = -2$	✓ substitution into Δ ✓ $\Delta = 0$ ✓ answer (5)
	OR/*OF*	**OR/*OF***
	$f(x) = -x^2 + 4x + 5$ $f'(x) = -2x + 4 = 2$ $-2x = -2$ $x = 1$	✓ $f'(x) = 2$ ✓ x-value
	$f(1) = -(1)^2 + 4(1) + 5$ $\therefore y = 8$ $\therefore$ translate 2 units to the right $\therefore m = -2$	✓ y-value ✓ 2 units to the right ✓ answer (5)
		[15]

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QUESTION/*VRAAG* 7

7.1	$A = P(1+i)^n$ $A = 5\,000\left(1+\frac{6,8}{400}\right)^{64}$ $= \text{R}\,14\,706,56$	✓ *i*, *n* ✓ substitution into correct formula ✓ answer (3)
7.2	$A = P(1-in)$ $\frac{1}{2}P = P(1-4i)$ $\frac{1}{2} = (1-4i)$ $i = \frac{1}{8}$ $\therefore r = 12,5\%$ **OR/*OF*** $r = \frac{50\%}{4}$ $r = 12,5\%$	✓substitution into correct formula ✓ answer (2) **OR/*OF*** ✓ method ✓ answer (2)
7.3.1	Already paid: $2\,300,98 \times 60 = \text{R}\,138\,\,058,80$ Interest: 138 058,80 – 100 000 = R 38 058,80	✓ amount already paid ✓ interest (2)

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7.3.2	Balance after 2 years: $P = \frac{x\left[1-(1+i)^{-n}\right]}{i}$ $P = \frac{2\,300,98\left[1-\left(1+\frac{13,5}{1200}\right)^{-36}\right]}{\frac{13,5}{1200}}$ = R 67 804,94 R 67 804,94 – R20 000 = R 47 804,94 $P = \frac{x\left[1-(1+i)^{-n}\right]}{i}$ $47\,804,94 = \frac{2\,300,98\left[1-\left(1+\frac{13,5}{1200}\right)^{-n}\right]}{\frac{13,5}{1200}}$ $0,766 = (1,01125)^{-n}$ $\log_{1,01125} 0,766 = -n$ n = 23,83 ∴ 12 months earlier **OR/*OF*** $A = 100\,000\left(1+\frac{13,5}{1200}\right)^{12\times 2}$ = R130 799,12 $F = \frac{2\,300,98\left[\left(1+\frac{13,5}{1200}\right)^{12\times 2}-1\right]}{\frac{13,5}{1200}}$ = R 62 993, 92 Balance outstanding = A – F = 130 799,12 – 62 993,92 = R67 805,20 R 67 805,20 – R20 000 = R 47 805,20 $P = \frac{x\left[1-(1+i)^{-n}\right]}{i}$ $47\,805,20 = \frac{2\,300,98\left[1-\left(1+\frac{13,5}{1200}\right)^{-n}\right]}{\frac{13,5}{1200}}$ $0,766... = (1,01125)^{-n}$ $\log_{1,01125} 0,766... = -n$ n = 23,80 ∴ 12 months' earlier	✓n= 36 ✓i ✓ substitution into correct formula ✓ answer ✓ answer ✓substitution into correct formula ✓ answer in months (7) **OR/*OF*** ✓n = 24 ✓i ✓ substitution into both correct formulae ✓ answer ✓ answer ✓ substitution into correct formula ✓ answer in months (7)

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	OR/*OF*	**OR/*OF***
	$100\ 000 = \dfrac{2\ 300,98\left[1-\left(1+\dfrac{13,5}{1200}\right)^{-n}\right]}{\dfrac{13,5}{1200}} + 20\ 000\left(1+\dfrac{13,5}{1200}\right)^{-24}$	✓ i ✓ n = 24 ✓= 100 000 ✓ substitution into correct P formula ✓ substitution into correct A formula
	$84\ 709,38 = \dfrac{2\ 300,98\left[1-\left(\dfrac{809}{800}\right)^{-n}\right]}{\dfrac{0,135}{12}}$	✓ simplification
	$0,4142 = 1-\left(\dfrac{809}{800}\right)^{-n}$ $\left(\dfrac{809}{800}\right)^{-n} = 0,5858$ $-n = \log_{\left(\frac{809}{800}\right)} 0,5858$	
	n = 47,80 months after starting payments ∴ 12 months earlier	✓ answer in months (7)
		[14]

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QUESTION/*VRAAG* 8

8.1.1	$\frac{d}{dx}\left[3x-5x^2\right]$ $=3-10x$	✓3 ✓$-10x$ (2)
8.1.2	$g(x)=\frac{2}{x^2}-\sqrt[3]{x^7}$ $g(x)=2x^{-2}-x^{\frac{7}{3}}$ $g'(x)=-4x^{-3}-\frac{7}{3}x^{\frac{4}{3}}$	✓$2x^{-2}$ ✓$-x^{\frac{7}{3}}$ ✓$-4x^{-3}$ ✓$-\frac{7}{3}x^{\frac{4}{3}}$ (4)
8.2	$f(x)=x^3-4x^2+2x+3$ $f'(x)=3x^2-8x+2$ $m=f'(2)=3(2)^2-8(2)+2$ $m=-2$ $y=f(2)=(2)^3-4(2)^2+2(2)+3$ $y=-1$ $y+1=-2(x-2)$ $y=-2x+3$	✓$m=-2$ ✓$y=-1$ ✓ answer (3)
8.3.1	$f(x)=-6x^2$ $f'(x)=\lim\limits_{h\to 0}\frac{f(x+h)-f(x)}{h}$ $=\lim\limits_{h\to 0}\frac{-6(x+h)^2+6x^2}{h}$ $=\lim\limits_{h\to 0}\frac{-6x^2-12xh-6h^2+6x^2}{h}$ $=\lim\limits_{h\to 0}\frac{-12xh-6h^2}{h}$ $=\lim\limits_{h\to 0}\frac{h(-12x-6h)}{h}$ $=\lim\limits_{h\to 0}(-12x-6h)$ $=-12x$	✓substitution ✓ $f(x+h)=-6x^2-12xh-6h^2$ ✓simplification ✓common factor ✓answer (5)

