GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

JUNE EXAMINATION
GRADE 12

2024

MARKING GUIDELINES

MATHEMATICS

(PAPER 1)

12 pages

NOTE:

Read the following instructions carefully before answering the questions.

- If a candidate answers a question TWICE, only mark the first attempt.
- If a candidate has crossed OUT an answer and did not redo it, mark the crossed-out answers.
- Consistent accuracy applies in ALL aspects of the marking guidelines
- Assuming values/answers in order to solve a question is UNACCEPTABLE.

QUESTION 1				
1.1	1.1.1	$2x(3x+4)=0$ $x=0$ or $x=-\frac{4}{3}$	✓ $x=0$ ✓ $x=-\frac{4}{3}$	(2)
	1.1.2	$2x^2-4x+1=0$ $x=\frac{-(-4)\pm\sqrt{(-4)^2-4(2)(1)}}{(2)(2)}$ $x=\frac{4\pm\sqrt{8}}{4}$ $x=1{,}71$ or $x=0{,}29$	✓ standard form ✓ substitute into correct formula ✓ $x=1{,}71$ ✓ $x=0{,}29$ [-1 for incorrect rounding only in this question]	(4)
	1.1.3	$(x-2)^2\geq 1$ $x^2-4x+4\geq 1$ $x^2-4x+3\geq 0$ $(x-3)(x-1)\geq 0$ $CV\ x=3$ or $x=1$ $x\leq 1$ *or* $x\geq 3$ Or $(x-2)\leq -1\ or\ (x-2)\geq 1$ $x\leq -1+2\ or\ x\geq 1+2$ $x\leq 1 or\ x\geq 3$	✓ standard form ✓ factors ✓ critical values ✓ answer ✓✓ correct inequalities with square rooting both sides ✓ simplifying ✓ answer	(4)
1.2	1.2.1	$\sqrt{x-2}=4-x$ $x-2\geq 0$ *and* $4-x\geq 0$ $x\geq 2$ *and* $x\leq 4$ $2\leq x\leq 4$	✓ $x-2\geq 0$ ✓ $4-x\geq 0$	(2)
	1.2.2	$\sqrt{x-2}=4-x$ $x-2=16-8x+x^2$ $x^2-9x+18=0$ $(x-6)(x-3)=0$ $x\neq 6$ or $x=3$	✓ square both sides ✓ standard form ✓ factors ✓ selecting $x=3$	(4)

1.3	$3x + y = 2$ and $y^2 = 2x^2 - 1$ Equation 1. $y = 2 - 3x$ $(2 - 3x)^2 = 2x^2 - 1$ $4 - 12x + 9x^2 = 2x^2 - 1$ $7x^2 - 12x + 5 = 0$ $(7x - 5)(x - 1) = 0$ $x = \frac{5}{7}$ or $x = 1$ $y = -\frac{1}{7}$ of $y = -1$ OR Euqation 1 $x = \frac{2-y}{3}$ $y^2 = 2\left(\frac{2-y}{3}\right)^2 - 1$ $y^2 = 2\left(\frac{4-4y+y^2}{9}\right) - 1$ $9y^2 = 8 - 8y + 2y^2 - 9$ $7y^2 + 8y + 1 = 0$ $(7y + 1)(y + 1) = 0$ $y = -\frac{1}{7}$ or $y = -1$ $x = \frac{5}{7}$ or $x = 1$	✓ subject of equation ✓ substitution ✓ standard form ✓ factors ✓ x-values ✓ y-values	(6)
1.4	$r + 2s = a$ $\quad$ $r + 2s = a$ $\underline{r - 2s = b}$ $\quad$ $\underline{r - 2s = b}$ $2r = a + b$ $\quad$ $4s = a - b$ $r = \frac{a+b}{2}$ $\quad$ $s = \frac{a-b}{4}$ $rs = \frac{a^2 - b^2}{8}$ **OR** RHS $= \frac{a^2-b^2}{8}$ $= \frac{(r + 2s)^2 - (r - 2s)^2}{8}$ $= \frac{(r^2 + 4rs + 4s^2) - (r^2 - 4rs + 4s^2)}{8}$ $= \frac{8rs}{8}$ $= rs$	✓ $2r = a + b$ ✓ $4s = a - b$ ✓ r and s subject of equation ✓ multiplication OR ✓ substitution of a and b ✓ ✓ expand ✓ simplify	(4) **[26]**

