



# education

Department of  
Education  
FREE STATE PROVINCE

## **PREPARATORY EXAMINATION *VOORBEREIDENDE EKSAMEN***

**GRADE/*GRAAD* 12**

**MATHEMATICS P1  
*WISKUNDE V1***

**SEPTEMBER 2023**

**MARKS/*PUNTE*: 150**

**MARKING GUIDELINES  
*NASIENRIGLYNE***

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



**NOTE:**



- Constant accuracy applies in the whole marking guideline.
- If a learner answers a question twice, mark only the first attempt.
- If a learner cancels a question, but does not redo it, mark that attempt.



**NOTA:**

- *Volgehoue akkuraatheid word in ALLE aspekte van die nasienriglyne toegepas.*
- *As 'n kandidaat 'n vraag TWEE KEER beantwoord, sien slegs die EERSTE poging na.*
- *As 'n kandidaat 'n antwoord van 'n vraag doodtrek en nie oordoen nie, sien die doodgetrekte poging na.*





**QUESTION/VRAAG 1**

1.1		
1.1.1	 $(x - 1)(2x + 1) = 0$ $x = 1 \quad \text{or/of} \quad x = -\frac{1}{2}$	$\checkmark x = 1$ $\checkmark x = -\frac{1}{2}$  (2)
1.1.2	$(x - 1)(2x + 1) = 4$ $2x^2 - x - 5 = 0$ $\therefore x = \frac{-(-1) \pm \sqrt{(-1)^2 - 4(2)(-5)}}{2(2)}$ $x = \frac{1 \pm \sqrt{41}}{4}$ $x = 1,85 \quad \text{or/of} \quad x = -1,35$	$\checkmark$ standard form $\checkmark$ correct substitution in correct formula  $\checkmark 1,85$ $\checkmark -1,35$ Penalise/mark -1 for incorrect rounding  (4)
1.1.3	$x + \sqrt{x - 2} = 4$ $\sqrt{x - 2} = 4 - x$ $(\sqrt{x - 2})^2 = (4 - x)^2$ $x - 2 = 16 - 8x + x^2$ $0 = x^2 - 9x + 18$ $0 = (x - 6)(x - 3)$ $x = 6 \quad \text{or/of} \quad x = 3$ Not applicable/Nie van toepassing nie	$\checkmark$ isolate the surd $\checkmark$ squaring both sides  $\checkmark$ standard form  $\checkmark$ factors $\checkmark$ answer with choice  (5)
1.1.4	$3x^2 + x \leq 0$ $x(3x + 1) \leq 0$ Critical values: 0 and/en $-\frac{1}{3}$ $x \in \left[-\frac{1}{3}; 0\right] \quad \text{Or} \quad -\frac{1}{3} \leq x \leq 0$	$\checkmark$ factors $\checkmark$ critical values  $\checkmark$ answer   (3)


<p>1.2</p> 	$2x + y = 17$ $\therefore y = 17 - 2x$ <p>Substitute in/verv. in <math>xy = 8</math></p> $x(17 - 2x) = 8$ $0 = 2x^2 - 17x + 8$ $0 = (2x - 1)(x - 8)$ $\therefore x = \frac{1}{2} \text{ or } x = 8$ $y = 17 - 2\left(\frac{1}{2}\right) \quad \text{or/of} \quad y = 17 - 2(8)$ $y = 16 \quad \quad \quad y = 1$ <p>OR/OF</p> $x = \frac{17 - y}{2}$ <p>Substitute in/verv. in <math>xy = 8</math></p> $\left(\frac{17 - y}{2}\right)y = 8$ $17y - y^2 = 16$ $0 = y^2 - 17y + 16$ $0 = (y - 16)(y - 1)$ $\therefore y = 16 \text{ or/of } y = 1$ $x = \frac{17 - 16}{2} \quad \text{or/of} \quad x = \frac{17 - 1}{2}$ $x = \frac{1}{2} \quad \quad \quad x = 8$	<p>✓ <math>y = 17 - 2x</math></p> <p>✓ substitution</p> <p>✓ standard form</p> <p>✓ factors</p> <p>✓ both answers for <math>x</math></p> <p>✓ both answers for <math>y</math></p> <p>OR</p> $x = \frac{17 - y}{2}$ <p>✓ substitution</p> <p>✓ standard form</p> <p>✓ factors</p> <p>✓ both answers for <math>x</math></p> <p>✓ both answers for <math>y</math></p> <p>(6)</p>
<p>1.3</p>	$\sqrt{\sqrt{21x^2} - \sqrt{5x^2}} \times \sqrt{\sqrt{21x^2} + \sqrt{5x^2}}$ $= \sqrt{(\sqrt{21x^2} - \sqrt{5x^2})(\sqrt{21x^2} + \sqrt{5x^2})}$ $= \sqrt{21x^2 - 5x^2}$ $= \sqrt{16x^2}$ $= 4x$	<p>✓ one square root</p> <p>✓ difference between squares</p> <p>✓ answer</p>  <p>(3)</p>
		<p>[23]</p>

