education

Department:
Education
North West Provincial Government
REPUBLIC OF SOUTH AFRICA

PROVINCIAL ASSESSMENT
PROVINSIALE ASSESSERING

GRADE 12/*GRAAD 12*

MATHEMATICS P1/*WISKUNDE V1*
JUNE/*JUNIE* 2024
MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS: 150

TIME: 3 hours

These marking guidelines consists of 14 pages.
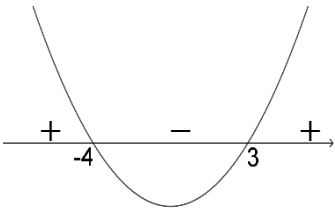*Hierdie nasienriglyne bestaan uit 14 bladsye.*

NOTE:

- If a candidate answered 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, word slegs die EERSTE poging nagesien.
- Volgehoue akkuraatheid is DEURGAANS op ALLE aspekte van die nasienriglyne van toepassing.

QUESTION/VRAAG 1

1.1 1.1.1	$2x(4-x) = 0$ $\therefore x = 0 \;\; or \mid of \;\; x = 4$	✓ $x = 0$ ✓ $x = 4$ (2)
1.1.2	$x(3x - 7) = 4$ $3x^2 - 7x - 4 = 0$ $\therefore x = \dfrac{-(-7) \pm \sqrt{(-7)^2 - 4(3)(-4)}}{2(3)}$ $\therefore x = 2{,}81 \;\; or\mid of \; -0{,}47$	✓ std form ✓ subst ✓✓ each answ/*elke antw* (4)
1.1.3	$x + \sqrt{x-3} = 15$ $\sqrt{x-3} = 15 - x$ $\therefore x - 3 = (15-x)^2$ $x - 3 = 225 - 30x + x^2$ $\therefore x^2 - 31x + 228 = 0$ $\therefore (x-12)(x-19) = 0$ $\therefore x = 12 \;\; or \mid of \;\; x \neq 19$	✓ isol $\sqrt{}$ ✓ square /*kwadreer* ✓ std form ✓ factors/*faktore* ✓ $x = 12; \;\; x \neq 19$ (5)
1.1.4	$x^2 + x - 12 > 0$ $\therefore (x+4)(x-3) > 0$ $\therefore x < -4 \;\; or \mid of \;\; x > 3$ (number line with + − + and -4, 3)	✓ factors/*faktore* ✓ critical values/*kritieke w* ✓✓ answer combo/*antwoord* (4)

1.2		
	$3x - y = 1$ .... ①	
	$x^2 + 2xy = 3y^2 - 7$ ....②	
	from / *uit* ① : $y = 3x - 1$ subst in ②:	✓ y subject/*onderwerp*
	$\quad\quad x^2 + 2x(3x - 1) = 3(3x - 1)^2 - 7$	✓ subst
	$\therefore x^2 + 6x^2 - 2x - 27x^2 + 18x - 3 + 7 = 0$	
	$\therefore \quad\quad\quad\quad\quad -20x^2 + 16x + 4 = 0$	
	$\therefore \quad\quad\quad\quad\quad\quad 5x^2 - 4x - 1 = 0$	✓ std form
	$\therefore \quad\quad\quad\quad\quad\quad (5x + 1)(x - 1) = 0$	✓ faktore/*factors*
	$\therefore \quad\quad\quad x = -\frac{1}{5}$ *or* $\mid$ *of* $x = 1$	✓ both x-values/*beide y-w*
	if / *as* $x = -\frac{1}{5} : y = 3\left(-\frac{1}{5}\right) - 1 = -\frac{8}{5}$	✓ both *y*-values/*beide x-w*
	if / *as* $x = 1 : y = 3(1) - 1 = 2$	
	OR/*OF*	(6)
	$3x - y = 1$ . . . . ①	
	$x^2 + 2xy = 3y^2 - 7$ . . . . ②	
	$x = \dfrac{y + 1}{3}$ . . . . ③	
	Subst. ③ into/*in* ②:	
	$\left(\dfrac{y + 1}{3}\right)^2 + 2y\left(\dfrac{y + 1}{3}\right) = 3y^2 - 7$	✓ x subject/*onderwerp*
	$\dfrac{y^2 + 2y + 1}{9} + \dfrac{2y^2 + 2y}{3} = 3y^2 - 7$	✓ subst
	$y^2 + 2y + 1 + 6y^2 + 6y = 27y^2 - 63$	
	$20y^2 - 8y - 64 = 0$	
	$5y^2 - 2y - 16 = 0$	
	$(y - 2)(5y + 8) = 0$	
	$y = 2 \quad\quad or \mid of \quad y = -\dfrac{8}{5}$	✓ std form
		✓ faktore/*factors*
	$\quad\quad\quad x = 1 \quad\quad or \mid of \quad x = -\dfrac{1}{5}$	✓ both y-values/*beide y-w*
		✓ both *x*-values/*beide x-w*
		(6)