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	OR/*OF*	**OR/*OF***
	$f(x)=-6x^2$ $f(x+h)=-6x^2-12xh-6h^2$ $f(x+h)-f(x)=-6x^2-12xh-6h^2+6x^2=-12xh-6h^2$	✓ $f(x+h)=-6x^2-12xh-6h^2$ ✓simplification
	$f'(x)=\lim\limits_{h\to 0}\dfrac{f(x+h)-f(x)}{h}$ $=\lim\limits_{h\to 0}\dfrac{-12xh-6h^2}{h}$ $=\lim\limits_{h\to 0}\dfrac{h(-12x-6h)}{h}$ $=\lim\limits_{h\to 0}(-12x-6h)$ $=-12x$	✓substitution ✓common factor ✓answer (5)
8.3.2	$x\geq 0$ **OR/*OF*** $x\leq 0$	✓answer (1) ✓answer (1)
8.3.3	$y=-6x^2$ $x=-6y^2$ $y^2=\dfrac{-1}{6}x$ $y=\pm\sqrt{-\dfrac{1}{6}x}$ $\therefore y=-\sqrt{-\dfrac{1}{6}x}\quad ;\quad x\leq 0$	✓ swopping x and y ✓ $y=\pm\sqrt{-\dfrac{1}{6}x}$ ✓ answer (3)
		[18]

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QUESTION/*VRAAG* 9

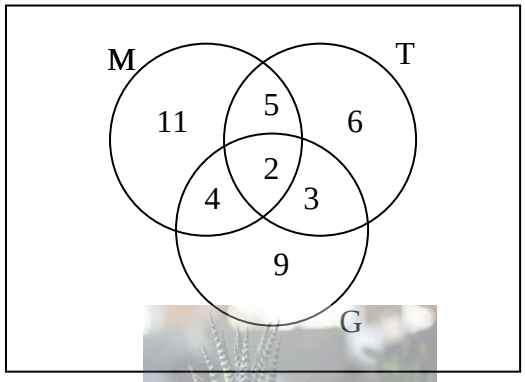
9.1	$1 < x < \frac{5}{2}$	✓✓answer (2)
9.2	$(1\,;0)$ and $\left(\frac{5}{2};0\right)$	✓ $x=1$ ✓ $x=\frac{5}{2}$ (2)
9.3	$\frac{\frac{5}{2}+1}{2}$ $=\frac{7}{4}$ Concave up for $x > \frac{7}{4}$	✓method ✓answer (2)
9.4	$-9 < k < -8$	✓✓answer (2)
		[8]

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QUESTION/*VRAAG* 10

10.1	$-6t+18=0$ $18=6t$ $3=t$ $s'(3)=-3(3)^2+18(3)=27$	✓ $=0$ ✓ value of t ✓ answer (3)
10.2	$-3t^2+18t=0$ $-3t(t-6)=0$ $t=0$ or $t=6$ $s(t)=at^3+bt^2$ $s'(t)=3at^2+2bt$ $3a=-3$ and $2b=18$ $a=-1$ $b=9$ $s(t)=-1t^3+9t^2$ $s(6)=-(6)^3+9(6)^2$ $s(6)=108$	✓ factors ✓ values ✓ a and b ✓ substitution ✓ answer (5)
		[8]

QUESTION/*VRAAG* 11

11.1		✓2 ✓3 ; 4 ; 5 ✓6 ; 9 ; 11 (3)
11.2	P(at least two subjects) = $\frac{4+2+5+3}{40} = \frac{14}{40} = \frac{7}{20} = 0,35$	✓ (4 + 2 + 5 + 3) or 14 in numerator ✓ 40 in denominator (2)
11.3	$P(M) \times P(T) = \frac{22}{40} \times \frac{16}{40} = \frac{11}{50} = 0,22$ $P(M \text{ and } T) = \frac{7}{40} = 0,175$ $P(M) \times P(T) \neq P(M \text{ and } T)$ Events M and T are not independent	✓$\frac{22}{40} \times \frac{16}{40}$ ✓$\frac{11}{50}$ ✓$\frac{7}{40}$ ✓answer (4)
		[9]

QUESTION/*VRAAG* 12

12.1	$26 \times 10 \times 26 \times 10 = 67\ 600$	✓for correct letters ✓for correct digits (2)
12.2	$18 \times 9 \times 19 \times 5 = 15\ 390$	Given that its multiplication ✓ 18 ✓ 19 ✓ 9 ✓ 5 (4)
12.3	$24 \times 9 \times 25 \times 5 = 27\ 000$ $\frac{27\ 000 - 15390}{15\ 390} \times 100 = 75,44\%$	✓$24 \times 9 \times 25 \times 5$ ✓answer (2)
		[8]

TOTAL/*TOTAAL*: 150

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