**QUESTION/VRAAG 2**

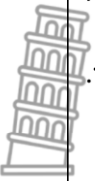
2.1.1	 $S_n = a + (a + d) + (a + 2d) + \dots + a + (n-1)d$ $S_n = a + (n-1)d + a + (n-2)d + \dots + a$ $\therefore 2S_n = n(2a + (n-1)d)$ $S_n = \frac{n}{2}(2a + (n-1)d)$	$\checkmark T_n = a + (n-1)d$ $\checkmark$ reverse $\checkmark$ add  (3)
2.1.2	$2^x + 2.2^x + 3.2^x + \dots$ $\therefore a = 2^x$ $d = 2^x$ $1680 = \frac{20}{2}(2(2^x) + (19)(2^x))$ $168 = 21.2^x$ $8 = 2^x$ $x = 3$	$\left. \begin{array}{l} \text{value } a \\ \text{value } d \end{array} \right\} \checkmark$  $\checkmark$ substitution in correct formula  $\checkmark$ Simplification ( $8 = 2^x$ )  $\checkmark$ answer  (4)
2.2	$S_n = \frac{n^2 + n}{4}$ $\therefore T_8 = S_8 - S_7$ $= \frac{8^2 + 8}{4} - \frac{7^2 + 7}{4}$ $= 18 - 14$ $= 4$	$\checkmark$ correct method  $\checkmark$ substitution  $\checkmark$ answer  (3)
2.3	$S_n = \frac{a(1 - r^n)}{1 - r}$ $S_{10} = \frac{32 \left( 1 - \left( -\frac{1}{2} \right)^{10} \right)}{1 - \left( -\frac{1}{2} \right)}$ $S_{10} = \frac{341}{16} \text{ or/of } 21,31$	$\checkmark$ values of $a$ and $r$  $\checkmark$ substitution into correct formula  $\checkmark$ answer   (3)
		<b>[13]</b>



**QUESTION/VRAAG 3**

3.1	-4 ; -6 ; -10 ; -16 ; ... given/gegee	
3.1.1	 <p>First difference/eerste verskil : -2 ; -4 ; -6                      Second differences/tweede verskil -2 ; -2</p> $2a = -2 \qquad 3(-1) + b = -2$ $a = -1 \qquad b = 1$ $-1 + 1 + c = -4$ $c = -4$ $T_n = -n^2 + n - 4$	<p>✓ value of <math>a</math></p> <p>✓ value of <math>b</math></p> <p>✓ value of <math>c</math></p> <p>✓ <math>T_n = -n^2 + n - 4</math></p> <p>(4) ANSWER ONLY FULL MARKS</p>
3.1.2	$T_n = -2 + (n-1)(-2)$ $T_n = -2n$ $-100 = -2n$ $\therefore n = 50$ <p>Between/tussen  <math>T_{50}</math> and/en <math>T_{51}</math></p> <p style="text-align: center;">OR/OF</p> $T_{n+1} - T_n = -100$ $-(n+1)^2 + (n+1) - 4 - [-n^2 + n - 4] = -100$ $-n^2 - 2n - 1 + n + 1 - 4 + n^2 - n + 4 = -100$ $-2n = -100$ $n = 50$ <p>Between/tussen  <math>T_{50}</math> and/en <math>T_{51}</math></p>	<p>✓ <math>d = -2</math></p> <p>✓ <math>T_n = -2n</math></p> <p>✓ 50</p> <p>✓ answer</p> <p>OR</p> <p>✓ <math>T_{n+1} - T_n = -100</math></p> <p>✓ substitution</p> <p>✓ 50</p> <p>✓ answer</p> <p>(4)</p>

