basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

SENIOR CERTIFICATE EXAMINATION/
SENIORSERTIFIKAAT-EKSAMEN

MATHEMATICS P1/*WISKUNDE V1*

2015

MEMORANDUM

MARKS/*PUNTE*: 150

This memorandum consists of 19 pages./
Hierdie memorandum bestaan uit 19 bladsye.

NOTE:

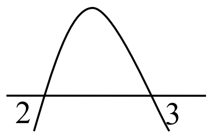
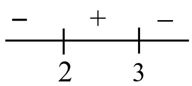
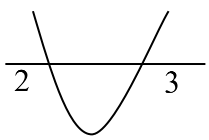
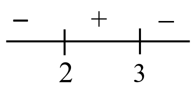
- If a candidate answers a QUESTION TWICE, only mark the FIRST attempt.
- Consistent accuracy applies in all aspects of the marking memorandum.

LET WEL:

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

QUESTION/*VRAAG 1*

1.1.1	$x(x-1)=0$ $x=0$ or $x=1$	✓$x=0$ ✓ $x=1$ (2)
1.1.2	$2x^2-4x-5=0$ $x=\frac{-(-4)\pm\sqrt{(-4)^2-4(2)(-5)}}{2(2)}$ $=\frac{4\pm\sqrt{56}}{4}$ $x=-0{,}87$ or $x=2{,}87$ **OR/*OF*** $x^2-2x-\frac{5}{2}=0$ $(x-1)^2=\frac{5}{2}+1$ $x-1=\pm\sqrt{\frac{7}{2}}$ $\therefore x=1\pm\sqrt{\frac{7}{2}}$ $x=-0{,}87$ or $x=2{,}87$	✓ correct substitution into correct formula ✓✓ answers (3) ✓completing the square/ *voltooiing van die vierkant* ✓✓answers (3)
1.1.3	$5^x=\frac{1}{125}$ $5^x=5^{-3}$ $x=-3$ **OR/*OF***	✓ 5^{-3} ✓ answer (2)

	$5^x = \frac{1}{125}$ $\left(\frac{1}{5}\right)^{-x} = \left(\frac{1}{5}\right)^3$ $-x = 3$ $x = -3$ **OR / *OF*** $5^x = \frac{1}{125}$ $x = \log_5\left(\frac{1}{125}\right)$ $= -3$ **OR / *OF*** $5^x = \frac{1}{125}$ $5^x \cdot 125 = 1$ $5^x \cdot 5^3 = 1$ $5^{x+3} = 5^0$ $x + 3 = 0$ $x = -3$	✓$\left(\frac{1}{5}\right)^{-x} = \left(\frac{1}{5}\right)^3$ ✓answer (2) ✓use of logs ✓ answer (2) ✓ 5^3 ✓ answer (2)
1.1.4	$(x-3)(2-x) > 0$  **OR/*OF***  $2 < x < 3$ **OR/*OF*** $(x-3)(2-x) > 0$ $(x-3)(x-2) < 0$  **OR/*OF***  $2 < x < 3$	✓critical values ✓ solves an equality ✓ answer (3) ✓critical values ✓ $2 < x$ ✓ $x < 3$ (3)

1.2.1	$x=3$	✓answer (1)
1.2.2	$x+1=\frac{-4}{x-3}$ $(x+1)(x-3)=-4$ $(x+1)(x-3)+4=0$ $x^2-2x+1=0$ $(x-1)^2=0$ $x=1$	✓ $(x+1)(x-3)=-4$ ✓standard form ✓factors ✓answer (4)
1.2.3	Yes, the graph of f and the graph of g have equal roots at $x = 1$. *Ja, die grafiek van f en die grafiek van g het gelyke wortels by* $x = 1$. **OR/*OF*** Yes, the graphs of f and g intersect in only one point, which is at $x = 1$. /*Ja die grafieke van f en g sny in slegs een punt wat by* $x = 1$ is.	✓yes ✓reason (2) ✓yes ✓reason (2)

1.3

$$A \longrightarrow B$$

Speed/*Spoed* = y km/h
Distance/*Afstand* = x km
Time/*Tyd* = $\dfrac{x}{y}$

✓time from A to B is $\dfrac{x}{y}$

$$A \longleftarrow B$$

Speed/*Spoed* = $\dfrac{3y}{2}$ km/h
Distance/*Afstand* = x km
Time/*Tyd* = $\dfrac{x}{\frac{3y}{2}} = \dfrac{2x}{3y}$

