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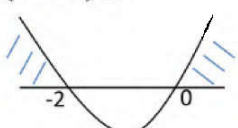
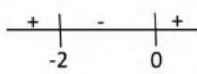
SEPTEMBER EXAM PAPER 1

25 AUGUST 2023

MARKS: 150

This marking guideline consists of 14 pages.

QUESTION 1

1.1.1	$x(x+2) = 0$ $x = 0$ OR/OF $x = -2$	$\checkmark x = 0$ $\checkmark x = -2$ (2)
1.1.2	$x^2 + 2x \geq 0$ $x(x+2) \geq 0$  OR/OF  $\therefore x > 0$	$\checkmark x^2 + 2x \geq 0$ $\checkmark$ graph/grafiek/ critical pts $\checkmark x > 0$ If $x \geq 0$ only 1 mark Indien $x \geq 0$ slegs 1 punt (3)
1.2	$x = \frac{-(-3) \pm \sqrt{(-3)^2 - 4(2)(-7)}}{2(2)}$ $= \frac{3 \pm \sqrt{65}}{4}$ $x = 2,77$ OR/OF $x = -1,27$	$\checkmark$ substitution into correct formula/ <i>substitusie in korrekte formule</i> $\checkmark$ simplify $\checkmark 2,77$ $\checkmark -1,27$ If left in surd form only 2 marks. Indien in wortelvorm, slegs 2 punte. (4)
1.3.1	$k^2 + 5k - 14 = 0$ $(k-2)(k+7) = 0$ $k = 2$ or $k = -7$	$\checkmark$ multiplying $\checkmark$ factorising $\checkmark$ both solutions (3)
1.3.2	$\sqrt{x+5} = 2$ or $\sqrt{x+5} = -7$ $x+5 = 4$ or invalid/ no solution $x = -1$	$\checkmark$ substitution $\checkmark$ identifying invalid $\checkmark$ value of x
1.4	$x - 2y - 3 = 0$ (1) $4x^2 - 5xy + y^2 = 0$ (2) From eq (1): $x = 2y + 3$...(3) Subst. (3) into (2): $\therefore 4(2y+3)^2 - 5y(2y+3) + y^2 = 0$ $\therefore 4(4y^2 + 12y + 9) - 5y(2y+3) + y^2 = 0$ $\therefore 16y^2 + 48y + 36 - 10y^2 - 15y + y^2 = 0$ $\therefore 7y^2 + 33y + 36 = 0$ $\therefore (7y+12)(y+3) = 0$ $\therefore y = \frac{-12}{7}$ or $y = -3$ $\therefore x = \frac{-3}{7}$ or $x = -3$	$\checkmark$ equation (3) $\checkmark$ substitution $\checkmark$ simplification $\checkmark$ standard form $\checkmark$ factors $\checkmark$ both y values $\checkmark$ both x-values (7)

1.5	For real roots : $4 - 20k \geq 0$ $\therefore -20k \geq -4$ $\therefore k \leq \frac{1}{5}$	$\checkmark 4 - 20k \geq 0$ $\checkmark$ Answer (2)
[24]		