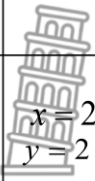
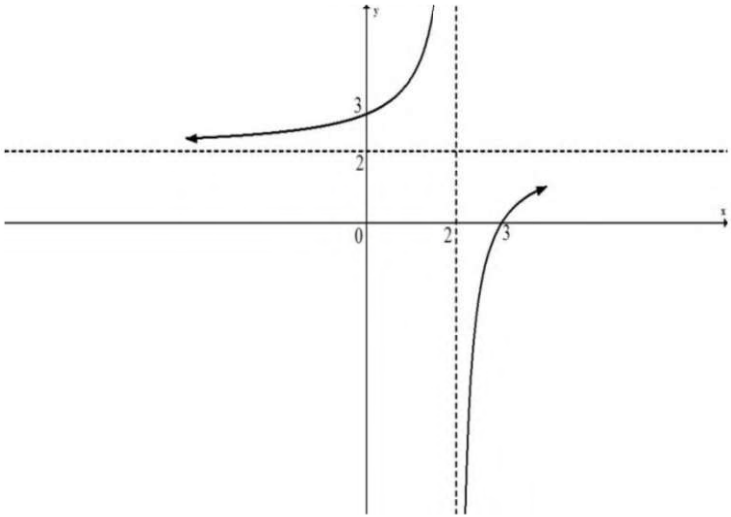
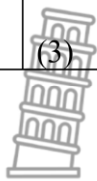


3.2	 $a = k - \frac{3}{2}$ $r = k - \frac{3}{2}$ $\therefore S_{\infty} = \frac{a}{1-r}$ $-\frac{5}{3} = \frac{k - \frac{3}{2}}{1 - \left(k - \frac{3}{2}\right)}$ $-\frac{5}{3} + \frac{5}{3}k - \frac{5}{2} = k - \frac{3}{2}$ $-10 + 10k - 15 = 6k - 9$ $4k = 16$ $k = 4$	<p>✓ value of <math>a</math> and <math>r</math></p> <p>✓ substitution in correct formula</p> <p>✓ simplification shown</p> <p>✓ answer</p> <p>(4)</p>
		<b>[12]</b>







**QUESTION/VRAAG 4**

	Given/gegee $h(x) = -\frac{2}{x-2} + 2$	
4.1	 $x = 2$ $y = 2$	✓ $x = 2$ ✓ $y = 2$  (2)
4.2	$0 = -\frac{2}{x-2} + 2$ $-2(x-2) = -2$ $x-2 = 1$ $x = 3$	✓ $y = 0$  ✓ $x = 3$  (2)
4.3		✓ BOTH asymptotes  ✓ x- intercept  ✓ y- intercept  ✓ shape  (4)
4.4	$y - 2 = -1(x - 2)$ $y = -x + 4$	✓ gradient -1 ✓ substitute (2; 2) ✓ equation   (3)



4.5	$-h(x) + 1$ $= \frac{2}{x-2} - 2 + 1$ $= \frac{2}{x-2} - 1$ $\therefore y \in R; y \neq -1$	✓ new equation ✓ answer  (2) ANSWER ONLY FULL MARKS
4.6	$h(x) \leq 0$ $\therefore x \in (2;3]$ OR/OR $2 < x \leq 3$	✓ critical values ✓ notation  (2)
		[15]



