basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE/ *NASIONALE SENIOR SERTIFIKAAT*

GRADE 12/*GRAAD* 12

MATHEMATICS P1/*WISKUNDE V1*

FEBRUARY/MARCH/*FEBRUARIE/MAART* 2018

MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS/*PUNTE*: 150

Approved
Carmichael
5/3/2018

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

DEPARTMENT OF BASIC EDUCATION
PRIVATE BAG X895, PRETORIA 0001
2018 -03- 05
APPROVED MARKING GUIDELINE
PUBLIC EXAMINATION

Approved
2018-03-05

Please turn over/*Blaai om asseblief*

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, merk slegs die EERSTE poging.*
- *Volgehoue akkuraatheid is op ALLE aspekte van die nasienriglyne van toepassing.*

QUESTION/*VRAAG* 1

1.1.1

$x^2 - 6x - 16 = 0$

$(x-8)(x+2) = 0$ ✓

$x = -2$ ✓ or $x = 8$ ✓

✓ factors / Subst. into formula
✓ $x = -2$
✓ $x = 8$ (3)

1.1.2

$2x^2 + 7x - 1 = 0$

$x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$= \dfrac{-(7) \pm \sqrt{(7)^2 - 4(2)(-1)}}{2(2)}$ ✓

$= \dfrac{-7 \pm \sqrt{57}}{4}$ ✓

$x = 0{,}14$ ✓ or $x = -3{,}64$ ✓

✓subs into correct formula
✓ $\dfrac{-7 \pm \sqrt{57}}{4}$
✓ $x = 0{,}14$
✓ $x = -3{,}64$

NOTE: Penalise 1 mark if the rounding to TWO decimal places is incorrect.

OR/*OF*

$x^2 + \dfrac{7}{2}x + \dfrac{49}{16} = \dfrac{1}{2} + \dfrac{49}{16}$

$\left(x + \dfrac{7}{4}\right)^2 = \dfrac{57}{16}$

$x + \dfrac{7}{4} = \pm\dfrac{\sqrt{57}}{4}$

$x = \dfrac{-7 \pm \sqrt{57}}{4}$

$x = 0{,}14$ or $x = -3{,}64$

OR/*OF*

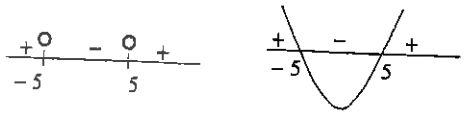
✓for adding $\dfrac{49}{16}$ on both sides

✓ $\dfrac{-7 \pm \sqrt{57}}{4}$
✓ $x = 0{,}14$
✓ $x = -3{,}64$ (4)

1.2

$x^2 - 25 < 0$

$(x-5)(x+5) < 0$



$-5 < x < 5$

$x = \{-4; -3; -2; -1; 0; 1; 2; 3; 4\}$

NOTE:
Final answer only
4 / 4

✓factors

✓✓inequality

✓answer (4)

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1.3

$x = 2y - 1$ ✓ $x = 2y - 1$

$(2y-1)^2 - 7 - y^2 = -y$ ✓ substitution

$4y^2 - 4y + 1 - 7 - y^2 = -y$

$3y^2 - 3y - 6 = 0$ ✓ correct standard form

$y^2 - y - 2 = 0$

$(y-2)(y+1) = 0$ ✓ factors

$y = 2$ or $y = -1$ ✓ y – values

$x = 2(2) - 1$ or $x = 2(-1) - 1$

$x = 3$ or $x = -3$ ✓ x – values

OR/*OF*

OR/*OF*

$y = \frac{x+1}{2}$ ✓ $y = \frac{x+1}{2}$

$x^2 - 7 - y^2 = -y$

$x^2 - 7 - \left(\frac{x+1}{2}\right)^2 = -\left(\frac{x+1}{2}\right)$ ✓ substitution

$x^2 - 7 - \left(\frac{x^2+2x+1}{4}\right) = \frac{-x-1}{2}$

$4x^2 - 28 - x^2 - 2x - 1 = -2x - 2$

$3x^2 - 27 = 0$ ✓ correct standard form

$x^2 - 9 = 0$

$(x-3)(x+3) = 0$ ✓ factors

$x = -3$ or $x = 3$ ✓ x – values

$y = \frac{-3+1}{2}$ or $y = \frac{3+1}{2}$

$y = -1$ or $y = 2$ ✓ y – values (6)

