education

Department of Education
FREE STATE PROVINCE

PREPARATORY EXAMINATION
VOORBEREIDENDE EKSAMEN

GRADE/*GRAAD* 12

MATHEMATICS P1
WISKUNDE V1

SEPTEMBER 2023

MARKS/*PUNTE*: 150

Stanmorephysics

MARKING GUIDELINES
NASIENRIGLYNE

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

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Please turn over/*Blaai om asseblief*

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

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

QUESTION/*VRAAG* 2

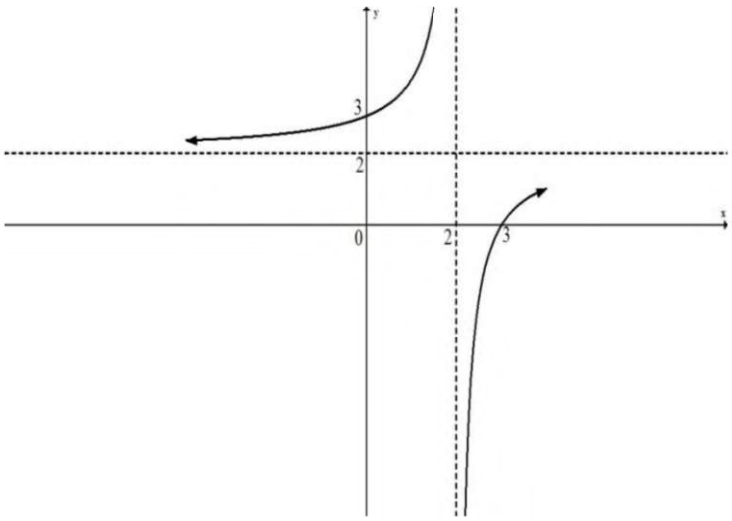
2.1.1	$S_n = a + (a+d) + (a+2d) + \ldots + a + (n-1)d$ $S_n = a + (n-1)d + a + (n-2)d + \ldots + a$ $\therefore 2S_n = n(2a + (n-1)d)$ $S_n = \frac{n}{2}(2a + (n-1)d)$	✓ $T_n = a + (n-1)d$ ✓ reverse ✓ add (3)
2.1.2	$2^x + 2.2^x + 3.2^x + \ldots$ $\therefore a = 2^x$ $d = 2^x$ $1680 = \frac{20}{2}(2(2^x)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

QUESTION/*VRAAG* 3

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

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

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/*OF* $2 < x \leq 3$	✓ critical values ✓ notation (2)
		[15]

QUESTION/*VRAAG* 5

	Given/*gegee* $f(x)=-\frac{1}{2}x^2+2x+6$ $g(x)=-x-2$	
5.1.1	$x=\frac{-2}{2\left(-\frac{1}{2}\right)}$ $x=2$ $\therefore D(2;8)$ OR/*OF* $f'(x)=0$ $0=-x+2$ $x=2$ $y=-\frac{1}{2}(x^2-4x)+6$ $y=-\frac{1}{2}(x-2)^2+8$ $\therefore D(2;8)$	✓ 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	$f'(x)\times g(x)\le 0$ $\therefore x\in[-2;2]$	✓ 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)
		[10]

QUESTION/*VRAAG* 7

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

	ALTERNATIVE method*ALTERNATIEWE metode* $400000\left(1+\frac{0,104}{12}\right)^{108}$ $-\frac{4396,83\left[\left(1+\frac{0,104}{12}\right)^{108}-1\right]}{\frac{0,104}{12}}$ $= R234770,77$	✓ loan with n = 108 ✓ F_v with n = 108 ✓ answer (3)
7.3.2	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./*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*	✓ R474 857,64 ✓ R165 229,25 or R165 229,23 ✓ R309 628,39 or R306 628,41 (3)
		[15]

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

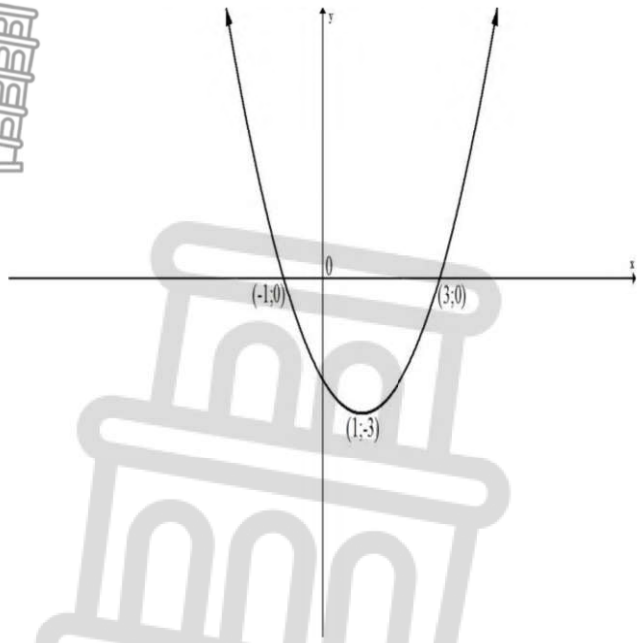
8.1	$f(x)=3-x^2$ $f(x+h)=3-(x+h)^2$ $=3-x^2-2xh-h^2$ $f'(x)=\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$ $=\lim_{h\to 0}\frac{3-x^2-2xh-h^2-(3-x^2)}{h}$ $=\lim_{h\to 0}\frac{-2xh-h^2}{h}$ $=\lim_{h\to 0}\frac{h(-2x-h)}{h}$ $=\lim_{h\to 0}(-2x-h)$ $=-2x$	✓ $=3-x^2-2xh-h^2$ ✓ substitution in correct formula ✓ simplify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

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



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QUESTION/*VRAAG* 9

9.1		✓ turning point ✓ shape ✓ *x*- intercepts (3)
9.2	$T(t) = 60 + 27t - t^3$	
9.2.1	Average change/ *Gemid. verandering* $= \frac{T(6) - T(3)}{3}$ $= \frac{6 - 114}{3}$ $= -36$	✓ correct formula ✓ substitution ✓ answer (3)
9.2.2	$0 = 27 - 3t^2$ $\therefore t^2 = 9$ $t = 3$	✓ $27 - 3t^2$ ✓ $= 0$ ✓ answer (3)
		[9]

Stanmorephysics

QUESTION/*VRAAG* 10

10.1	$P(A) = 0{,}4$ $P(B) = 0{,}5$	
10.1.1	$P(A\ or/of\ B) = P(A) + P(B) - P(A\ and/en\ B)$ $= 0{,}4 + 0{,}5 - 0$ $= 0{,}9$	✓ $P(AandB) = 0$ ✓ answer (2)
10.1.2	$P(A\ or/of\ B) = P(A) + P(B) - P(A\ and/en\ B)$ $= 0{,}4 + 0{,}5 - (0{,}4 \times 0{,}5)$ $= 0.7$	✓ rule ✓ $P(A) \times P(B) = P(AandB)$ ✓ answer (3)
10.2		
10.2.1	$5 \times 5 \times 10 \times 9$ $= 2250$	✓ 5 ✓ 5 ✓ 10 ✓ 9 (4)
10.2.2	$\frac{1 \times 5 \times 9 \times 5}{2250}$ $= \frac{1}{10}$ $= 0{,}1$	✓ denominator 2250 ✓ 1×5 ✓ 9×5 ✓ answer (4)
		[13]

TOTAL/*TOTAAL*: 150