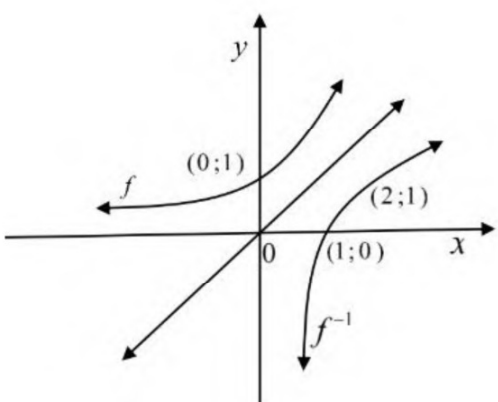
QUESTION 2

2.1.1	$1; -5; -13; -23$ $-6 \quad -8 \quad -10$ $-2 \quad -2$ $2a = -2 \quad 3a + b = -6 \quad a + b + c = 1$ $a = -1 \quad 3(-1) + b = 5 \quad -1 - 3 + c = 1$ $b = -3 \quad c = 5$ $T_n = -n^2 - 3n + 5$	$\checkmark$ Value of a $\checkmark$ Value of b $\checkmark$ Value of c $\checkmark$ General term (3)
2.1.2	$-n^2 - 3n + 5 = -643$ $n^2 + 3n - 648 = 0$ $(n + 27)(n - 24) = 0$ $n = -27 \text{ or } n = 24$ $\therefore T_{24} = -643$	$\checkmark$ equating $\checkmark$ factors $\checkmark$ answer (3)
2.2.1	$3k - (2k + 1) = 5k - 5 - 3k$ $k - 1 = 2k - 5$ $k = 4$	$\checkmark$ Difference $\checkmark$ answer (2)
2.2.2	$9, 12, 15$ $T_n = 3n + 6$ $\sum_{n=1}^{20} (3n + 6)$	$\checkmark$ Sequence $\checkmark$ General term $\checkmark$ Sigma Notation (3)

2.3.1	$r = \frac{4x^4}{8x^3}$ $r = \frac{x}{2}$ $-1 < r < 1$ $-1 < \frac{x}{2} < 1$ $-2 < x < 2$	✓ value of r ✓ Condition for converging series ✓ answer (3)
2.3.2	$S_{\infty} = \frac{a}{1-r}$ $S_{\infty} = \frac{8x^2}{1-\frac{x}{2}}$ $\frac{8}{3}\left(1-\frac{x}{2}\right) = 8x^2$ $\frac{8}{3} - \frac{8x}{6} = 8x^2$ $16 - 8x = 48x^2$ $48x^2 + 8x - 16 = 0$ $6x^2 + x - 2 = 0$ $(3x+2)(2x-1) = 0$ $x = -\frac{2}{3} \text{ or } x = \frac{1}{2}$	✓ Substitution into the correct formula ✓ Standard form ✓ Factors ✓ Answers (4)
2.4.1	$\begin{array}{l} a+2d=ar \\ 1+2d=1r \\ d=\frac{r-1}{2} \end{array} \longrightarrow \begin{array}{l} a+12d=ar^2 \\ 1+12d=1r^2 \\ 1+12\left(\frac{r-1}{2}\right)=r^2 \\ 1+6r-6=r^2 \\ r^2-6r+5=0 \\ (r-1)(r-5)=0 \\ r=1 \text{ or } r=5 \end{array}$ 1; 5; 25 OR $r=1+2d \longrightarrow \begin{array}{l} 1+12d=r^2 \\ 1+12d=(1+2d)^2 \\ =1+4d+4d^2 \\ 4d^2-8d=0 \\ 4d(d-2)=0 \\ d=0 \text{ or } d=2 \end{array}$ $\begin{array}{ll} r=1+2(0) & r=1+2(2) \\ =1 & =5 \end{array}$ 1; 5; 25	✓ $a+2d=ar$ ✓ $a+12d=ar^2$ ✓ values of d ✓ standard form ✓ factors ✓ values of r ✓ sequence ✓ $a+2d=ar$ ✓ $a+12d=ar^2$ ✓ values of r ✓ standard form ✓ factors ✓ values of d ✓ sequence (6)

2.4.2	$S_n = \frac{a(r^n - 1)}{r - 1}$ $S_7 = \frac{1(5^7 - 1)}{5 - 1}$ $= 19531$	✓ substitute in correct formula ✓ answer (2)
		[27]

