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PREPARATORY EXAMINATION

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MARKING GUIDELINES

MATHEMATICS (FIRST PAPER) (10611)

14 pages

**GAUTENG DEPARTMENT OF EDUCATION
PREPARATORY EXAMINATION**

**MATHEMATICS
(First Paper)**

MEMORANDUM

	QUESTION 1	
1.1		
1.1.1	$x(x-1) = 12$ $x^2 - x = 12$ $x^2 - x - 12 = 0$ $(x-4)(x+3) = 0$ $x = 4$ OR $x = -3$	✓ standard form ✓ both factors ✓ both answers (3)
1.1.2	$2x^2 + 3 = 8x$ $2x^2 - 8x + 3 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{8 \pm \sqrt{(-8)^2 - 4(2)(3)}}{2(2)}$ $= \frac{8 \pm \sqrt{64 - 24}}{4}$ $= \frac{8 \pm \sqrt{40}}{4}$ $x = 3,58$ OR $x = 0,42$	✓ standard form ✓ substitution into correct formulae ✓✓ each x answer (4)
1.1.3	$(2x+3)(3-x) > 4$ $6x - 2x^2 + 9 - 3x - 4 > 0$ $-2x^2 + 3x + 5 > 0$ $2x^2 - 3x - 5 < 0$ $(2x-5)(x+1) < 0$ $-1 < x < \frac{5}{2}$	✓ simplification ✓ standard form $2x^2 - 3x - 5 < 0$ ✓ factors ✓ critical values ✓ inequalities (5)
1.1.4	$2^x - 5 \cdot 2^{x+1} = -144$ $2^x(1 - 5 \cdot 2) = -144$ $2^x(-9) = -144$ $2^x = 16$ $2^x = 2^4$ $x = 4$	✓ common factor ✓ simplification $2^x = 2^4$ ✓ answer (3)

1.2	$y + 2x - 3 = 0$ (1) $y = x^2 + 2x + 3$ (2) From (1): $y = -2x + 3$ (3) Substitute (3) into (2): $-2x + 3 = x^2 + 2x + 3$ $x^2 + 4x = 0$ $x(x + 4) = 0$ $x = 0$ or $x = -4$ Substitute $x = 0$ into (3): $y = -2(0) + 3$ $y = 3$ OR Substitute $x = -4$ into (3): $y = -2(-4) + 3$ $y = 11$	$\checkmark y = -2x + 3$ $\checkmark$ equating $-2x + 3 = x^2 + 2x + 3$ $\checkmark$ factorisation $\checkmark$ both x -values $\checkmark$ both y -values (5)
[20]		
	QUESTION 2	
2.1	$4a - a - 2 = 6a + 4 - 4a$ $a = 6$	$\checkmark$ equating $\checkmark$ answer (2)
2.2 2.2.1		$\checkmark 33$ $\checkmark 96$ (2)
2.2.2	45 – Term odd 23 rd term of the odd sequence: $T_{23} = 5 + (23 - 1)(7)$ $T_{23} = 159$	$\checkmark$ 45 – Term odd $\checkmark$ verifying T_{23} $\checkmark$ answer (3)

2.3	$T_8 = 33 = a + 7d \quad (1)$ $T_{11} = 45 = a + 10d \quad (2)$ From equation (2): $a + 10d = 45 \quad (2)$ $a + 7d = 33 \quad (1)$ $a = 45 - 10d \quad (3) \quad \text{OR} \quad (2) - (1):$ $3d = 12$ $d = 4$ Substitute (3) into (1): $33 = 45 - 10d + 7d$ $-12 = -3d$ $d = 4$ Substitute into (2) $a = 45 - 10(4)$ $a = 5$ $T_{15} = 5 + 14(4)$ $T_{15} = 61$ OR $T_8 + 3d = T_{11}$ $33 + 3d = 45$ $3d = 12$ $d = 4$ $T_{15} = T_{11} + 4d$ $T_{15} = 45 + 4(4)$ $= 61$	$\checkmark$ equation 1 $\checkmark$ equation 2 $\checkmark$ value of d $\checkmark$ value of a $\checkmark T_{15} = 61$ $\checkmark T_8 + 3d = T_{11}$ $\checkmark$ substitution $\checkmark$ value of d $\checkmark T_{15} = T_{11} + 4d$ $\checkmark$ answer (5)
2.4	$2a = -4$ $a = -2$ $3a + b = 0$ $3(-2) + b = 0$ $b = 6$ $a + b + c = 6$ $-2 + 6 + c = 6$ $c = 2$ $T_n = -2n^2 + 6n + 2$	$\checkmark$ second difference $\checkmark$ value of a $\checkmark$ value of b $\checkmark$ value of c (4)