1.3	$\sqrt[a]{2} = 3;\ \sqrt[b]{3} = 5;\ \sqrt[c]{5} = 8$	
	$\therefore 2^{\frac{1}{a}} = 3;\ 3^{\frac{1}{b}} = 5;\ 5^{\frac{1}{c}} = 8$	✓exp form
	$\therefore \left[\left(2^{\frac{1}{a}}\right)^{\frac{1}{b}}\right]^{\frac{1}{c}} = 8$	✓subt
	$2^{\frac{1}{abc}} = 2^3$	✓exp eq/*eksp verg*
	$\dfrac{1}{abc} = 3$	
	$\therefore \quad abc = \dfrac{1}{3}$	✓answer/*antwoord* (4)
		[25]

QUESTION/VRAAG 2

2.1	$19;\ \ 8;\ \ -1;\ \ -8;\ \dots$ $\quad -11\ \ -9\ \ \ -7\ -5$ $\qquad 2\quad\ \ 2\quad\ \ 2$	
2.1.1	$T_5 = -13$	✓-13 (1)
2.1.2	$2a = 2;\ a = 1$	✓$a = 1$
	$3a + b = -11$	
	$3(1) + b = -11;\ b = -14$	✓$b = -14$
	$a + b + c = 19$	
	$1 - 14 + c = 19;\ c = 32$	✓$c = 32$
	$\therefore T_n = n^2 - 14n + 32$	✓answer/*antw* (4)

2.1.3	$T_{26} = (26)^2 - 14(26) + 32$	✓subst
	$\quad = 344$	
	$T_{25} = (25)^2 - 14(25) + 32$	✓subst
	$\quad = 307$	
	$\therefore T_{26} - T_{25}$	
	$= 344 - 307$	
	$= 37$	✓answer/*antwoord*
	OR/*OF*	
	$T_n = 2n - 13$	✓T_n
	$T_{25} = 2(25) - 13$	✓ *subst*
	$\quad = 37$	✓37 (3)

2.1.4	$n = -\frac{b}{2a}$ $= -\left(\frac{-14}{2}\right)$ $= 7$ $\therefore T_7 = 7^2 - 14(7) + 32$ $= 53$	✓ method/*metode* ✓ subst into T_n ✓ 53 (3)
2.2.1	$3; \; b; \; 13; \; 18; \, . \, .$ $b - 3 = 13 - b$ $2b = 16 \;\; \therefore \;\; b = 8$	✓ $T_2 - T_1 = T_3 - T_2$ ✓ $b = 8$ (2)
2.2.2	$T_n = a + (n-1)d$ $= 3 + (n-1)(5)$ $= 5n - 2$	✓ subst ✓ answer/*antwoord* (2)
2.2.3	$S_n = \frac{n}{2}[2a + (n-1)d]$ $S_{30} = \frac{30}{2}[2(3) + 29(5)]$ $= 2\,265$ **OR/OF** $T_{30} = 5(30) - 2$ $= 148$ $S_n = \frac{n}{2}(a + l)$ $= \frac{30}{2}(3 + 148)$ $= 2\,265$	✓ subst ✓ $S_{30} = 2\,265$ ✓ $T_{30} = 148$ ✓ $S_{30} = 2\,265$ (2)
2.3	$2^x + 2^{x+1} + 3.2^x + 2^{x+2} + \, . \, . \, .$ (15 *terms*) $= 2^x + 2.2^x + 3.2^x + 4.2^x + \, . \, . \, . + 15.2^x$ $a = 2^x; \; d = 2^x$ $S_n = \frac{n}{2}[2a + (n-1)d]$ $S_{15} = \frac{15}{2}[2.2^x + 14.2^x]$ $= 15(8).2^x$ $= 15.2^{x+3}$ $\therefore k = 15; \; p = 3$	✓ $a = 2^x; \; d = 2^x$ ✓ subst ✓ $k = 15$ ✓ $p = 3$ (4)