1.4

$\frac{3^{2018} + 3^{2016}}{3^{2017}}$

$= \frac{3^{2017}(3^1 + 3^{-1})}{3^{2017}}$ ✓

$= 3\frac{1}{3}$ or $\frac{10}{3}$ ✓

OR/*OF*

✓ common factor

✓ $3\frac{1}{3}$ or $\frac{10}{3}$

OR/*OF*

$\frac{3^{2018} + 3^{2016}}{3^{2017}}$

$= \frac{3^{2016}(3^2 + 1)}{3^{2017}}$ ✓ common factor

$= \frac{10}{3}$ ✓ $3\frac{1}{3}$ or $\frac{10}{3}$

OR/*OF*

OR/*OF*

$\frac{3^{2018} + 3^{2016}}{3^{2017}}$

$= \frac{3^{2018}}{3^{2017}} + \frac{3^{2016}}{3^{2017}}$ ✓ dividing by 3^{2017}

$= 3 + \frac{1}{3}$

$= 3\frac{1}{3}$ or $\frac{10}{3}$ ✓ $3\frac{1}{3}$ or $\frac{10}{3}$ (2)

1.5.1

$3x - 5 \geq 0$ and $x \neq 3$ ✓ $3x - 5 \geq 0$

$x \geq \frac{5}{3}$ and $x \neq 3$ ✓ $x \geq \frac{5}{3}$

✓ $x \neq 3$ (3)

1.5.2

$\frac{\sqrt{3x-5}}{x-3} = 1$

$\sqrt{3x-5} = x - 3$ ✓ ✓ $\sqrt{3x-5} = x - 3$

$3x - 5 = (x-3)^2$ ✓ ✓ $3x - 5 = (x-3)^2$

$3x - 5 = x^2 - 6x + 9$

$x^2 - 9x + 14 = 0$

$(x-7)(x-2) = 0$ ✓ ✓ factors

$x \neq 2$ or $x = 7$ ✓ $x = 7$ (4)

[26]

NOTE: If $x = 2$ is not rejected, then maximum 3 / 4 marks

QUESTION/*VRAAG* 2

2.1.1	$30\ ;\ 10\ ;\ \frac{10}{3}\ldots\ldots$ $a=30 \quad r=\frac{1}{3}$ ✓✓ $T_n = ar^{n-1}$ $\frac{10}{729} = 30\left(\frac{1}{3}\right)^{n-1}$ ✓ $\frac{1}{2187} = 3^{1-n}$ $3^{-7} = 3^{1-n}$ ✓ $-7 = 1-n$ $n = 8$ ✓ **OR/*OF*** $\frac{1}{2187} = \left(\frac{1}{3}\right)^{n-1}$ $\left(\frac{1}{3}\right)^{7} = \left(\frac{1}{3}\right)^{n-1}$ $7 = n-1$ $n = 8$	✓ $r=\frac{1}{3}$ ✓substitution into correct formula ✓ $3^{-7}=3^{1-n}$ or $\left(\frac{1}{3}\right)^{7}=\left(\frac{1}{3}\right)^{n-1}$ or use of logs ✓ $n=8$ (4)
2.1.2	$S_\infty = \frac{a}{1-r}$ $= \frac{30}{1-\frac{1}{3}}$ ✓ $= 45$ ✓	✓substitution into correct formula ✓answer (2)
2.2	$S_n = a+(a+d)+\ldots\ldots+(a+(n-2)d)+(a+(n-1)d)$ (1) $S_n = (a+(n-1)d)+(a+(n-2)d)+\ldots\ldots+(a+d)+a$ (2) Adding both equations/*Tel die twee vergelykings bymekaar:* $2S_n = 2a+(n-1)d+2a+(n-1)d+2a+(n-1)d+\ldots\ldots\ldots$ $= n[2a+(n-1)d]$ $S_n = \frac{n}{2}[2a+(n-1)d]$ **OR/OF** $S_n = a+(a+d)+\ldots\ldots+(a+(n-2)d)+T_n$ (1) $S_n = T_n+(T_n-d)+(T_n-2d)+\ldots\ldots+a$ (2) Adding both equations/*Tel die twee vergelykings bymekaar:* $2S_n = (a+T_n)+(a+T_n)+(a+T_n)+\ldots\ldots+(a+T_n)$ $S_n = \frac{n}{2}(a+T_n)$ but $Tn = a+(n-1)d$ $S_n = \frac{n}{2}[2a+(n-1)d]$	✓expanding S_n ✓reverse writing ✓ $2S_n = n[2a+(n-1)d]$ ✓ $S_n = \frac{n}{2}[2a+(n-1)d]$ (4) ✓expanding S_n ✓reverse writing ✓ $2S_n = n(a+T_n)$ ✓ $S_n = \frac{n}{2}[2a+(n-1)d]$ (4) **[10]**