2.5 2.5.1	$3; \frac{3}{2}; \frac{3}{4}; \dots$ $S_{\infty} = \frac{a}{1-r}$ $S_{\infty} = \frac{3}{1-\frac{1}{2}}$ $=6$	✓ substitute into the correct formula ✓ answer (2)
2.5.2	$S_n = \frac{a(1-r^n)}{1-r}$ $S_n = \frac{3\left(1-\left(\frac{1}{2}\right)^n\right)}{1-\frac{1}{2}}$ $=6\left(1-\left(\frac{1}{2}\right)^n\right)$	✓ substitute into the correct formula ✓ answer (2)
2.5.3	$A-B < \frac{1}{36}$ $6-6\left(1-\left(\frac{1}{2}\right)^n\right) < \frac{1}{36}$ $6\left(1-1+\left(\frac{1}{2}\right)^n\right) < \frac{1}{36}$ $1-1+\left(\frac{1}{2}\right)^n < \frac{1}{216}$ $\left(\frac{1}{2}\right)^n < \frac{1}{216}$ $n > \log_{\frac{1}{2}} \frac{1}{216}$ $n > 7,75$ $\therefore n=8; 9; \dots$	✓ factorisation ✓ $\frac{1}{216}$ ✓ $\left(\frac{1}{2}\right)^n < \frac{1}{216}$ ✓ $\log_{\frac{1}{2}} \frac{1}{216}$ ✓ answer (5)
		[25]

QUESTION 3		
3.1	$(1 + i_{eff}) = \left(1 + \frac{i_{nom}}{m}\right)^m$ $(1 + i_{eff}) = \left(1 + \frac{0,06}{4}\right)^4$ $i_{eff} = 1,06 - 1$ $i_{eff} = 6,14\%$	✓ correct formula ✓ correct substitution ✓ answer (3)
3.2	$P = \frac{x[1 - (1 + i)^{-n}]}{i}$ $P = \frac{2000[1 - (1 + 0,02)^{-24}]}{0,02}$ $= R37\,827,85$ The gym borrowed R 37 827,85.	✓ substitution of x into correct formula ✓ $n = 24$ ✓ $i = 0,02$ ✓ answer (4)
3.3	$F = \frac{x[(1 + i)^n - 1]}{i}$ $200000 = \frac{x\left[\left(1 + \frac{0,0625}{12}\right)^{57} - 1\right]}{\frac{0,0625}{12}}$ $x = \frac{200000 \times \frac{0,0625}{12}}{\left[\left(1 + \frac{0,0625}{12}\right)^{57} - 1\right]}$ $x = 3022,73$ ∴ The monthly payments are R 3 022,73 per month.	✓ formula ✓ value of F ✓ $n = 57$ ✓ $i = \frac{0,0625}{12}$ ✓ making x the subject ✓ answer (6)
		[13]

4.3	$g(x) = 4 \cdot 2^{x-2+1} - 2$ $g(x) = 4 \cdot 2^{x-1} - 2$ OR $g(x) = 2 \cdot 2^x - 2$ OR $g(x) = 2^{x+1} - 2$	✓ answer ✓ answer ✓ answer (1)
		[11]
	QUESTION 5	
5.1 5.1.1	(3; 4)	✓3 ✓4 (2)
5.1.2	$y \geq -4$ OR $y \in [-4; \infty)$	✓critical values ✓inequality ✓critical values ✓correct brackets (2)
5.1.3	(2; 3) (5; 0) $m = \frac{0-3}{5-2}$ $m = -1$	✓ substitute with correct coordinates ✓ answer (2)
5.1.4	$y = -(-1) + 5$ $y = 6$ $KM = 6$ $y = -(-1-3)^2 + 4$ $y = -12$ $LM = 12$ $KL = 12 + 6$ $= 18$	✓ $KM = 6$ OR $y = 6$ ✓ $LM = 12$ OR $y = -12$ ✓ $KL = 18$ (3)
5.1.5	$x \in (2; 5)$ OR $2 < x < 5$	✓ critical values ✓ correct brackets ✓ critical values ✓ correct inequality (2)