✓time from B to A is $\dfrac{2x}{3y}$

OR/*OF*

	S	D	T
A to/*na* B	y	x	$\dfrac{x}{y}$
B to/*na* A	$\dfrac{3y}{2}$	x	$\dfrac{2x}{3y}$

Average speed travelled/*Gemiddelde spoed afgelê*:

$$\frac{\text{Total distance travelled}/\textit{Totale afstand gereis}}{\text{Total time taken}/\textit{Totale tyd geneem}} = \frac{2x}{\frac{x}{y}+\frac{2x}{3y}}$$

$$= \frac{2x}{\frac{3x+2x}{3y}}$$

$$= \frac{6xy}{5x}$$

$$= \frac{6y}{5} \text{ km/h}$$

✓ $2x$
✓ $\dfrac{x}{y}+\dfrac{2x}{3y}$
✓ $\dfrac{6xy}{5x}$
✓ $\dfrac{6y}{5}$ km/h

(6)
[23]

QUESTION/*VRAAG* 2

2.1	$T_4 = 31$	✓answer (1)
2.2	$T_n = 9n - 5$ **OR/*OF*** $T_n = a + (n-1)d$ $= 4 + (n-1)(9)$ $= 9n - 5$	✓ $9n$ ✓ -5 (2) ✓ 4 ✓ $(n-1)(9)$ (2)
2.3	$4; 22; 40.......$ $a = 4$ $d = 18$ $S_{25} = \frac{n}{2}[2a + (n-1)d]$ $= \frac{25}{2}[2(4) + (24)(18)]$ $= \frac{25}{2}(440)$ $= 5500$ **OR/*OF*** $T_{25} = 9(49) - 7$ $= 436$ $S_{25} = \frac{25}{2}[4 + 436]$ $= 5500$ **OR/*OF*** $4 + 22 + 40 + 58 + 76 + 94 + 112 + 130 + 148 + 166 + 184 + 202 + 220 + 238 +$ $256 + 274 + 292 + 310 + 328 + 346 + 364 + 382 + 400 + 418 + 436$ $= 5500$	✓✓ $d = 18$ ✓correct substitution into correct formula ✓answer (4) ✓✓ $T_{25} = 436$ ✓substitution into correct formula ✓answer (4) ✓✓ $T_{25} = 436$ ✓expands whole series ✓answer (4)

2.4

$$\begin{array}{ccccccc} -6 & & -2 & & 11 & & 33 \\ & 4 & & 13 & & 22 & \\ & & 9 & & 9 & & \end{array}$$

✓ sets up quadratic sequence

$2a = 9 \qquad 3a + b = 4 \qquad a + b + c = -6$

$a = \frac{9}{2} \qquad 3\left(\frac{9}{2}\right) + b = 4 \qquad \frac{9}{2} - \frac{19}{2} + c = -6$

$b = -\frac{19}{2} \qquad c = -1$

$T_n = \frac{9}{2}n^2 - \frac{19}{2}n - 1$

✓ $a = \frac{9}{2}$
✓ $b = -\frac{19}{2}$
✓ $c = -1$

(4)

OR/*OF*

$T_n = T_1 + (n-1)d_1 + \frac{(n-1)(n-2)d_2}{2}$

$= -6 + (n-1)(4) + \frac{(n-1)(n-2)(9)}{2}$

$= -6 + 4n - 4 + \frac{9n^2 - 27n + 18}{2}$

$= \frac{9}{2}n^2 - \frac{19}{2}n - 1$

✓formula & substitution
✓ $a = \frac{9}{2}$
✓ $b = -\frac{19}{2}$
✓ $c = -1$

(4)

OR/*OF*

$T_n = an^2 + bn + c$

$2a = 9$

$a = \frac{9}{2}$

$T_1 = \left(\frac{9}{2}\right)(1)^2 + b(1) + c$

$-6 = \frac{9}{2} + b + c \qquad \ldots \quad \text{line}\,1$

$T_2 = \left(\frac{9}{2}\right)(2)^2 + b(2) + c$

$-2 = 18 + 2b + c \qquad \ldots \quad \text{line}\,2$

$4 = \frac{27}{2} + b \qquad \ldots \quad \text{line}\,2 \ - \ \text{line}\,1$

$b = \frac{-19}{2}$

$c = -1$

$T_n = \frac{9}{2}n^2 - \frac{19}{2}n - 1$

✓ sets up quadratic sequence
✓ $a = \frac{9}{2}$
✓ $b = -\frac{19}{2}$
✓ $c = -1$