OR/OF	
$S_n = \dfrac{n}{2}(a + l)$ $S_{15} = \dfrac{15}{2}(2^x + 15.2^x)$ $\qquad = 15.2^3.2^x$ $\qquad = 15.2^{x+3}$ $\therefore k = 15;\ p = 3$	$\checkmark a = 2^x;\ l = 15.2^x$ $\checkmark$ subst $\checkmark\ k = 15\ \ \checkmark p = 3$ (4) **[21]**

QUESTION/VRAAG 3

3.1.1	$-4 + 2 - 1 + \ldots + \dfrac{1}{32}$ $a = -4;\ r = -\dfrac{1}{2}$ $\therefore T_n = -4.\left(-\dfrac{1}{2}\right)^{n-1}$	$\checkmark a$ and r /a en r $\checkmark T_n$ (2)
3.1.2	$T_n = -4.\left(-\dfrac{1}{2}\right)^{n-1}$ $\dfrac{1}{32} = -4.\left(-\dfrac{1}{2}\right)^{n-1}$ $-\dfrac{1}{128} = \left(-\dfrac{1}{2}\right)^{n-1}$ **OR** $n-1 = \log_{\frac{1}{2}}\left(\dfrac{1}{128}\right)$ $\left(-\dfrac{1}{2}\right)^7 = \left(-\dfrac{1}{2}\right)^{n-1}$ $n - 1 = 7$ $\qquad 7 = n - 1$ $n = 8$ $\therefore \quad n = 8$ $\displaystyle\sum_{n=1}^{8} -4.\left(-\dfrac{1}{2}\right)^{n-1}$	 $\checkmark n = 8$ $\checkmark$ answer/*antwoord* (2)
3.1.3	$S_\infty = \dfrac{a}{1 - r}$ $\qquad = \dfrac{-4}{1 - (-0{,}5)}$ $\qquad = -\dfrac{8}{3}$	 $\checkmark$ subst $\checkmark$ answer (2)

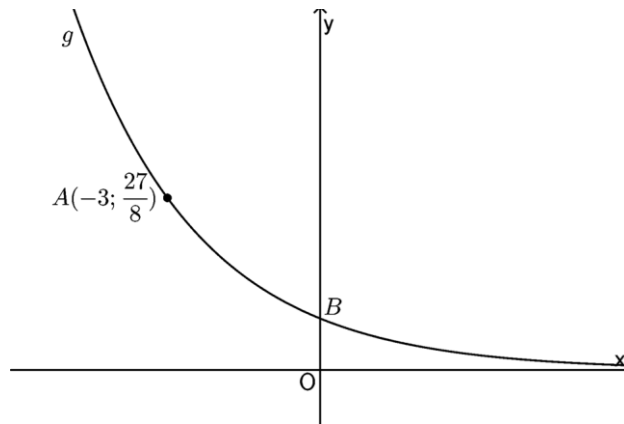| 3.2.1	$S_n = 32 - 32\left(\frac{1}{2}\right)^n$ $S_5 = 32 - 32\left(\frac{1}{2}\right)^5$ $= 31$	✓ 31 (1)
3.2.2	$a = 16;\ r = \frac{1}{2}$ $\therefore S_n = \frac{a(1 - r^n)}{1 - r}$ $\frac{255}{8} = \frac{16\left[1 - \left(\frac{1}{2}\right)^n\right]}{1 - \frac{1}{2}}$ $\frac{255}{256} = 1 - \left(\frac{1}{2}\right)^n$ $\left(\frac{1}{2}\right)^n = \frac{1}{256}$ $2^{-n} = 2^{-8}$ $\therefore\ \ n = 8$	✓ subst ✓ $\left(\frac{1}{2}\right)^n = \frac{1}{256}$ ✓ 8 terms/*terme* (3)
3.2.3	$S_{5-n} - S_{5+n}$ $= \left[32 - 32\left(\frac{1}{2}\right)^{5-n}\right] - \left[32 - 32\left(\frac{1}{2}\right)^{5+n}\right]$ $= 32 - 2^5 . 2^{-5+n} - 32 + 2^5 . 2^{-5-n}$ $= -2^n + 2^{-n}$ $= -p + \frac{1}{p}\quad \textbf{OR}$ $= \frac{-p^2 + 1}{p}$	✓ subst ✓ $-2^n + 2^{-n}$ ✓ answer/*antwoord* (3) **[13]**