QUESTION 2

2.1	2.1.1	$85\,;82\,;79\,;76$ $a = 85 \quad d = -3$ $T_n = a + (n-1)d$ $T_n = 85 + (n-1)(-3)$ $T_n = 85 - 3n + 3$ $T_n = 88 - 3n$	✓ d value ✓substitute a and d ✓ answer	(3)
	2.1.2	$T_n = 88 - 3n < 0$ $-3n < -88$ $n > \frac{88}{3}$ $\therefore T_{30}$ will be the first negative number.	✓ Tn<0 ✓ simplify ✓ answer Answer only full marks	(3)
2.2	$T_n - T_{n-1} = 4n - 3$ $\therefore T_1 = 4(2) - 3 = 5 \quad T_2 = 4(3) - 3 = 9 \quad T_3 = 4(4) - 3 = 13$ First difference = 5 ; 9 ; 13 Second difference = 4 ; 4 $2a = 4 \qquad 3a + b = 5$ $a = 2 \qquad 3(2) + b = 5$ $b = -1$ $T_{11} = 190$ $T_n = 2n^2 - 1n + c$ $190 = 2(11)^2 - 1(11) + c$ $190 = 242 - 11 + c$ $c = -41$ $T_n = 2n^2 - n - 41$ $T_1 = 2(1)^2 - (1) - 41 = -40$ **OR**	✓ first difference ✓ value of a ✓ value of b ✓ value of c ✓ value of T_1 OR	(5)

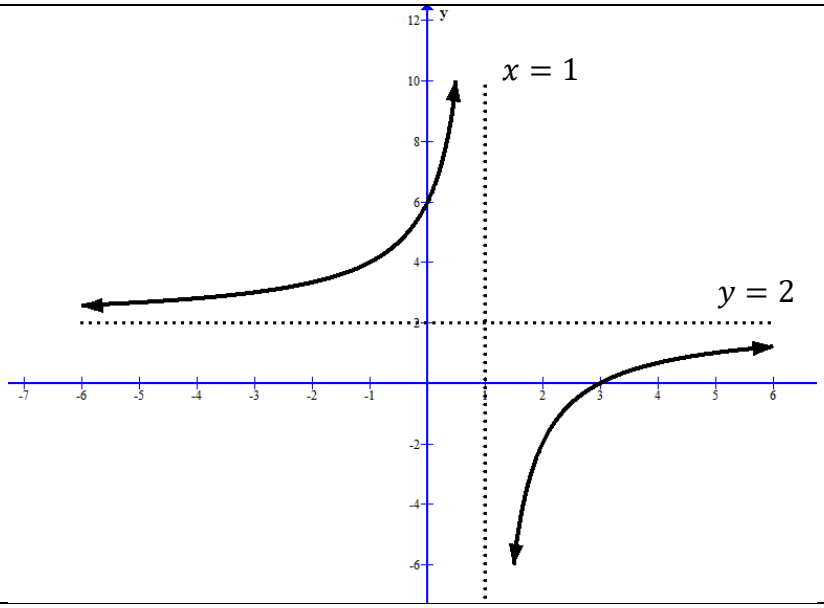
	$Tn = an^2 + bn + c$ $Tn - 1 = a(n-1)^2 + b(n-1) + c$ $Tn - Tn - 1 = an^2 + bn + c - [a(n^2 - 2n + 1) + bn - b + c]$ $= an^2 + bn + c - an^2 + 2an - a - bn + b - c$ $= 2an - a + b$ $2an - a + b = 4n - 3$ $2a = 4$ $a = 2$ $-a + b = -3$ $-2 + b = -3$ $b = -1$ $121(2) + 11(-1) + c = 190$ $c = -41$ $T_n = 2n^2 - n - 41$ $T_1 = 2(1)^2 - (1) - 41 = -40$	✓ expanding T_{n-1} ✓ value of a ✓ value of b ✓ value of c ✓ value of T_1
2.3	$S_n = \frac{n}{2}[2a + (n-1)d]$ $1275 = \frac{50}{2}[2a + (50-1)d]$ $51 = [2a + 49d]$ $T_{25} + T_{26} = a + 24d + a + 25d$ $T_{25} + T_{26} = 2a + 49d$ $T_{25} + T_{26} = 51$	✓ substitute in formula ✓ expanding $T_{25} + T_{26}$ ✓ answer
		(3)
		[14]

QUESTION 3

3.1	$\sum_{k=1}^{\infty}(4x-1)^k$ $(4x-1)^1 + (4x-1)^2 + (4x-1)^3 \ldots\ldots$ $r = (4x-1)$ $-1 < r < 1$ $-1 < 4x - 1 < 1$ $0 < 4x < 2$ $0 < x < \frac{1}{2}$ $x \neq \frac{1}{4}$		✓r ✓ condition ✓ answer ✓ excluding $x \neq \frac{1}{4}$ (4)
3.2	3.2.1	$T_1 = 3$ and $T_5 = 48$ $T_n = ar^{n-1}$ $48 = 3.r^4$ $16 = r^4$ $\therefore r = 2$	✓ sub into formula ✓ simplify ✓ answer (3)