(4)
[11]

QUESTION/*VRAAG* 3

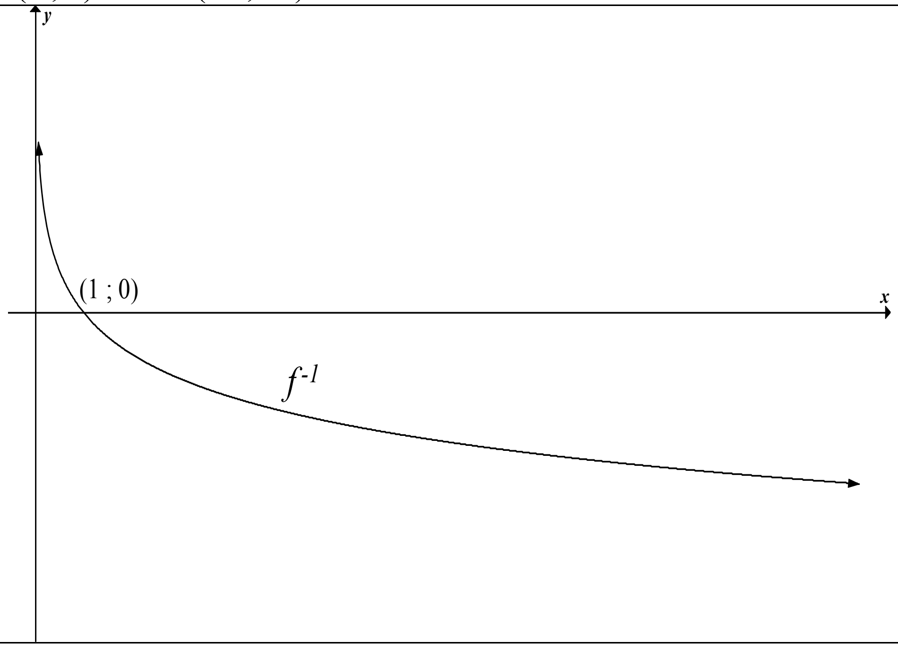
3.1	Given $\sum_{p=4}^{21}(-3)^p$	
3.1.1	$T_1=(-3)^4=81$ $T_2=(-3)^5=-243$ $T_3=(-3)^6=729$	✓81 ✓-243 and 729 (2)
3.1.2	$r=-3$	✓answer (1)
3.1.3	$\sum_{p=4}^{\infty}(-3)^p$ will NOT converge/*sal NIE konvergeer.* To converge/*om te konvergeer*, $-1<r<1$ and $r=-3$ **OR/*OF*** $\sum_{p=4}^{\infty}(-3)^p$ will NOT converge/*sal NIE konvergeer.* Because/*Omdat* $r<-1$	✓NOT converge/ *NIE konvergeer* ✓we do not have $-1<r<1$ (2) ✓NOT converge/ *NIE konvergeer* ✓ $r<-1$ (2)
3.1.4	$S_{18}=\dfrac{81x\left(1-(-3)^{18}\right)}{1-(-3)}$ $=-7\,845\,264\,882\,x$ **OR/*OF*** $S_{18}=\dfrac{81x\left((-3)^{18}-1\right)}{(-3)-1}$ $=-7\,845\,264\,882\,x$	✓ $n=18$ ✓ $a=81x$ ✓ correct substitution into correct formula (3) ✓ $n=18$ ✓ $a=81x$ ✓ correct substitution into correct formula (3)
3.2.1	$6-x\,;\ 5\,;\ \sqrt{4x+12}$ $5-(6-x)=\sqrt{4x+12}-5$ $x-1=\sqrt{4x+12}-5$ $x+4=\sqrt{4x+12}$ $\quad$ (and $x\geq-4$ and $x\geq-3$) $x^2+8x+16=4x+12$ $x^2+4x+4=0$ $(x+2)^2=0$ $x=-2$	✓ $T_2-T_1=T_3-T_2$ ✓ $x+4=\sqrt{4x+12}$ ✓ $x^2+8x+16=4x+12$ ✓ factorisation ✓ answer (5)

