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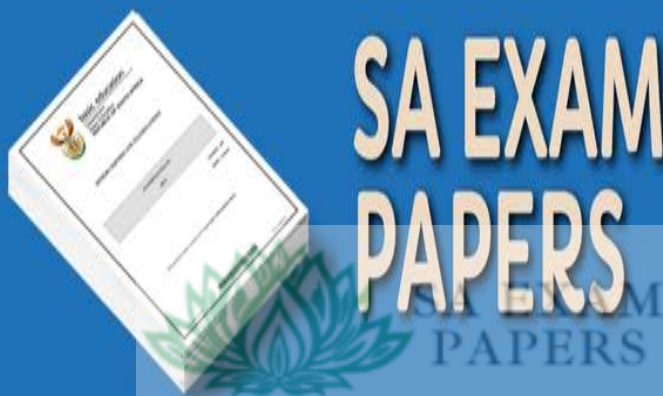


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PREPARATORY EXAMINATION
VOORBEREIDENDE EKSAMEN

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	$(x-1)(2x+1) = 0$ $x = 1$ or/of $x = -\frac{1}{2}$	$\checkmark x = 1$ $\checkmark x = -\frac{1}{2}$ (2)
1.1.2	$(x-1)(2x+1) = 4$ $2x^2 - x - 5 = 0$ $\therefore x = \frac{-(-1) \pm \sqrt{(-1)^2 - 4(2)(-5)}}{2(2)}$ $x = \frac{1 \pm \sqrt{41}}{4}$ $x = 1,85$ or/of $x = -1,35$	$\checkmark$ standard form $\checkmark$ correct substitution in correct formula $\checkmark 1,85$ $\checkmark -1,35$ Penalise/mark -1 for incorrect rounding (4)
1.1.3	$x + \sqrt{x-2} = 4$ $\sqrt{x-2} = 4 - x$ $(\sqrt{x-2})^2 = (4-x)^2$ $x-2 = 16 - 8x + x^2$ $0 = x^2 - 9x + 18$ $0 = (x-6)(x-3)$ $x = 6$ or/of $x = 3$ 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 $-\frac{1}{3}$ $x \in \left[-\frac{1}{3}; 0\right]$ Or $-\frac{1}{3} \leq x \leq 0$	$\checkmark$ factors $\checkmark$ critical values $\checkmark$ 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/OR $x = \frac{17 - y}{2}$ 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 $x = \frac{17 - 1}{2}$ $x = \frac{1}{2}$ $x = 8$	$\checkmark y = 17 - 2x$ $\checkmark$ substitution $\checkmark$ standard form $\checkmark$ factors $\checkmark$ both answers for x $\checkmark$ both answers for y OR $x = \frac{17 - y}{2}$ $\checkmark$ substitution $\checkmark$ standard form $\checkmark$ factors $\checkmark$ both answers for x $\checkmark$ both answers for y (6)
1.3	$\sqrt{\sqrt{21x^2} - \sqrt{5x^2}} \times \sqrt{\sqrt{21x^2} + \sqrt{5x^2}}$ $= \sqrt{(\sqrt{21x^2} - \sqrt{5x^2})(\sqrt{21x^2} + \sqrt{5x^2})}$ $= \sqrt{21x^2 - 5x^2}$ $= \sqrt{16x^2}$ $= 4x$	$\checkmark$ one square root $\checkmark$ difference between squares $\checkmark$ answer (3)
		[23]



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	$2^x + 2 \cdot 2^x + 3 \cdot 2^x + \dots$ $\therefore a = 2^x$ $d = 2^x$ $1680 = \frac{20}{2}(2(2^x) + (19)(2^x))$ $168 = 21 \cdot 2^x$ $8 = 2^x$ $x = 3$	value a } $\checkmark$ value d } $\checkmark$ 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)
		[13]