QUESTION/VRAAG 5



	 <p>Given/gegee <math>f(x) = -\frac{1}{2}x^2 + 2x + 6</math>  <math>g(x) = -x - 2</math></p>	
5.1.1	$x = \frac{-2}{2\left(-\frac{1}{2}\right)}$ OR/OR $f'(x) = 0$ $0 = -x + 2$ $x = 2$ $y = -\frac{1}{2}(x^2 - 4x) + 6$ $x = 2$ $\therefore D(2;8)$ $y = -\frac{1}{2}(x-2)^2 + 8$ $\therefore D(2;8)$	✓ method for turning point ✓ x-value ✓ y-value (3)
5.1.2	$D(2;8)$ $\therefore F(2;-4)$ DF = 12 units/eenhede	✓✓ coordinates F ✓ answer (3)
5.2	$6 < k < 8$	✓✓ answer (2)
5.3	$h'(x) = f(x)$ $0 = -\frac{1}{2}x^2 + 2x + 6$ $0 = x^2 - 4x - 12$ $0 = (x-6)(x+2)$ $A(-2;0)$ $B(6;0)$ $\therefore x = -2$ $x = 6$ for turning points of/vir draaipunte van $h$	✓ $f(x) = h'(x) = 0$ ✓ Factors ✓ both $x$ values (3)
5.4	$f'(x) \times g(x) \leq 0$ $\therefore x \in [-2;2]$	✓ critical values ✓ notation  (2)
		[13]


**QUESTION/VRAAG 6**

6.1	 $T(0; 1)$	✓ answer (1)
6.2	 $\frac{27}{8} = a^3$ $\therefore a = \frac{3}{2}$	✓ substitute B ✓ answer (2)
6.3	$g(x) = \left(\frac{2}{3}\right)^x$ OR/OF $g(x) = \left(\frac{3}{2}\right)^{-x}$	✓ base ✓ exponent (2)
6.4	$f^{-1} : x = \left(\frac{3}{2}\right)^y$ $\therefore y = \log_{\frac{3}{2}} x$	✓ swop $x$ and $y$ ✓ answer (2)
6.5	$\log_{\frac{3}{2}} x = 1$ $\therefore x = \frac{3}{2}$ $f^{-1}(x) \leq 1$ $\therefore x \in (0; \frac{3}{2}]$	✓ $x = \frac{3}{2}$ ✓ critical values ✓ notation (3)
		<b>[10]</b>





QUESTION/VRAAG 7


7.1	 $A = P(1+i)^n$ $3x = x(1+0,098)^n$ $3 = 1,098^n$ $n = \log_{1,098} 3$ $n = 11,751$ <p>It will take 12 years to triple the money/Dit sal 12 jaar neem om die geld te verdriedubbel.</p>	<p>✓ correct substitution in correct formula</p> <p>✓ use of logs (independent mark)</p> <p>✓ 12 also accept 11,75</p> <p>(3)</p>
7.2		
7.2.1	$F_v = \frac{x[(1+i)^n - 1]}{i}$ $64000 = \frac{x \left[ \left( 1 + \frac{0,085}{12} \right)^{120} - 1 \right]}{\frac{0,085}{12}}$ $x = 340,18$	<p>✓ <math>i = \frac{0,085}{12}</math></p> <p><math>n = 120</math> both <math>i</math> and <math>n</math></p> <p>✓ substitution in correct formula</p> <p>✓ answer</p> <p>(3)</p>
7.2.2	$F_v = \frac{340,18 \left[ \left( 1 + \frac{0,085}{12} \right)^{96} - 1 \right]}{\frac{0,085}{12}} \left( 1 + \frac{0,085}{12} \right)^{24}$ $= 55135,69$	<p>✓ <math>96 = n</math></p> <p>✓ compound interest 24 months</p> <p>✓ answer</p> <p>(3)</p>
7.3		
7.3.1	$P_v = \frac{4396,83 \left[ 1 - \left( 1 + \frac{0,104}{12} \right)^{-72} \right]}{\frac{0,104}{12}}$ $= R234770,75$	<p>✓ <math>72 = n</math> and <math>i = \frac{0,104}{12}</math></p> <p>✓ substitution into correct formula</p> <p>✓ answer</p> 