3.2.2	$T_1 = 6-(-2) = 8$ $T_2 = 5$ $T_3 = \sqrt{4(-2)+12}$ $= 2$ $d = -3$ $T_{10} = 8+9(-3)$ $= -19$	✓ $d = -3$ ✓ correct substitution into correct formula ✓ answer (3) **[16]**

QUESTION/*VRAAG* 4

4.1	**R** , $y \neq -2$ **OR/*OF*** $(-\infty;-2)\cup(-2;\infty)$	✓✓ $y \neq -2$ (2) ✓ $(-\infty;-2)$ ✓ $(-2;\infty)$ (2)
4.2	$g(x) = \dfrac{a}{x-1} - 2$ $-5 = \dfrac{a}{-1} - 2$ $5 = a+2$ $a = 3$	✓substitution of the point (0; –5) in to $g(x)$ ✓answer (2)
4.3	For g, asymptotes intersect at/*Vir g, asimptote sny by* $(1;-2)$ $\therefore$ For/*Vir* $y = g(x-3)+7$, asymptotes will intersect at/ *asimptote sal sny by* $(1+3;-2+7)$ i.e./*d.i.* at/*by* $(4;\ 5)$ **OR/*OF*** $g(x) = \dfrac{a}{x-1} - 2$ $y = g(x-3)+7$ $= \dfrac{3}{x-3-1} - 2 + 7$ $= \dfrac{3}{x-4} + 5$ $(4\ ;5)$	✓ $(1;-2)$ for g ✓$x = 4$ ✓$y = 5$ (3) ✓subs ✓$x = 4$ ✓$y = 5$ (3) **[7]**

QUESTION/*VRAAG* 5

5.1	$y=\left(\frac{1}{4}\right)^{-2}$ $=4^2$ $=16$	✓substitution ✓ answer (2)
5.2	$y=\left(\frac{1}{4}\right)^{x}$ $f^{-1}:\ x=\left(\frac{1}{4}\right)^{y}$ $y=\log_{\frac{1}{4}} x$ or $y=-\log_4 x$	✓interchange x and y ✓ answer (2)
5.3	f and f^{-1} are symmetrical about the line $y = x$, to obtain f^{-1}, reflect f in the line $y = x$. *f en f^{-1} is simmetries om die lyn $y = x$, om dus f^{-1} te kry reflekteer f in die lyn $y = x$.* **OR/*OF*** The x and y-coordinates of points on f may be swopped around to obtain the coordinates of the points on f^{-1}. Two points that lie on the graph of f are (0 ; 1) and (–2 ; 16). The corresponding points that will lie on f^{-1} will therefore be (1 ; 0) and (16 ; –2). *Die x- en y-koördinate van punte op f mag omgeruil word om die koördinate van punte op f^{-1} te kry. Twee punte op die grafiek van f is* (0 ; 1) *en* (–2 ; 16). *Die ooreenstemmende punte op* f^{-1} sal dus (1 ; 0) and/*en* (16 ; –2) *wees*.	✓reflect in $y = x$ (1) ✓swop x and y (1)
5.4		✓ shape of f^{-1} ✓x-int of f^{-1} at 1 (2)