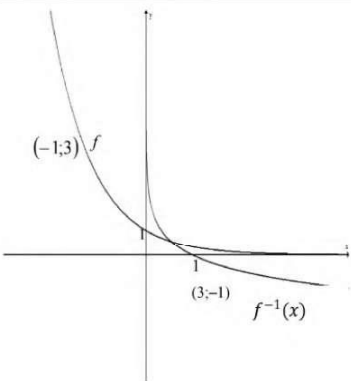
QUESTION 3

3.1	$y = 2^x$ $x = 0$ $\therefore f(0) = 2^0 = 1$ $\therefore C(0;1)$ y - intercept: $g(x) = -(x-1)^2 + q$ $C(0;1)$ $1 = -(0-1)^2 + q$ $1 = -1 + q$ $\therefore q = 2$	✓ substitute $x = 0$ and $y = 0$ into correct formula ✓ $x = -4$ ✓ $y = -2$ ✓ Symmetry $E(4; 0)$ (4)
3.2	$g(x) = -(x-1)^2 + 2$ $D(1; 2)$	✓✓ answer /antwoord (2)
3.3	$t = 2$	✓ answer/antwoord (1)
3.4	$f^{-1} : x = 2^y$ $\therefore y = \log_2 x$	✓✓ answer/antwoord (2)
3.5		✓ form of the graph /vorm van die grafiek ✓ x - intercept/afsnit ✓ any other coordinate on the graph /enige ander koördinaat op die grafiek (3)
3.6	$g(x) = -(x-1)^2 + 2$ $g(x+1) - 2 = -(x-1+1)^2 + 2 - 2$ $\therefore h(x) = -x^2$	✓ $+1$ and -2 ✓ answer:antwoord (2)
3.7	Domain: $x \geq 0$ or $x \leq 0$	✓ Answer (1)
		[08]

QUESTION 4

4		
4.1	$f(x) = \frac{2+x}{x-1}$ $f(x) = \frac{x-1+3}{x-1}$ $f(x) = \frac{x-1}{x-1} + \frac{3}{x-1}$ $f(x) = \frac{3}{x-1} + 1$	$\checkmark \frac{x-1+3}{x-1}$ $\checkmark \frac{x-1}{x-1} + \frac{3}{x-1}$ $\checkmark f(x) = \frac{3}{x-1} + 1 \quad (3)$
4.2	$x = 1$ $y = 1$	$\checkmark x = 1$ $\checkmark y = 1(2)$
4.3	$0 = \frac{2+x}{x-1}$ $0 = 2+x$ $x = -2$ $A(-2; 0)$	$\checkmark y = 0$ $\checkmark x = -2 \quad (2)$
		[07]

QUESTION 5

5.1.1	$x = \left(\frac{1}{3}\right)^y$ $f^{-1}(x) = \log_{\frac{1}{3}} x$ OF $f^{-1}(x) = -\log_3 x$ Slegs Antwoord: Volpunte	$\checkmark x = \left(\frac{1}{3}\right)^y$ $\checkmark \checkmark$ antwoord (3)
5.1.2		$f(x) = \left(\frac{1}{3}\right)^x$ $\checkmark$ vorm $\checkmark$ y-afsnit $f^{-1}(x) = \log_{\frac{1}{3}} x$ $\checkmark$ vorm $\checkmark$ x-afsnit (4)
5.2	$p(-3) = 10$ en $p'(x) = -2$ $p(x) = -2x + c$ $10 = -2(-3) + c$ $\therefore c = 16$ $p(x) = y = -2x + 16$ $x = -2y + 16$ $p^{-1}(x) = -\frac{1}{2}x + 8$	$\checkmark m = -2$ $\checkmark c = 16$ $\checkmark$ omruil van x en y $(x = -2y + 16)$ $\checkmark$ antwoord (4)
		[10]

QUESTION 6

6.1	$F = \frac{x[(1+i)^n - 1]}{i}$ $= \frac{2500 \left[\left(1 + \frac{0,06}{12}\right)^{60} - 1 \right]}{\frac{0,06}{12}}$ $= R174\,425,08$	✓ $n = 60$ and $i = \frac{0,06}{12} / 0,005$ ✓ correct substitution into correct formula ✓ answer (3)
6.2.1	After eleven months, Genevieve will owe/ <i>Na elf maande skuld Genevieve</i> $A = 82\,000 \left(1 + \frac{0,15}{12}\right)^{11}$ $= R\,94\,006,79$	✓ $n = 11$ ✓ correct substitution into correct formula ✓ answer (3)
6.2.2	$P = \frac{x[1 - (1+i)^{-n}]}{i}$ $94\,006,79 = \frac{3\,200 \left[1 - \left(1 + \frac{0,15}{12}\right)^{-n} \right]}{\frac{0,15}{12}}$ $\frac{94\,006,79}{3\,200} \times \frac{0,15}{12} = 1 - \left(1 + \frac{0,15}{12}\right)^{-n}$ $\left(1 + \frac{0,15}{12}\right)^{-n} = 1 - 0,3672147...$ $-n \log \left(1 + \frac{0,15}{12}\right) = \log 0,6327852...$ $-n = -36,8382...$ $n = 36,84$ Genevieve will have to pay 36 installments of R3 200	✓ 94006,79 ✓ substitute into correct formula ✓ correct use of logs (logs to be defined) ✓ $n = 36,84$ ✓ 36 installments (5)