QUESTION/*VRAAG* 3

3.1	$-1\ ;\ 2\ ;\ 5$ $T_n = -1+(n-1)(3)$ $= 3n-4$	NOTE: Simplification is not necessary.	✓ $3n$ ✓ -4 (2)
3.2	$T_{43} = 3(43)-4$ OR/ OF $T_{43} = -1+(43-1)(3)$ $=125$ $=125$	NOTE: Answer only 2 / 2	✓ subs of 43 ✓ answer (2)
3.3	$T_n = 3n-4$ $S_n = \sum_{k=1}^{n} T_k = -1+2+5+\ldots\ldots\ldots+3n-4$ $S_n = \frac{n}{2}[-1+3n-4]$ or $S_n = \frac{n}{2}[-2+(n-1)3]$ $= \frac{n}{2}[3n-5]$ $= \frac{3n^2-5n}{2}$ **OR/*OF*** $T_n = 3n-4$ $\sum_{k=1}^{n} T_k = 3(1)-4+3(2)-4+3(3)-4+\ldots\ldots\ldots+3n-4$ $= 3(1+2+3+\ldots\ldots+n)-4n$ $= \frac{3n(n+1)}{2}-4n$ $= \frac{3n^2-5n}{2}$		✓ $3n-4$ OR $a=-1$ and $d=3$ ✓ substitution into correct formula ✓ $\frac{n}{2}[3n-5]$ or $\frac{3n^2-5n}{2}$ **OR/*OF*** ✓ $3(1)-4+3(2)-4+3(3)-4+\ldots\ldots+3n-4$ ✓ $3(1+2+3+\ldots\ldots+n)-4n$ ✓ $\frac{3n^2-5n}{2}$ (3)

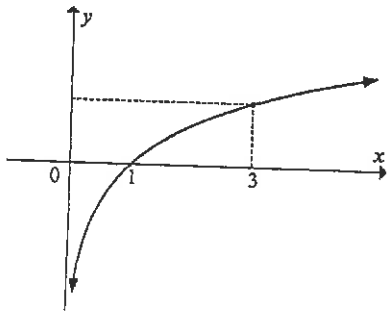
3.4	$T_{11} = (T_{11}-T_{10})+(T_{10}-T_9)+(T_9-T_8)+\ldots+(T_3-T_2)+(T_2-T_1)+T_1$ $125 = 29+26+23+\ldots 2+T_1$ $= \frac{10}{2}(29+2)+T_1$ $= 155+T_1$ $T_1 = -30$ **OR/*OF*** $T_n = an^2+bn+c$ $\therefore T_{11} = 121a+11b+c = 125$ ✓ $T_n - T_{n-1} = an^2+bn+c-\left[a(n-1)^2+b(n-1)+c\right]$ $= an^2+bn+c-an^2+2an-a-bn+b-c$ $= 2an+b-a$ ✓ $T_n - T_{n-1} = 3n-4$ $2a = 3$ and $b-a=-4$ $a = \frac{3}{2}$ ✓ and $b = -\frac{5}{2}$ ✓ $121a+11b+c = 125$ $121\left(\frac{3}{2}\right)+11\left(-\frac{5}{2}\right)+c = 125$ $c = -29$ ✓ $T_n = \frac{3}{2}n^2-\frac{5}{2}n-29$ $T_1 = \frac{3}{2}(1)^2-\frac{5}{2}(1)-29$ $= -30$ ✓	NOTE: Answer only 1 / 6 If they only use $3n-4$ breakdown 0 / 6	✓✓ generating sum ✓ $29+26+23+\ldots 2$ ✓ $\frac{10}{2}(29+2)$ ✓ 155 ✓ -30 **OR/*OF*** ✓ $121a+11b+c=125$ ✓ calculating $T_n - T_{n-1}$ in terms of a, b and c ✓ $a=\frac{3}{2}$ ✓ $b=-\frac{5}{2}$ ✓ $c=-29$ ✓ -30 (6) [13]