5.5	$x > 0$ **OR/*OF*** $(0\,;\infty)$	✓ $x > 0$ (1) ✓ $(0\,;\infty)$ (1)
5.6	$f^{-1}(x) \geq -2$ From 5.1, $f^{-1}(16) = -2$ $0 < x \leq 16$ or $x \in (0\,;16]$	✓ $x > 0$ ✓ $x \leq 16$ (2)
5.7.1	$q = \frac{1}{2}$ (using a calculator/*gebruik 'n sakrekenaar*) **OR/*OF*** Without a calculator (not necessary)/*Sonder sakrekenaar (nie nodig)* $q = \log_{\frac{1}{4}} \frac{1}{2}$ $\left(\frac{1}{4}\right)^q = \frac{1}{2}$ $2^{-2q} = 2^{-1}$ $2q = 1$ $q = \frac{1}{2}$ **OR/*OF*** $q = \log_{\frac{1}{4}} \frac{1}{2}$ $q = \dfrac{\log \frac{1}{2}}{\log \frac{1}{4}}$ $q = \dfrac{-\log 2}{-2\log 2}$ $q = \frac{1}{2}$	✓ $q = \frac{1}{2}$ (1) ✓ $q = \frac{1}{2}$ (1)
5.7.2	At the intersection point of *f* and f^{-1}, $y = x$ (by symmetry). Thus need only solve $f^{-1}(x) = x$ (instead of $f(x) = f^{-1}(x)$) *By die snypunt van f en* f^{-1}, $y = x$ *(deur simmetrie).* *Slegs nodig om* $f^{-1}(x) = x$ *op te los (in plaas van* $f(x) = f^{-1}(x)$ $\log_{\frac{1}{4}} x = x$ $\log_{\frac{1}{4}} \frac{1}{2} = \frac{1}{2}$ from 5.7.1 $x = \frac{1}{2}$ $y = \frac{1}{2}$ $\left(\frac{1}{2}\,;\frac{1}{2}\right)$ **OR/*OF*** By/*Van* 5.7.1, $\frac{1}{2} = \log_{\frac{1}{4}} \frac{1}{2}$ Which means that $\left(\frac{1}{2}\,;\frac{1}{2}\right)$ lies on the graph of f^{-1}./	✓ $\frac{1}{2} = \log_{\frac{1}{4}} \frac{1}{2}$ ✓ $x = \frac{1}{2}$ ✓ $y = \frac{1}{2}$ (3) ✓ $\frac{1}{2} = \log_{\frac{1}{4}} \frac{1}{2}$

	Wat beteken $\left(\frac{1}{2};\frac{1}{2}\right)$ *lê op die grafiek van* f^{-1}. But clearly, $\left(\frac{1}{2};\frac{1}{2}\right)$ lies on $y=x$ /*Maar,* $\left(\frac{1}{2};\frac{1}{2}\right)$ *lê op* $y=x$ Hence $\left(\frac{1}{2};\frac{1}{2}\right)$ is the intersection point of f and f^{-1} /*Dus is* $\left(\frac{1}{2};\frac{1}{2}\right)$ *die snypunt van* f *en* f^{-1}	✓ $x=\frac{1}{2}$ ✓ $y=\frac{1}{2}$ (3) **[14]**

QUESTION/*VRAAG 6*

6.1	$-3x^2-9x+30=0$ $x^2+3x-10=0$ $(x+5)(x-2)=0$ $x=-5$ or $x=2$ $\text{AB}=7$ units	✓ $-3x^2-9x+30=0$ ✓factors ✓answers ✓AB = 7 (4)
6.2	$-3x^2-9x+30=-12x+12$ $-3x^2+3x+18=0$ $x^2-x-6=0$ $(x-3)(x+2)=0$ $x=-2$ or $x=3$ At K, $x>0$, hence $y=-12(3)+12=-24$ $\text{K}(3;-24)$	✓equating of equations ✓ $x^2-x-6=0$ ✓factors ✓$x=3$ ✓$y=-24$ (5)
6.3	$f(x)\le g(x)$ $x\le-2$ or $x\ge3$ **OR/*OF*** $f(x)\le g(x)$ $x\in(-\infty;-2]$ or $[3;\infty)$ **OR/*OF*** $-3x^2-9x+30-(-12x+12)\le0$ $-3x^2+3x+18\le0$ $x^2-x-6\ge0$ $(x-3)(x+2)\ge0$ $x\le-2$ or $x\ge3$	✓ $x\le-2$ ✓ $x\ge3$ ✓ or (3) ✓ $(-\infty;-2]$ ✓ $[3;\infty)$ ✓ or (3) ✓ $x\le-2$ ✓ $x\ge3$ ✓ or (3)