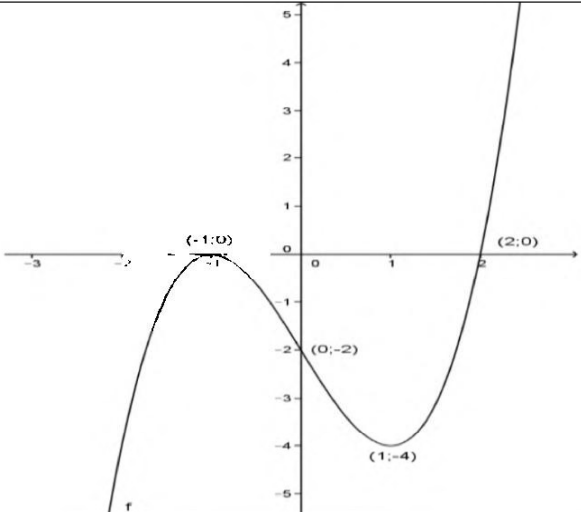
6.2.3	$P = \frac{x[1 - (1+i)^{-n}]}{i}$ $= \frac{3200 \left[1 - \left(1 + \frac{0,15}{12} \right)^{-0,83826912} \right]}{\frac{0,15}{12}}$ $P = 2652$ Outstanding balance after 36 installments is R2 652 Final payment will be: $A = 2652,00 \left(1 + \frac{0,15}{12} \right)^1$ $= R\ 2685,00$ OR/OF $\text{Balance : } 94006,79 \left(1 + \frac{0,15}{12} \right)^{36} - \frac{3\ 200 \left[\left(1 + \frac{0,15}{12} \right)^{36} - 1 \right]}{\frac{0,15}{12}}$ $= R2\ 651,72$ 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 ✓ answer ✓ $2\ 652,00 \left(1 + \frac{0,15}{12} \right)^1$ ✓ answer OR/OF ✓ $94006,79 \left(1 + \frac{0,15}{12} \right)^{36}$ ✓ $\frac{3\ 200 \left[\left(1 + \frac{0,15}{12} \right)^{36} - 1 \right]}{\frac{0,15}{12}}$ ✓ $2\ 651,72$ ✓ $2651,72 \left(1 + \frac{0,15}{12} \right)^1$ ✓ answer (5)
		[16]

QUESTION 7

7.1	$f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h)-f(x)}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{-2(x+h)^2 - (-2x^2)}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{-2x^2 - 4xh - 2h^2 + 2x^2}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{-2h(4x+h)}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{-4x-h}{1}$ $f'(x) = -4x$	✓ Substitution into correct formula ✓ Expansion ✓ Factoring ✓ Applying limits ✓ Answer
7.2.1	$y = \frac{2x^2}{x^{\frac{1}{2}}} - \frac{1}{x^{\frac{1}{2}}}$ $y = 2x^{\frac{3}{2}} - x^{-\frac{1}{2}} \checkmark$ $\frac{dy}{dx} = 3x^{\frac{1}{2}} + \frac{1}{2}x^{-\frac{3}{2}}$	✓ Simplified to binomial. ✓ $3x^{\frac{1}{2}}$ ✓ $+\frac{1}{2}x^{-\frac{3}{2}}$ (3)
7.2.2	$D_x[9x^2 - 12x + 4]$ $= 18x - 12$	✓ $9x^2 - 12x + 4$ ✓ $18x$ ✓ -12 (3)
7.3	$y = x^{-2}$ $\frac{dy}{dx} = -2x^{-3} = -\frac{2}{x^3}$ Therefore $\frac{dy}{dx} < 0$ for $x > 0$	✓ $-2x^{-3}$ ✓ $-\frac{2}{x^3}$ ✓ $\frac{dy}{dx} < 0$ for $x > 0$ (3)
		[14]