QUESTION/VRAAG 4

4.1	$x = -3$ $y = -2$	✓ ✓ each equation / *elke vgl* (2)
4.2	$h(x) = \dfrac{-6}{x+3} - 2$	✓ $(-6; 0)$ ✓ $(0; -4)$ ✓ asymptotes/*asymptote* ✓ shape/*vorm* (4)
4.3	$y = x + c$ $\therefore\ -2 = -3 + c$ $\therefore\ \ c = 1$ $\therefore y = x + 1$	✓ subst (-3; -2) ✓ equation/*vergelyking* (2)
4.4	$y \neq -2;\ y \in \mathbb{R}$	✓ $y \neq -3$ ✓ $y \in \mathbb{R}$ (2)
4.5	$-6 \leq x < -3$	✓ interval ✓ notation (2) **[12]**

QUESTION/VRAAG 5

$g(x) = a^x$

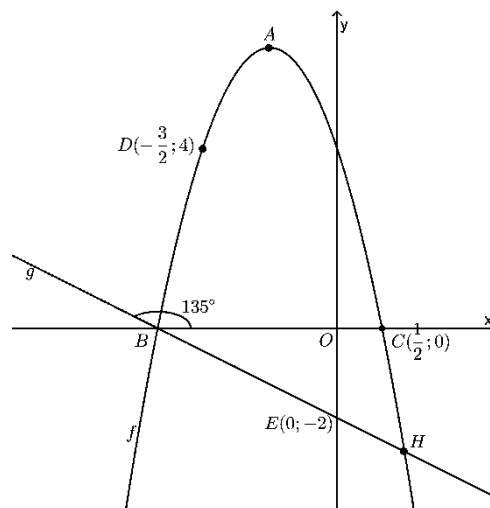| 5.1	B(0; 1)	$\checkmark\checkmark(0; 1)$ (2)
5.2	$g(x) = a^x$ $\frac{27}{8} = a^{-3}$ $\frac{27}{8} = \frac{1}{a^3}$ $a^3 = \frac{8}{27}$ $\therefore \quad a = \frac{2}{3}$	$\checkmark$ subst $\left(-3; \frac{27}{8}\right)$ $\checkmark$ $a = \frac{2}{3}$ (2)
5.3	$h(x) = g(-x) = \left(\frac{2}{3}\right)^{-x}$ $\therefore h(x) = \left(\frac{3}{2}\right)^{x}$	$\checkmark\checkmark \left(\frac{2}{3}\right)^{-x}$ **OR** $\checkmark\checkmark \left(\frac{3}{2}\right)^{x}$ (2)
5.4	$y = \log_{\frac{3}{2}} x$	$\checkmark \checkmark$ answer/*antwoord* (2)
5.5	$0 < x \leq \frac{3}{2}$	$\checkmark$ interval $\checkmark$ notation/*notasie* (2)
5.6	$x > 3; x \in \mathbb{R}$	$\checkmark\checkmark$ (2)
		[12]

QUESTION/VRAAG 6

$f(x) = ax^2 + bx + c$

and/*en* $g(x) = mx + q$

6.1	$c = -2;$	✓ $c = -2$
	$m = \tan 135° = -1$	✓ $m = -1$
	$\therefore y = -x - 2$	(2)
6.2	$x - \text{intercept } of\ g: y = 0$	✓ $y = 0$
	$x = -2$	
	$\therefore B(-2;\ 0)$	✓ $(-2;\ 0)$ (2)
6.3	$f: y = a(x - x_1)(x - x_2)$	
	$\quad y = a(x - (-2))(x - \frac{1}{2})$	✓ subst roots/*wortels*
	$\quad 4 = a\left(-\frac{3}{2} + 2\right)\left(-\frac{3}{2} - \frac{1}{2}\right)$	✓ subst $\left(-\frac{3}{2};\ 4\right)$
	$\quad 4 = \frac{1}{2} \cdot (-2) \cdot a$	
	$\therefore\ a = -4$	
	$\therefore f(x) = -4(x + 2)\left(x - \frac{1}{2}\right)$	✓ $a = -4$
	$\quad = -4x^2 - 6x + 4$	✓ $-4(x + 2)\left(x - \frac{1}{2}\right)$
		(4)
6.4	$x = -\dfrac{b}{2a} = \dfrac{-(-6)}{2(-4)} = -\dfrac{3}{4}$ **OR** $x = \dfrac{-2 + \frac{1}{2}}{2} = -\dfrac{3}{4}$	✓ $x = -\frac{3}{4}$
	$f\left(-\frac{3}{4}\right) = -4\left(-\frac{3}{4}\right)^2 - 6\left(-\frac{3}{4}\right) + 4 = \frac{25}{4}$	✓ subst
	$\therefore A\left(-\frac{3}{4};\ \frac{25}{4}\right)$	✓coordinate/*koördinaat* (3)