QUESTION/VRAAG 3

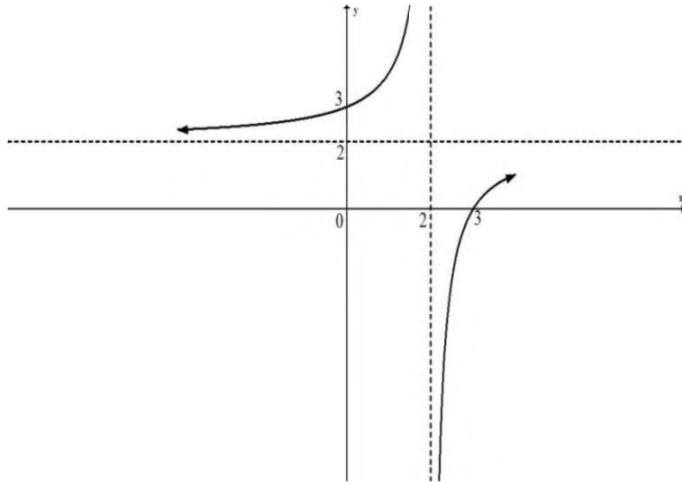
3.1	-4 ; -6 ; -10 ; -16 ; ... given/gegee	
3.1.1	First difference/<i>eerste verskil</i> : -2 ; -4 ; -6 Second differences/<i>tweede verskil</i> -2 ; -2 $2a = -2 \quad 3(-1) + b = -2$ $a = -1 \quad b = 1$ $-1 + 1 + c = -4$ $c = -4$ $T_n = -n^2 + n - 4$	✓ value of a ✓ value of b ✓ value of c ✓ $T_n = -n^2 + n - 4$ (4) ANSWER ONLY FULL MARKS
3.1.2	$T_n = -2 + (n-1)(-2)$ $T_n = -2n$ $-100 = -2n$ $\therefore n = 50$ Between/<i>tussen</i> T_{50} and/<i>en</i> T_{51} OR/OF $T_{n+1} - T_n = -100$ $-(n+1)^2 + (n+1) - 4 - [-n^2 + n - 4] = -100$ $-n^2 - 2n - 1 + n + 1 - 4 + n^2 - n + 4 = -100$ $-2n = -100$ $n = 50$ Between/<i>tussen</i> T_{50} and/<i>en</i> 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	$x = \frac{-2}{2\left(-\frac{1}{2}\right)}$ $f'(x) = 0$ $0 = -x + 2$ $x = 2$ OR/OR $y = -\frac{1}{2}(x^2 - 4x) + 6$ $x = 2$ $\therefore D(2;8)$ $y = -\frac{1}{2}(x-2)^2 + 8$ $\therefore D(2;8)$	✓ 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	$h'(x) = f(x)$ $0 = -\frac{1}{2}x^2 + 2x + 6$ $0 = x^2 - 4x - 12$ $0 = (x-6)(x+2)$ $A(-2;0)$ $B(6;0)$ $\therefore x = -2$ $x = 6$	✓ $f(x) = h'(x) = 0$ ✓ 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/OR $g(x) = \left(\frac{3}{2}\right)^{-x}$	✓ 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/ <i>Dit sal 12 jaar neem om die geld te verdriedubbel.</i>	✓ correct substitution in correct formula ✓ use of logs (independent mark) ✓ 12 also accept 11,75 (3)
7.2		
7.2.1	$F_v = \frac{x[(1+i)^n - 1]}{i}$ $64000 = \frac{x \left[\left(1 + \frac{0,085}{12} \right)^{120} - 1 \right]}{\frac{0,085}{12}}$ $x = 340,18$	✓ $i = \frac{0,085}{12}$ $n = 120$ 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 <i>ALTERNATIEWE metode</i> $400000 \left(1 + \frac{0,104}{12} \right)^{108}$ $- \frac{4396,83 \left[\left(1 + \frac{0,104}{12} \right)^{108} - 1 \right]}{\frac{0,104}{12}}$ = 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. / <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>	✓ 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.

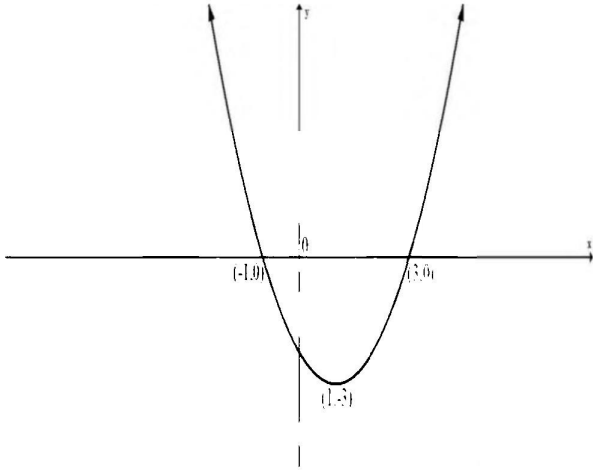
8.1	$f(x) = 3 - x^2$ $f(x+h) = 3 - (x+h)^2$ $= 3 - x^2 - 2xh - h^2$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{3 - x^2 - 2xh - h^2 - (3 - x^2)}{h}$ $= \lim_{h \rightarrow 0} \frac{-2xh - h^2}{h}$ $= \lim_{h \rightarrow 0} \frac{h(-2x - h)}{h}$ $= \lim_{h \rightarrow 0} (-2x - h)$ $= -2x$	$\checkmark = 3 - x^2 - 2xh - h^2$ $\checkmark$ 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/ <i>konkaaf op</i> : $x \in (0; \infty)$ or written/ <i>of geskryf</i> as $x > 0$	$\checkmark 6x = 0$ $\checkmark$ values $\checkmark$ notation (3)
		[27]



QUESTION/VRAAG 9

9.1		✓ turning point ✓ shape ✓ x- intercepts (3)
9.2	$T(t) = 60 + 27t - t^3$	
9.2.1	Average change/ $= \frac{T(6) - T(3)}{3}$ <i>Gemid. verandering</i> $= \frac{6 - 114}{3}$ $= -36$	✓ 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]



QUESTION/VRAAG 10

10.1	$P(A) = 0,4$ $P(B) = 0,5$	
10.1.1	$P(A \text{ or/of } B) = P(A) + P(B)$ $\quad - P(A \text{ and/en } B)$ $= 0,4 + 0,5 - 0$ $= 0,9$	$\checkmark P(A \text{ and } B) = 0$ $\checkmark$ answer (2)
10.1.2	$P(A \text{ or/of } B) = P(A) + P(B)$ $\quad - P(A \text{ and/en } B)$ $= 0,4 + 0,5 - (0,4 \times 0,5)$ $= 0,7$	$\checkmark$ 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)
		[13]

TOTAL/TOTAAL: 150