5.2 5.2.1	$y = \left(\frac{4}{3}\right)^x$ $x = \left(\frac{4}{3}\right)^y$ $y = \log_{\frac{4}{3}} x$ $g(x) = \log_{\frac{4}{3}} x$	✓ interchange x and y ✓ $g(x) = \log_{\frac{4}{3}} x$ (2)
5.2.2	$h(x) = \left(\frac{4}{3}\right)^{-x}$ $= \left(\frac{3}{4}\right)^x$	✓ $-x$ ✓ answer (2)
5.2.3 a)	$x = 0$	✓ answer (1)
b)	$0 < x \leq 1$ OR $x \in (0;1]$	✓ critical values ✓ inequalities ✓ critical values ✓ correct brackets (2)
		[18]

4 <i>pendicular lines</i> $= \frac{4}{x^2}$ $\frac{4}{x^2}$ $-4 \quad y = -\frac{4}{-4} + 7$ $y = 8$ stitute) $x + c$ OR $y - 8 = \frac{1}{4}(x + 4)$ $(-4) + c$ $y = \frac{1}{4}x + 9$ $x + 9$	✓ m ✓ $\frac{1}{4}$ ✓ sel ✓ y ✓ an
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QUESTION 7		
7.1 7.1.1	$f(x+h) = 1 - 4(x+h)^2$ $= 1 - 4x^2 - 8xh - 4h^2$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{1 - 4x^2 - 8xh - 4h^2 - (1 - 4x^2)}{h}$ $= \lim_{h \rightarrow 0} \frac{-8xh - 4h^2}{h}$ $= \lim_{h \rightarrow 0} \frac{h(-8x - 4h)}{h}$ $= -8x$	$\checkmark f(x+h) =$ $1 - 4x^2 - 8xh - 4h^2$ $\checkmark$ correct substitution into correct formula $\checkmark$ simplify $(-8xh - 4h^2)$ $\checkmark$ common factor h $\checkmark -8x$ (5)
7.1.2	$f'(2) = -8(2)$ $= -16$	$\checkmark$ substitute $x = 2$ into $f'(x)$ $\checkmark$ answer (2)
7.2 7.2.1	$y = x^2 - 4x + 4$ $\frac{dy}{dx} = 2x - 4$	$\checkmark$ expansion $\checkmark 2x$ $\checkmark -4$ (3)
7.2.2	$f(x) = x^{\frac{2}{3}} + \frac{1}{4}x^{-4}$ $f'(x) = \frac{2}{3}x^{\frac{-1}{3}} - x^{-5}$	$\checkmark x^{\frac{2}{3}}$ $\checkmark \frac{1}{4}x^{-4}$ $\checkmark \frac{2}{3}x^{\frac{-1}{3}}$ $\checkmark -x^{-5}$ (4)
		[14]