QUESTION/*VRAAG* 4

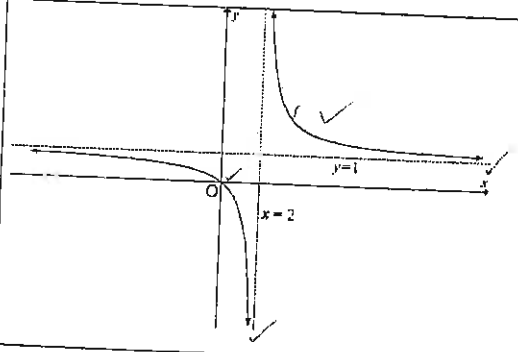
4.1	E(4 ; –9)	✓ $x = 4$ ✓ $y = -9$ (2)
4.2	$f(x) = (x-4)^2 - 9$ $(x-4)^2 - 9 = 0$ $(x-4)^2 = 9$ $x-4 = \pm 3$ $x = 7$ or $x = 1$ A(1 ; 0) **OR/*OF*** $f(x) = (x-4)^2 - 9$ $0 = x^2 - 8x + 16 - 9$ $0 = x^2 - 8x + 7$ $(x-7)(x-1) = 0$ $x = 7$ or $x = 1$ A(1 ; 0)	✓ $y = 0$ ✓ $x-4 = \pm 3$ ✓ A(1 ; 0) **OR/*OF*** ✓ $y = 0$ ✓ $(x-7)(x-1)$ ✓ A(1 ; 0) (3)
4.3	C(0 ; 7) M(8 ; 7) NOTE: Answer only 3 / 3	✓ C(0 ; 7) ✓ $x = 8$ ✓ $y = 7$ (3)
4.4	C(0 ; 7) D(4 ; 0) $m = \frac{7-0}{0-4}$ or $m = \frac{0-7}{4-0}$ or $0 = 4m + 7$ $m = -\frac{7}{4}$ $m = -\frac{7}{4}$ $m = -\frac{7}{4}$ $y - 0 = -\frac{7}{4}(x-4)$ $y = -\frac{7}{4}x + 7$	✓ D(4 ; 0) ✓ $m = -\frac{7}{4}$ ✓ $y = -\frac{7}{4}x + 7$ (3)
4.5	$g : y = -\frac{7}{4}x + 7$ $g^{-1} : x = -\frac{7}{4}y + 7$ $4x = -7y + 28$ $7y = -4x + 28$ $y = -\frac{4}{7}x + 4$ **OR/*OF***	✓ interchange x and y ✓ simplification ✓ $y = -\frac{4}{7}x + 4$ **OR/*OF***

	g^{-1} is the straight line through (0 ; 4) and (7 ; 0) $y = mx + 4$ $0 = 7m + 4$ $y = -\frac{4}{7}x + 4$	✓ straight line through (0 ; 4) and (7 ; 0) ✓ substitution ✓ $y = -\frac{4}{7}x + 4$ (3)
4.6	$x \cdot f(x) \leq 0$ $\therefore x \leq 0$ or $1 \leq x \leq 7$	✓✓ $x \leq 0$ ✓✓ $1 \leq x \leq 7$ (4) [18]