6.4	$CD = -3x^2 - 9x + 30 - (-12x + 12)$ $= -3x^2 + 3x + 18$ $x = -\frac{b}{2a}$ **OR/*OF*** $f'(x) = 0$ **OR/*OF*** $CD = -3(x^2 - x) + 18$ $= \frac{-3}{2(-3)}$ $\quad -6x + 3 = 0$ $\quad = -3\left[\left(x - \frac{1}{2}\right)^2 - \left(\frac{1}{2}\right)^2\right] + 18$ $= \frac{1}{2}$ $\quad x = \frac{1}{2}$ $\quad = -3\left(x - \frac{1}{2}\right)^2 + \frac{3}{4} + 18$ $= -3\left(x - \frac{1}{2}\right)^2 + 18\frac{3}{4}$ Max length/*Maks lengte* CD **OR/*OF*** Max length/*Maks lengte* CD $= -3\left(\frac{1}{2}\right)^2 + 3\left(\frac{1}{2}\right) + 18$ $\quad = 18\frac{3}{4}$ $= \frac{75}{4}$ $= 18\frac{3}{4}$	✓ $CD = y_f - y_g$ ✓ $-3x^2 + 3x + 18$ ✓method ✓ $x = \frac{1}{2}$ ✓max length $CD = \frac{75}{4}$ or $18\frac{3}{4}$ (5) **[17]**

QUESTION/*VRAAG 7*

7.1	Anisha: Final investment value/*Finale beleggingswaarde* $= P(1 + in) + 7{,}5\%$ of R12 000 $= 12\,000(1 + 0{,}085 \times 5) + 900$ $=$ R18 000 Lindiwe: Final investment value /*Finale beleggingswaarde* $= P(1+i)^n$ $= 12\,000\left(1 + \frac{0{,}085}{4}\right)^{20}$ $=$ R18 273,54 Therefore Lindiwe will have a larger final amount./ *Lindiwe sal 'n groter finale bedrag hê.*	✓900 or 7,5% of R12 000 ✓ $12000(1 + 0{,}085 \times 5)$ ✓R18 000 ✓ $12\,000\left(1 + \frac{0{,}085}{4}\right)^{20}$ ✓R18273,54 ✓conclusion (6)

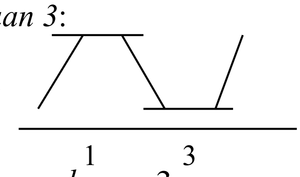
7.2	$A = P(1-i)^n$ $41\ 611,57 = 120\,000(1-0,124)^n$ $\dfrac{41\ 611,57}{120\,000} = (0,876)^n$ $n = \log_{(0,876)} \dfrac{41611,57}{120\,000}$ $= 8 \text{ years}$	✓formula ✓substitution ✓ $n = \log_{(0,876)} \dfrac{41611,57}{120\,000}$ ✓answer (4)
	OR/*OF* $A = P(1-i)^n$ $41611,57 = 120\,000(1-0,124)^n$ $\dfrac{41611,57}{120\,000} = (0,876)^n$ $\log \dfrac{41611,57}{120\,000} = n\log(0,876)^n$ $n = \dfrac{\log \dfrac{41611,57}{120\,000}}{\log 0,876}$ $= 8 \text{ years}$	✓formula ✓substitution ✓ $n = \dfrac{\log \dfrac{41611,57}{120\,000}}{\log 0,876}$ ✓answer (4)
7.3	final amount / *finale bedrag* $= P(1+i)^n + \dfrac{x\left[(1+i)^n - 1\right]}{i}$ $= 5000\left(1+\dfrac{0,15}{12}\right)^{24} + \dfrac{800\left[\left(1+\dfrac{0,15}{12}\right)^{24} - 1\right]}{\dfrac{0,15}{12}}$ $= 6\,736,755 + 22\ 230,467$ $= \text{R}28\ 967,22$	✓ $i = \dfrac{0,15}{12}$ ✓ $n = 24$ ✓(subs) ✓(adding) $5000\left(1+\dfrac{0,15}{12}\right)^{24} + \dfrac{800\left[\left(1+\dfrac{0,15}{12}\right)^{24} - 1\right]}{\dfrac{0,15}{12}}$ ✓ answer (5) **[15]**