	<p>ALTERNATIVE method <i>ALTERNATIEWE metode</i></p>  $400000 \left( 1 + \frac{0,104}{12} \right)^{108}$ $- \frac{4396,83 \left[ \left( 1 + \frac{0,104}{12} \right)^{108} - 1 \right]}{\frac{0,104}{12}}$ $= R234770,77$	<p>✓ loan with <math>n = 108</math></p> <p>✓ <math>F_v</math> with <math>n = 108</math></p> <p>✓ answer</p> <p>(3)</p>
7.3.2	<p>During 9 years, she paid R474 857,64.                      Her payment on the loan however is only R165 229,25.                      She paid interest of R309 628,39 over the 9 years. / <i>Gedurende 9 jaar het sy R474 857,64 betaal. Haar betaling op die lening is egter slegs R165 229,25. Sy het rente van R309 628,39 oor die 9 jaar betaal</i></p>	<p>✓ R474 857,64</p> <p>✓ R165 229,25 or R165 229,23</p> <p>✓ R309 628,39 or R306 628,41</p> <p>(3)</p>
		<b>[15]</b>



**QUESTION/VRAAG 8 Penalise 1 mark for incorrect notation in question 8 only/Penaliseer slegs 1 punt vir verkeerde notasie in vraag 8.**

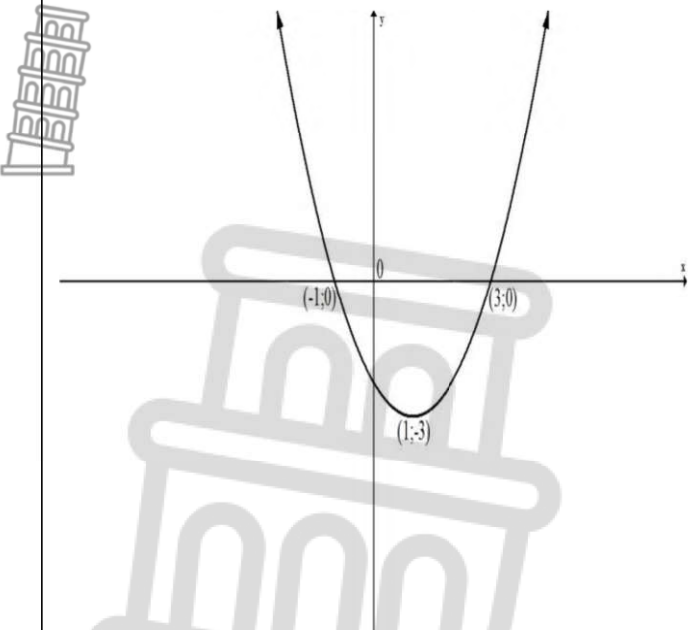
8.1	 $f(x) = 3 - x^2$ $f(x+h) = 3 - (x+h)^2$ $= 3 - x^2 - 2xh - h^2$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{3 - x^2 - 2xh - h^2 - (3 - x^2)}{h}$ $= \lim_{h \rightarrow 0} \frac{-2xh - h^2}{h}$ $= \lim_{h \rightarrow 0} \frac{h(-2x - h)}{h}$ $= \lim_{h \rightarrow 0} (-2x - h)$ $= -2x$	$\checkmark = 3 - x^2 - 2xh - h^2$  $\checkmark$ substitution in correct formula  $\checkmark$ simplify  $\checkmark$ factors  $\checkmark$ answer  (5)
8.2		
8.2.1	$D_x \left[ \frac{2}{x} - \sqrt{x} \right]$ $= D_x \left[ 2x^{-1} - x^{\frac{1}{2}} \right]$ $= -2x^{-2} - \frac{1}{2}x^{-\frac{1}{2}}$	$\checkmark 2x^{-1}$ $\checkmark x^{\frac{1}{2}}$ $\checkmark -2x^{-2}$ $\checkmark -\frac{1}{2}x^{-\frac{1}{2}}$  (4)
8.2.2	$y = (x^3 - 1)^2$ $y = x^6 - 2x^3 + 1$ $\therefore \frac{dy}{dx} = 6x^5 - 6x^2$	$\checkmark x^6 - 2x^3 + 1$ $\checkmark 6x^5$ $\checkmark -6x^2$  (3)