QUESTION/*VRAAG* 5

5.1	$a^0 = 1$ T(0 ; 1)	✓ $x = 0$ ✓ $y = 1$ (2)
5.2	$g(x) = a^x$ $9 = a^2$ $a = 3$ $a > 1$ NOTE: Answer only 2 / 2	✓ substitution ✓ $a = 3$ (2)
5.3	$y = \left(\frac{1}{3}\right)^x$ or $y = 3^{-x}$	✓✓ $y = \left(\frac{1}{3}\right)^x$ (2)
5.4	$3^0 < 3^{\log_3 x} < 3^1$ $1 < x < 3$ **OR**  $1 < x < 3$	✓ critical values ✓ $1 < x < 3$ (2) ✓ critical values ✓ $1 < x < 3$ (2) [8]

QUESTION/*VRAAG 6*

6.1	$q = 1$	✓ $q = 1$ (1)
6.2	Subs $(0;0)$ $0 = \frac{a}{0+p} + 1$ ✓ $\frac{a}{p} = -1$ $a = -p$ ✓ Subs P: $\sqrt{2}+1 = \frac{a}{\sqrt{2}+2+p} + 1$ ✓ $\sqrt{2} = \frac{a}{\sqrt{2}+2+p}$ $2+2\sqrt{2}+\sqrt{2}p = a$ $2+2\sqrt{2} = a - p\sqrt{2} = a + a\sqrt{2}$ $2(1+\sqrt{2}) = a(1+\sqrt{2})$ $a = 2$, $p = -2$ ✓ NOTE: Answer only 2 / 5	✓ $0 = \frac{a}{0+p} + 1$ ✓ $a = -p$ ✓ substitution ✓ $a = 2$ ✓ $p = -2$ (5)
6.3		✓ $y = 1$ ✓ $x = 2$ ✓ shape ✓ graph passing through (0 ; 0) (4) [10]

QUESTION/*VRAAG 8*

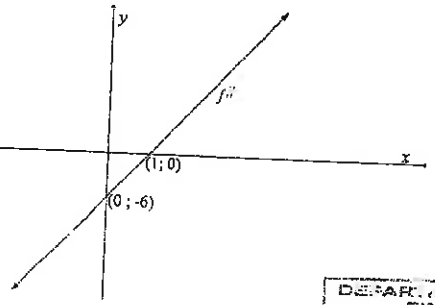
8.1	$f(x+h) = 4x^2$ $f(x+h) - f(x) = 4(x+h)^2 - 4x^2$ $= 4(x^2 + 2xh + h^2) - 4x^2$ $= 4x^2 + 8xh + 4h^2 - 4x^2$ $= 8xh + 4h^2$ $f'(x) = \lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$ $= \lim_{h\to 0}\left[\frac{8xh+4h^2}{h}\right]$ $= \lim_{h\to 0}\left[\frac{h(8x+4h)}{h}\right]$ $= 8x$ **OR/OF** $f'(x) = \lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$ $= \lim_{h\to 0}\left[\frac{4(x+h)^2-4x^2}{h}\right]$ $= \lim_{h\to 0}\left[\frac{4x^2+8xh+4h^2-4x^2}{h}\right]$ $= \lim_{h\to 0}\left[\frac{8xh+4h^2}{h}\right]$ $= \lim_{h\to 0}\left[\frac{h(8x+4h)}{h}\right]$ $= 8x$	✓ $4(x+h)^2$ ✓ $8xh + 4h^2$ ✓ $\frac{f(x+h)-f(x)}{h}$ ✓ $\frac{h(8x+4h)}{h}$ ✓ $8x$ **OR/OF** ✓ $\frac{f(x+h)-f(x)}{h}$ ✓ $4(x+h)^2$ ✓ $8xh + 4h^2$ ✓ $\frac{h(8x+4h)}{h}$ ✓ $8x$ (5)
8.2.1	$D_x\left[\frac{x^2-2x-3}{x+1}\right]$ $= D_x\left[\frac{(x-3)(x+1)}{x+1}\right]$ $= D_x(x-3)$ $= 1$	✓ $\frac{(x-3)(x+1)}{x+1}$ ✓ $(x-3)$ ✓ 1 (3)
8.2.2	$f(x) = \sqrt{x} = x^{\frac{1}{2}}$ $f'(x) = \frac{1}{2}x^{-\frac{1}{2}}$ $f''(x) = -\frac{1}{4}x^{-\frac{3}{2}}$	✓ $x^{\frac{1}{2}}$ ✓ $\frac{1}{2}x^{-\frac{1}{2}}$ ✓ $-\frac{1}{4}x^{-\frac{3}{2}}$ (3) [11]