QUESTION/*VRAAG* 8

8.1	$f(x+h)=\dfrac{4}{x+h}$ $f(x+h)-f(x)=\dfrac{4}{x+h}-\dfrac{4}{x}$ $=\dfrac{4x\text{-}4(x+h)}{x(x+h)}$ $=\dfrac{4x-4x-4h}{x(x+h)}$ $=\dfrac{-4h}{x(x+h)}$ $\dfrac{f(x+h)-f(x)}{h}=\dfrac{\frac{-4h}{x(x+h)}}{h}$ $=\dfrac{-4h}{xh(x+h)}$ $\dfrac{-4}{x(x+h)}$ $f'(x)=\lim\limits_{h\to 0}\dfrac{f(x+h)-f(x)}{h}$ $=\lim\limits_{h\to 0}\dfrac{-4}{x(x+h)}$ $=\dfrac{-4}{x^2}$ **OR/*OF***	✓ $\dfrac{4}{x+h}-\dfrac{4}{x}$ ✓ $\dfrac{4x-4(x+h)}{x(x+h)}$ ✓ $\dfrac{-4}{x(x+h)}$ ✓formula ✓answer (5)

	$f'(x)=\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$ $=\lim_{h\to 0}\frac{\frac{4}{x+h}-\frac{4}{x}}{h}$ $=\lim_{h\to 0}\frac{\frac{4x-4(x+h)}{x(x+h)}}{h}$ $=\lim_{h\to 0}\frac{4x-4x-4h}{hx(x+h)}$ $=\lim_{h\to 0}\frac{-4h}{xh(x+h)}$ $=\lim_{h\to 0}\frac{-4}{x(x+h)}$ $=\frac{-4}{x^2}$	✓formula ✓subst. into formula ✓ $\frac{4x-4(x+h)}{x(x+h)}$ ✓ $\frac{-4}{x(x+h)}$ ✓answer (5)
8.2.1	$y=5x^2+5x+2$ $\frac{dy}{dx}=10x+5$	✓$10x$ ✓5 (2)
8.2.2	$D_x\left[\sqrt[3]{x^2}-\frac{1}{2}x\right]$ $=D_x\left[x^{\frac{2}{3}}-\frac{1}{2}x\right]$ $=\frac{2}{3}x^{\frac{-1}{3}}-\frac{1}{2}$	✓ $x^{\frac{2}{3}}$ ✓ $\frac{2}{3}x^{\frac{-1}{3}}$ ✓ $-\frac{1}{2}$ (3)
8.3	$p(x)=x^3+2x$ $p'(x)=3x^2+2$ $3x^2\geq 0$ or / *of* $x^2\geq 0$ for all/*vir alle* $x\in\mathbf{R}$ $\therefore 3x^2+2\geq 2>0$ for all/*vir alle* $x\in\mathbf{R}$ i.e. $p'(x)>0$ for all/*vir alle* $x\in\mathbf{R}$ i.e. all tangents to *p* have gradient greater than (or equal to) 2. Thus there is no tangent to *p* that has negative gradient. *Alle raaklyne aan p sal dus 'n gradiënt groter (of gelyk aan) 2 hê. Daar sal dus geen raaklyn aan p wees met 'n negatiewe gradiënt nie.*	✓ $p'(x)=3x^2+2$ ✓states & justifies $p'(x)>0$ ✓linking derivative to gradient of tangent/*verband tussen gradiënt en afgeleide* (3) **[13]**