8.3	$f(x) = x^3 - 12x - 16$	
8.3.1(a)	 $f'(x) = 3x^2 - 12$ $0 = 3(x - 2)(x + 2)$ $x = 2$ $x = -2$ $\therefore (2; -32)$ $(-2; 0)$	$\checkmark 3x^2 - 12$ $\checkmark = 0$ $\checkmark$ factors  $\checkmark (2; -32)$ $\checkmark (-2; 0)$  (5)
8.3.1(b)	$x^3 - 12x - 16 = 0$ $(x + 2)(x + 2)(x - 4) = 0$ $x = -2$ $x = 4$	$\checkmark y = 0$ $\checkmark$ factors $\checkmark$ BOTH answers  (3)
8.3.2	$15 = 3x^2 - 12$ $0 = 3x^2 - 27$ $x^2 = 9$ $x = \pm 3$	$\checkmark$ derivative = 15 $\checkmark$ standard form $\checkmark x = 3$ $\checkmark x = -3$  (4)
8.3.3	$f''(x) = 6x$ $0 = 6x$ $x = 0$ Concave up/konkaaf op: $x \in (0; \infty)$ or written/of geskryf as $x > 0$	$\checkmark 6x = 0$  $\checkmark$ values $\checkmark$ notation  (3)
		[27]






QUESTION/VRAAG 9

9.1		<ul style="list-style-type: none"> <li>✓ turning point</li> <li>✓ shape</li> <li>✓ x- intercepts</li> </ul> <p>(3)</p>
9.2	$T(t) = 60 + 27t - t^3$	
9.2.1	<p>Average change/ <math>= \frac{T(6) - T(3)}{3}</math></p> <p>Gemid. verandering <math>= \frac{6 - 114}{3}</math></p> <p><math>= -36</math></p>	<ul style="list-style-type: none"> <li>✓ correct formula</li> <li>✓ substitution</li> <li>✓ answer</li> </ul> <p>(3)</p>
9.2.2	<p><math>0 = 27 - 3t^2</math></p> <p><math>\therefore t^2 = 9</math></p> <p><math>t = 3</math></p>	<ul style="list-style-type: none"> <li>✓ <math>27 - 3t^2</math></li> <li>✓ <math>= 0</math></li> <li>✓ answer</li> </ul> <p>(3)</p>
		[9]

**QUESTION/VRAAG 10**

10.1	 $P(A) = 0,4$ $P(B) = 0,5$	
10.1.1	$P(A \text{ or/of } B) = P(A) + P(B)$ $- P(A \text{ and/en } B)$ $= 0,4 + 0,5 - 0$ $= 0,9$	$\checkmark P(A \text{ and } B) = 0$ $\checkmark$ answer (2)
10.1.2	$P(A \text{ or/of } B) = P(A) + P(B)$ $- P(A \text{ and/en } B)$ $= 0,4 + 0,5 - (0,4 \times 0,5)$ $= 0,7$	$\checkmark$ rule $\checkmark P(A) \times P(B) = P(A \text{ and } B)$ $\checkmark$ answer (3)
10.2		
10.2.1	$5 \times 5 \times 10 \times 9$ $= 2250$	$\checkmark$ 5 $\checkmark$ 5 $\checkmark$ 10 $\checkmark$ 9 (4)
10.2.2	$\frac{1 \times 5 \times 9 \times 5}{2250}$ $= \frac{1}{10}$ $= 0,1$	$\checkmark$ denominator 2250 $\checkmark$ $1 \times 5$ $\checkmark$ $9 \times 5$ $\checkmark$ answer (4)
		<b>[13]</b>

 **TOTAL/TOTAAL: 150**