	QUESTION 8	
8.1	$f(x) = (x+2)(x-1)(x-3)$ $= x^3 - 2x^2 - 5x + 6$	✓ factors $(x+2)(x-1)(x-3)$ ✓ product of any two factors ✓ product of any binomial and trinomial $x^3 + x^2 - 2x - 3x^2 - 3x + 6$ (3)
8.2	$f'(x) = 3x^2 - 4x - 5$ $0 = 3x^2 - 4x - 5$ $x = \frac{4 \pm \sqrt{16+60}}{6}$ $x = 2,12 \quad \text{OR} \quad x = -0,7$ $y = 8,21 \quad \text{OR} \quad y = -4,06$ $A(-0,79; 8,21) \quad B(2,12; -4,06)$	✓ $f'(x) = 0$ ✓ substitute into quadratic formula ✓ x-values ✓ y-values (4)
8.3	$y = x^3 - 2x^2 - 5x + 6 - (2x)$ $= x^3 - 2x^2 - 7x + 6$ $\frac{dy}{dx} = 3x^2 - 4x - 7$ $= (3x-7)(x+1)$ <i>for max</i> $0 = (3x-7)(x+1)$ $x = \frac{7}{3} \quad \text{OR} \quad x = -1$ $y = (-1)^3 - 2(-1)^2 - 7(-1) + 6$ $PQ = 10$	✓ simplification $x^3 - 2x^2 - 7x + 6$ ✓ differentiation ✓ factors ✓ $\frac{dy}{dx} = 0$ ✓ x-values ✓ answer (6)
8.4	$f'(x) = 3x^2 - 4x - 5$ $f''(x) = 6x - 4$ $6x - 4 < 0$ $x < \frac{2}{3}$ $k = \frac{2}{3}$	✓ $f''(x)$ ✓ $f''(x) < 0$ ✓ answer (3)
		[16]

QUESTION 9		
9.1	$BC = 50 - 2x$	✓ answer (1)
9.2	$\begin{aligned} \text{Area} &= AB \times BC \\ &= x(50 - 2x) \\ &= 50x - 2x^2 \end{aligned}$ $\begin{aligned} \text{Max } A'(x) &= 50 - 4x \\ 0 &= 50 - 4x \\ x &= 12,5m \end{aligned}$	✓ $x(50 - 2x)$ ✓ simplification $(50x - 2x^2)$ ✓ differentiate ✓ answer (4)
QUESTION 10		
10.1	1st selection 2nd selection Outcomes	✓ first branches ✓ $\frac{2}{9}; \frac{2}{9}; \frac{5}{9}$ ✓ $\frac{3}{9}; \frac{1}{9}; \frac{5}{9}$ ✓ $\frac{3}{9}; \frac{2}{9}; \frac{4}{9}$ ✓ all outcomes (5)
10.2 10.2.1	$\begin{aligned} P(B, B) &= \frac{5}{10} \times \frac{4}{9} \\ &= 0,22 \quad \text{OR} \quad \frac{2}{9} \end{aligned}$	✓ $\frac{5}{10} \times \frac{4}{9}$ ✓ answer (2)
10.2.2	$\begin{aligned} P(G, P) &= \frac{3}{10} \times \frac{2}{9} + \frac{2}{10} \times \frac{3}{9} \\ &= 0,13 \quad \text{OR} \quad \frac{12}{90} \quad \text{OR} \quad \frac{2}{15} \end{aligned}$	✓ $\frac{3}{10} \times \frac{2}{9}$ OR $\frac{6}{90}$ ✓ $\frac{2}{10} \times \frac{3}{9}$ OR $\frac{6}{90}$ ✓ answer (3)
[10]		

QUESTION 11		
11.1	Letters : $26 - 6 = 20$ Digits: $0 - 9 = 10$ $20^4 \times 10^4$ $= 1\,600\,000\,000$	✓ 20^4 ✓ 10^4 ✓ answer (3)
11.2 11.2.1	$P'(A) = 1 - P(A)$ $0,45 = 1 - P(A)$ $P(A) = 0,55$ $P(A \text{ or } B) = P(A) + P(B)$ $= 0,55 + 0,35$ $= 0,9$	✓ $P(A)$ ✓ substitute in correct formula ✓ answer (3)
11.2.2	$P(A) \times P(B)$ $= 0,55 \times 0,35$ $= 0,1975$ OR $\frac{77}{400}$ $P(A \text{ or } B) = P(A) + P(B) - P(A \cap B)$ $= 0,55 + 0,35 - 0,1975$ $= 0,71$ OR $\frac{283}{400}$ OR $\frac{71}{100}$	✓ $0,55 \times 0,35$ ✓ $0,1975$ OR $\frac{77}{400}$ ✓ substitute in correct formula ✓ answer (4)
		[10]
		TOTAL: 150