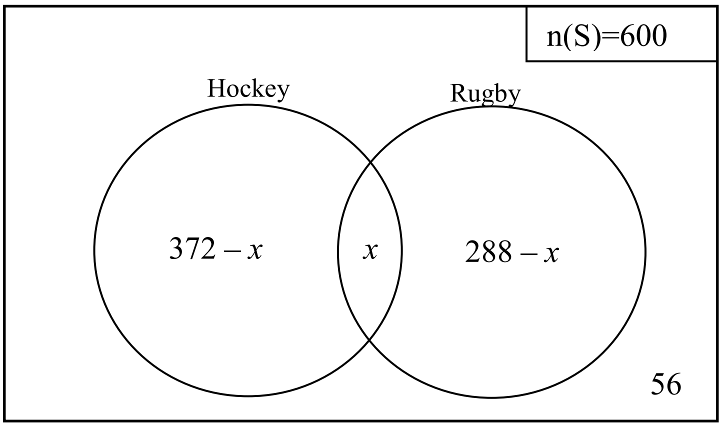
QUESTION/*VRAAG* 9

9.1	$x = 1$ or $x = 3$	✓ $x = 3$ ✓ $x = 1$ (2)
9.2	$1 < x < 3$	✓✓answer (2)
9.3	For a point x close to 3/*Vir 'n punt naby aan 3*: If $x < 3$, $f'(x) < 0 \Rightarrow f$ decreasing/*dalend* If $x > 3$, $f'(x) > 0 \Rightarrow f$ increasing/*stygend* Therefore: f has a local minimum at/*f het lokale minimum by* $x = 3$  **OR/*OF*** At $x = 3$, the gradient function changes from negative to positive therefore the function will have a local minimum point at $x = 3$/ *By* $x = 3$ *verander die gradiëntfunksie van negatief na positief dus sal die funksie 'n lokale minimum punt hê by* $x = 3$. **OR/*OF*** $f'(3) = 0$ and $f''(3) > 0$ therefore the function will have a local minimum point at $x = 3$ / $f''(3) > 0$ *dus sal die funksie 'n lokale minimum punt hê by* $x = 3$.	✓f dec for $x < 3$ *f dalend vir* $x < 3$ f incr for $x > 3$ *f stygend vir* $x > 3$ ✓ $x = 3$ local min (2) ✓ at $x = 3$ gradient changes from neg to pos ✓ $x = 3$ local min (2) ✓ $f''(3) > 0$ ✓ $x = 3$ local min (2)
9.4	$f''(x) = 0$ at the turning point of/*by die draaipunt van* $f'(x)$ Using symmetry/*Deur simmetrie* $x = \frac{1+3}{2}$ $= 2$	✓answer (1)
9.5	Concave up if/*Konkaaf op as* $f''(x) > 0$ $x > 2$	✓ $f''(x) > 0$ ✓answer (2) **[9]**

QUESTION/*VRAAG* 10

	Given: $M(t) = t^3 - 9t^2 + 3000 \quad ; \quad 0 \le t \le 30$	
10.1	$M(0) = 0^3 - 9(0)^2 + 3000$ $= 3000g$ or $3kg$	✓answer (1)
10.2	$t^3 - 9t^2 + 3000 = 3000$ $t^3 - 9t^2 = 0$ $t^2(t-9) = 0$ $t = 0$ or $t = 9$ Baby's mass will return to the birth mass on the 9th day/ *Baba se massa keer terug na massa by geboorte op die 9de dag.*	✓ $M(t) = 3000$ ✓ $t^3 - 9t = 0$ ✓factors ✓ $t = 9$ (4)
10.3	$M'(t) = 0$ $3t^2 - 18t = 0$ $3t(t-6) = 0$ $t = 0$ or $t = 6$ Baby's mass will be a minimum on the 6th day/ *Baba se massa sal 'n minimum wees op die 6de dag.*	✓ $M'(t) = 0$ ✓ $3t^2 - 18t$ ✓factors ✓ $t = 6$ (4)
10.4	$M'(t) = 3t^2 - 18t$ $M''(t) = 6t - 18$ $0 = 6t - 18$ $t = 3$ **OR / *OF*** Using symmetry/*Deur simmitrie*: $t = \frac{0+6}{2}$ $= 3$	✓ $6t - 18$ ✓answer (2) ✓ $\frac{0+6}{2}$ ✓answer (2) **[11]**

QUESTION/*VRAAG* 11

11.1.1		✓ $372-x$ for Hockey only ✓ $288-x$ for Rugby only ✓ 56 outside of Hockey & Rugby (3)
11.1.2	$(372-x)+x+(288-x)+56=600$ $716-x=600$ $x=116$ **OR/*OF*** $n(\text{H or R})=600-56$ $=544$ $n(\text{H or R})=n(\text{H})+n(\text{R})-n(\text{H and R})$ $544=372+288-x$ $x=372+288-544$ $=116$	✓ setting up the equation ✓ answer (2) ✓ setting up the equation ✓ answer (2)
11.1.3	No, they are not mutually exclusive. There is an intersection between the two sets/ *Nee, hul is nie onderling uitsluitend nie.* *Daar is 'n snyding tussen die twee stelle*	✓ No ✓ justification (2)
11.2.1	$5!=120$	✓ answer (1)
11.2.2	$1\times 2!\times 3!$ $=12$	✓ $2!$ ✓ $3!$ ✓ answer (3)
11.2.3	$\frac{5!\times 6!\times 2}{11!}$ $=\frac{1}{231}$	✓ $5!\times 6!\times 2$ ✓ division by $11!$ ✓ answer (3) **[14]**
	TOTAL/*TOTAAL*:	**150**