6.5	$f(x) = g(x)$ $-4x^2 - 6x + 4 = -x - 2$ $4x^2 + 5x - 6 = 0$ $(x + 2)(4x - 3) = 0$ $x = -2 \quad or/of \quad x = \dfrac{3}{4}$ NA $\qquad y = -\left(\dfrac{3}{4}\right) - 2$ $\qquad\qquad = -\dfrac{11}{4}$ $\therefore H\left(\dfrac{3}{4}; -\dfrac{11}{4}\right)$	✓ $f(x) = g(x)$ ✓ std form ✓ x values/*waardes* ✓ coordinate/*koördinaat* (4)
6.6	$x < -\dfrac{3}{4}$	✓✓ answer/*antwoord* (2)
6.7	$4 < k < \dfrac{25}{4}$	✓ values/*waardes* ✓ notation/*notasie* (2)
6.8	$D\left(\dfrac{3}{2}; -\dfrac{9}{4}\right)$	✓ x-value/*waarde* ✓ y-value/*waarde* (2) **[21]**

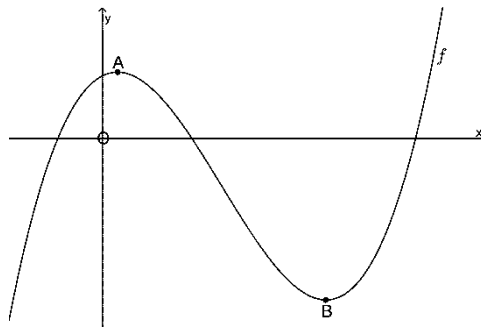## QUESTION/VRAAG 7

7.1	$f(x) = x^2 + 4x + 1$ $f(x + h) = (x + h)^2 + 4(x + h) + 1$ $\qquad\qquad = x^2 + 2xh + h^2 + 4x + 4h + 1$ $f'(x) = \lim\limits_{h \to 0} \dfrac{f(x + h) - f(x)}{h}$ $\qquad = \lim\limits_{h \to 0} \dfrac{x^2+2xh+h^2+4x+4h+1-(x^2+4x+1)}{h}$ $\qquad = \lim\limits_{h \to 0} \dfrac{x^2+ 2xh+ h^2+ 4x + 4h + 1- x^2- 4x - 1}{h}$ $\qquad = \lim\limits_{h \to 0} \dfrac{h(2x + h + 4)}{h}$ $\qquad = \lim\limits_{h \to 0}(2x + h + 4)$ $\qquad = 2x + 4$	✓ answer of $f(x + h)$ /*antwoord van* $f(x + h)$ ✓ subst ✓ simplify/ *vereenv* ✓ common factor/*gemene fakt* ✓ $2x + 4$ (5)
7.2.1	$f(x) = -3x^4 + 5x^2$ $f'(x) = -12x^3 + 10x$	✓ $-12x^3$ ✓ $10x$ (2)

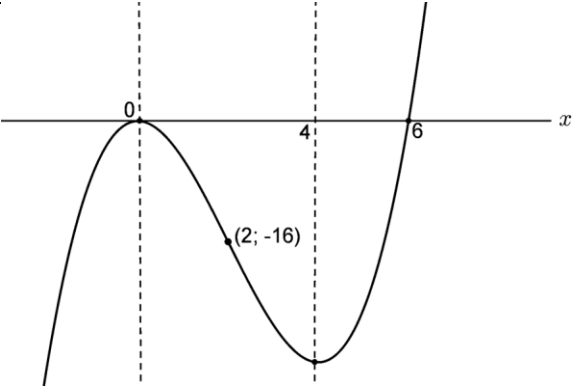| 7.2.2	$y = \sqrt{x} - \dfrac{2}{x}$ $= x^{\frac{1}{2}} - 2x^{-1}$ $\dfrac{dy}{dx} = \dfrac{1}{2}x^{-\frac{1}{2}} + 2x^{-2}$	✓ $x^{\frac{1}{2}}$ ✓ $2x^{-1}$ ✓ $\dfrac{1}{2}x^{-\frac{1}{2}}$ ✓ $2x^{-2}$ (4)
7.3	$h(x) = -x^3 + 2x - 5$ $h(-2) = -(-2)^3 + 2(-2) - 5$ $\qquad = -1$ $h'(x) = -3x^2 + 2$ $h'(-2) = -3(-2)^2 + 2$ $\qquad m = -10$ $\therefore y - (-1) = -10(x - (-2))$ $\qquad \therefore y = -10x - 21$	✓ subst ✓ subst ✓ $m = -10$ ✓ equation/*vergelyking* (4)
7.4	$x > 1$	✓✓ answer/*antwoord* (2) **[17]**