QUESTION/*VRAAG* 7

7.1	$F = \frac{x\left[(1+i)^n - 1\right]}{i}$ $= \frac{2500\left[\left(1+\frac{0,06}{12}\right)^{60} - 1\right]}{\frac{0,06}{12}}$ = R174 425,08	✓ $n = 60$ and $i = \frac{0,06}{12}$ / 0,005 ✓ correct substitution into correct formula ✓ answer (3)
7.2.1	After eleven months, Genevieve will owe/ *Na elf maande skuld Genevieve* $A = 82\ 000\left(1+\frac{0,15}{12}\right)^{11}$ = R 94 006,79	✓ $n = 11$ ✓ correct substitution into correct formula ✓ answer (3)
7.2.2	$P = \frac{x\left[1-(1+i)^{-n}\right]}{i}$ $94\,006,79 = \frac{3\,200\left[1-\left(1+\frac{0,15}{12}\right)^{-n}\right]}{\frac{0,15}{12}}$ $\frac{94\,006,79}{3\,200} \times \frac{0,15}{12} = 1-\left(1+\frac{0,15}{12}\right)^{-n}$ $\left(1+\frac{0,15}{12}\right)^{-n} = 1-0,3672147...$ $-n\log\left(1+\frac{0,15}{12}\right) = \log 0,6327852...$ $-n = -36,8382...$ $n = 36,84$ Genevieve will have to pay 36 installments of R3 200	✓ 94 006,79 ✓ substitute into correct formula ✓ correct use of logs (logs to be defined) ✓ n =36,84 ✓ 36 installments (5)

7.2.3	$P = \frac{x\left[1-(1+i)^{-n}\right]}{i}$ $= \frac{3200\left[1-\left(1+\frac{0,15}{12}\right)^{-0,83826912}\right]}{\frac{0,15}{12}}$ $P = 2652$ Outstanding balance after 36 installments is R2 652 Final payment will be: $A = 2652,00\left(1+\frac{0,15}{12}\right)^{1}$ = R 2685,00 **OR/*OF*** Balance: $94006,79\left(1+\frac{0,15}{12}\right)^{36} - \frac{3200\left[\left(1+\frac{0,15}{12}\right)^{36}-1\right]}{\frac{0,15}{12}}$ = R2 651,72 Final payment will be: $A = 2651,72\left(1+\frac{0,15}{12}\right)^{1}$ = R 2 685,00	✓ n = –0,83826912... ✓ substitute into correct formula 2657,45 (0,84) ✓ answer ✓ $2652,00\left(1+\frac{0,15}{12}\right)^{1}$ ✓ answer **OR/*OF*** ✓ $94006,79\left(1+\frac{0,15}{12}\right)^{36}$ ✓ $\frac{3200\left[\left(1+\frac{0,15}{12}\right)^{36}-1\right]}{\frac{0,15}{12}}$ ✓ 2 651,72 ✓ $2651,72\left(1+\frac{0,15}{12}\right)^{1}$ ✓ answer (5) **[16]**