QUESTION 8

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8.1		✓ $(-1; 0)$ ✓ $(2; 0)$ ✓ $(0; -2)$ ✓ $(1; -4)$ ✓ shape (5)
8.2	$-1 < x < 1$	(2)
8.3	Pt. of inflection: "halfway" between turning points(x-values) $\therefore x = \frac{-1+1}{2}$ $\therefore x = 0$	✓ $x = \frac{-1+1}{2}$ ✓ $x = 0$ (2)
8.4	$f''(x) > 0$ $\therefore x > 0$	✓ $f''(x) > 0$ ✓ $x > 0$ (2)
		[11]

QUESTION 9

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9.1	There are four horizontal bars and three vertical bars. $\Rightarrow 4y + 3h = 12$ $4y = 12 - 3h$ $y = \frac{1}{4}(12 - 3h)$	✓ $4y + 3h$ ✓ $4y + 3h = 12$ (2)
9.2	$Area = lb$ $= yh$ $= \frac{1}{4}(12 - 3h)h$ $= 3h - \frac{3}{4}h^2$	✓ $A=yh$ ✓ Subst of y ✓ simplification (3)
9.3	$Area = 3h - \frac{3}{4}h^2$ $\frac{dA}{dh} = 3 - \frac{3}{2}h$ $\frac{dA}{dh} = 0$ $3 - \frac{3}{2}h = 0$ $h = 2$ $y = \frac{1}{4}(12 - 3(2))$ $= \frac{3}{2}$	✓ derivative ✓ equating to 0 ✓ $h = 2$ ✓ subst of h ✓ value of y (5)
		[10]

QUESTION 10

10.1	$\frac{10!}{2.2.2} = 453600$	$\checkmark \frac{10!}{2! \cdot 2! \cdot 2!}$ $\checkmark$ Answer (2)
10.2	$\frac{8!}{4} = 10080$	$\checkmark \frac{8!}{4}$ $\checkmark$ Answer (2)
10.3	Same letters are together in $2.2.2.7!$ ways = $\text{Probability} = \frac{8.7!}{\frac{10!}{8}} = \frac{4}{45}$ So required probability is $\frac{41}{45}$ OR Same letters not together is 41380 ways Probability required is $\frac{41}{45}$	$\checkmark$ Same letters together $\checkmark$ Probability of same letters together $\checkmark$ Answer OR $\checkmark$ Same letter together $\checkmark$ Same letter not together $\checkmark$ Answer (3)
		[07]

QUESTION 11

11.1.1	$P(A \text{ or } B) = P(A) + P(B)$ $0.88 = 0.5 + x$ $x = 0.38$	$\checkmark$ subst into correct formula $\checkmark$ answer (2)
11.1.2	$P(A \text{ or } B) = P(A) + P(B) - P(A).P(B)$ $0.88 = 0.5 + x - 0.5x$ $0.38 = 0.5x$ $x = 0,76$	$\checkmark$ subst into correct formula $\checkmark$ 0.5x $\checkmark$ answer (3)

11.2.1		✓ 25% for C ✓ Correct outcomes to represent win/lose ✓ Correct diagram (3)
11.2.2	Probability of winning $P(W) = P(R \text{ and } W) \text{ or } P(S \text{ and } L) \text{ or } P(C \text{ and } W)$ $= 30\% \times 24\% + 45\% \times 65\% + 25\% \times 67\%$ $= \frac{1889}{2000} \text{ OR } 0.9445$	✓ $30\% \times 24\% + 45\% \times 65\% + 25\% \times 67\%$ ✓ . ✓ answer (3)
		[11]