QUESTION/VRAAG 8

$f(x) = x^3 - 8x^2 + 5x + 14$

8.1	$(0;\ 14)$	✓ answer/*antwoord* (1)
8.2	$f(x) = x^3 - 8x^2 + 5x + 14$ $f(7) = 7^3 - 8(7)^2 + 5(7) + 14$ $\qquad = 0$	✓ subst ✓ $f(7) = 0$ (2)
8.3	$x^3 - 8x^2 + 5x + 14$ $= (x - 7)(x^2 + kx - 2)$ $= (x - 7)(x^2 - x - 2)$ $= (x - 7)(x - 2)(x + 1)$ $\boxed{\begin{array}{c} kx^2 - 7x^2 = -8x^2 \\ kx^2 = -x^2 \\ k = -1 \end{array}}$	✓ method/*metode* ✓ $x^2 - x - 2$ ✓ factor/*faktor* $(x - 2)$ ✓ factor/*faktor* $(x + 1)$ (4)

8.4	$f'(x) = 0$	$\checkmark f'(x) = 0$
	$\therefore \quad 3x^2 - 16x + 5 = 0$	
	$\therefore (x - 5)(3x - 1) = 0$	$\checkmark$ factors/*faktore*
	$\therefore x = 5 \ or \mid \ of \ x = \dfrac{1}{3}$	$\checkmark\checkmark$ each *x*-value/*elke x-w*
	$\therefore f(5) = 5^3 - 8(5)^2 + 5(5) + 14$	
	$\qquad = -36$	$\checkmark (5; -36)$
	$\therefore f\left(\dfrac{1}{3}\right) = \left(\dfrac{1}{3}\right)^3 - 8\left(\dfrac{1}{3}\right)^2 + 5\left(\dfrac{1}{3}\right) + 14$	
	$\qquad = \dfrac{400}{27}$	
	$\qquad = 14,81$	$\checkmark\left(\dfrac{1}{3}; \dfrac{400}{27}\right)$ (6)
8.5	$f''(x) = 0$	$\checkmark f''(x) = 0$
	$6x - 16 = 0$	
	$\qquad x = \dfrac{8}{3}$	$\checkmark x = \dfrac{8}{3}$
	$f\left(\dfrac{8}{3}\right) = \left(\dfrac{8}{3}\right)^3 - 8\left(\dfrac{8}{3}\right)^2 + 5\left(\dfrac{8}{3}\right) + 14$	
	$\qquad = -\dfrac{286}{27}$	
	$\qquad = -10,59$	
	$\therefore \left(\dfrac{8}{3}; -\dfrac{286}{27}\right)$	$\checkmark$ coordinate/*koördinaat* (3) **[16]**

QUESTION/VRAAG 9

$\checkmark$ *x*-intercepts/*afsnitte*

$\checkmark$ turning points/*draaipunte*

$\checkmark$ shape/*vorm*

$\checkmark$ (2; -16)

[4]

QUESTION/VRAAG 10

10.1	$h(t) = 18t - 4t^2$ $h(2) = 18(2) - 4(2)^2$ $= 20\ m$	✓ subst ✓ 20 m (2)
10.2	$h = 18t - 4t^2$ $h'(t) = 18 - 8t$ $h'(1,5) = 18 - 8(1,5)$ $= 6$ m/s	✓ h'(t) ✓ subst 1,5 ✓ 6 (3)
10.3	$h'(t) = 0$ $18 - 8t = 0$ $\therefore t = 2,25\ s$ $h(2,25) = 18(2,25) - 4(2,25)^2$ $= 20,25\ m$	✓ $h'(t) = 0$ ✓ $t = 2,25\ s$ ✓ subst 2,25 ✓ 20,25 (4)
		[9]

TOTAL/*TOTAAL*: 150