QUESTION/*VRAAG* 9

9.1	$f(x)=(x+2)(x-1)(x-4)$ $=(x^2+x-2)(x-4)$ $=x^3+x^2-2x-4x^2-4x+8$ $=x^3-3x^2-6x+8$ $b=-3\ ;\ c=-6\ ;\ d=8$	✓✓ $f(x)=(x+2)(x-1)(x-4)$ ✓ expansion ✓ x^3-3x^2-6x+8 (4)
9.2	$f(x)=x^3-3x^2-6x+8$ $f'(x)=0$ $3x^2-6x-6=0$ $x^2-2x-2=0$ $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$ $=\frac{2\pm\sqrt{(2)^2-4(1)(-2)}}{2(1)}$ $=\frac{2\pm\sqrt{12}}{2}$ $x=-0,73$	✓ $f'(x)=0$ ✓ $3x^2-6x-6$ ✓ substitution into correct formula ✓ $x=-0,73$ (4)
9.3	$f(x)=x^3-3x^2-6x+8$ $f(-1)=(-1)^3-3(-1)^2-6(-1)+8$ or $f(-1)=(1)(-2)(-5)$ $=10$ $=10$ $f'(-1)=3(-1)^2-6(-1)-6$ $=3$ $y-10=3(x+1)$ $y=3x+13$	✓ $f(-1)=10$ ✓ $f'(-1)=3$ ✓ substitution ✓ $y=3x+13$ (4)
9.4	$f''(x)=6x-6$  	✓ $f''(x)=6x-6$ ✓ x- intercept ✓ y- intercept (3)

9.5	f concave upwards $f''(x)>0$ $6x-6>0$ $x>1$ NOTE: Answer only 2 / 2	✓ $f''(x)>0$ ✓ $x>1$ (2) [17]

QUESTION/*VRAAG* 10

$f(x)=-3x^3+x$

$-9x^2+1=0$ ✓ $-9x^2+1=0$

$x=\frac{1}{3}$ or $x=-\frac{1}{3}$ ✓ $x=\frac{1}{3}$ *or* $x=-\frac{1}{3}$

Maximum of f will be at $x=\frac{1}{3}$ ✓ Maximum at $x=\frac{1}{3}$

$f\left(\frac{1}{3}\right)=-3\left(\frac{1}{3}\right)^3+\left(\frac{1}{3}\right)$ ✓ $f\left(\frac{1}{3}\right)=\frac{2}{9}$

$=\frac{2}{9}$

Maximum of $f(x)+q$ will also be at $x=\frac{1}{3}$

$f\left(\frac{1}{3}\right)+q=\frac{8}{9}$ ✓ $\frac{2}{9}+q=\frac{8}{9}$

$\frac{2}{9}+q=\frac{8}{9}$

$q=\frac{6}{9}$ ✓ $q=\frac{2}{3}$

$=\frac{2}{3}$

For $f(x)+q$ to have a maximum of $\frac{8}{9}$ the value of q has to be $\frac{2}{3}$. [6]

QUESTION/*VRAAG* 11

11.1.1	Let the event Veli arrive late for school be V. Let the event Bongi arrive late for school be B. / *Laat V die gebeurtenis wees dat Veli Laat B die gebeurtenis wees dat Bongi laatkom* P(V or B) = 1 - 0,7 = 0,3	✓ answer (1)
11.1.2	P(V or B) = P(V) + P(B) – P(V and B) 0,3 = 0,25 + P(B) – 0,15 P(B) = 0,2	✓ P(V or B) = P(V) + P(B) – P(V and B) ✓ substitution ✓ 0,2 (3)
11.1.3	P(V) × P(B) = 0,25 × 0,2 = 0,05 P(V) × P(B) ≠ P(V and B) V and B are NOT independent/ *V en B is NIE onafhanklik nie.*	✓ P(V) × P(B) = 0,05 ✓ P(V) × P(B) ≠ P(V and B) ✓ NOT independent (3)
11.2.1	6 ! = 720	✓✓ 6! or 720 (2)
11.2.2	Number of arrangements = 3! × 3! × 2 = 72 NOTE: Answer only 3/3 marks	✓ 3! ✓ × 3! ✓ × 2 (3)
11.2.3	P(hearts next to each other) $= \frac{3! \times 4!}{6!}$ $= \frac{144}{720}$ $= \frac{1}{5}$ or 0,2 or 20% **OR/*OF*** P(hearts next to each other) $= \frac{4 \times 3! \times 3!}{6!}$ $= \frac{144}{720}$ $= \frac{1}{5}$ or 0,2 or 20%	✓✓ 3! × 4! ✓ $\frac{1}{5}$ or 0,2 or 20% **OR/*OF*** ✓✓ 4 × 3! × 3! ✓ $\frac{1}{5}$ or 0,2 or 20% (3) [15]

TOTAL/*TOTAAL*: 150