	3.2.2	Sum of radii for 5 circles $S_n = \frac{a(r^n - 1)}{r - 1}$ $S_5 = \frac{3(2^5 - 1)}{2 - 1} = 93\ units$ $L = 93 \times 2 = 186\ units$ **OR** Sum of diameter for 5 circles $S_5 = \frac{a(r^n - 1)}{r - 1}$ $S_5 = \frac{6(2^5 - 1)}{2}$ $S_5 = 186$ $L = 186$ units **OR** 6 + 12 + 24 +48 + 96 = 186	✓ subt in formula ✓ simplify ✓ answer	(3)
	3.2.3	$\pi 3^2 + \pi.6^2 + \pi.12^2 + \cdots to\ 10$ terms $r = \frac{\pi.6^2}{\pi.3^2}$ $r = 4$ $S_{10} = \frac{9\pi(4^{10} - 1)}{4 - 1}$ $S_{10} = 3\pi(1\ 048\ 575)$ $S_{10} = 3\ 145\ 725\pi$	✓ area of circle ✓ r value ✓ subt into formula ✓ answer	(4)
				[16]

QUESTION 4			
4.1	$y = x + 1$ and $y = -x + 3$ $x + 1 = -x + 3$ $2x = 2$ $x = 1$ $y = 1 + 1$ $y = 2$ $p = -1$ $q = 2$	✓ $x + 1 = -x + 3$ ✓ x-value ✓ y-value	(3)

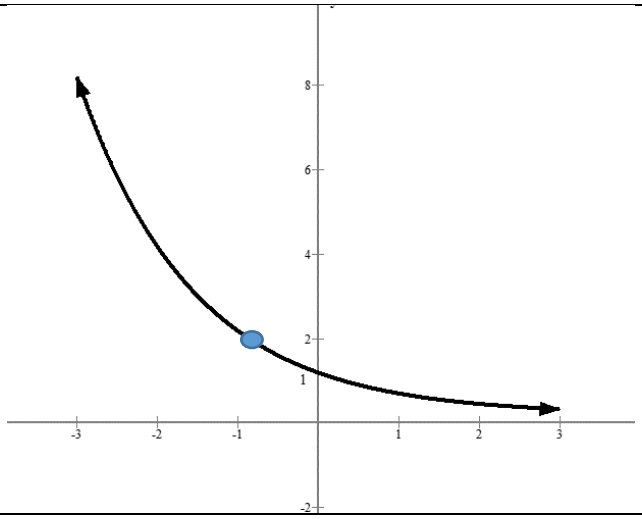
4.2	$y = \frac{-4}{x-1} + 2$ $0 = \frac{-4}{x-1} + 2$ $-2 = \frac{-4}{x-1}$ $-2x + 2 = -4$ $-2x = -6$ $x = 3$	✓ $y = 0$ ✓ $x = 3$	(2)
4.3		✓ horizontal asymptote ✓ vertical asymptote ✓ y-intercept ✓ shape	(4)
4.4	$x < 1 \quad or \quad x > 3$	✓ notation ✓ critical values	(2)
			[11]

QUESTION 5				
5.1	5.1.1	$f(x) = -(x-2)^2 + 9$ $0 = -x^2 + 4x - 4 + 9$ $0 = x^2 - 4x - 5$ $(x-5)(x+1) = 0$ $x = 5$ or $x = -1$ $AC = 6$ units **OR** $(x-2)^2 = 9$ $x - 2 = \pm 3$ $x - 2 = 3$ *or* $x - 2 = -3$ $x = 5$ *or* $x = -1$ $AC = 6$ units	✓ let $y = 0$ ✓ standard form ✓ x-values ✓ 6 units **OR** ✓ let $y = 0$ ✓ $(x-2)^2 = 9$ ✓ x-values ✓ 6 units	(4)
	5.1.2	D(2:9) $y = b^x$ $9 = b^2$ $b = 3$	✓ sub in $g(x)$ ✓ $b = 3$	(2)
	5.1.3	$x \geq 2$	✓ answer	(1)
	5.1.4	$f(x) = -(x-2)^2 + 9$ $y = -(x+2-2)^2 + 9 - 9$ $y = -x^2$	✓ subst ✓ answer Answer only full marks	(2)
	5.1.5	$x \leq 0$ or $x \geq 0$	✓ answer (accuracy mark)	(1)
	5.1.6	Prove: $g\left(x + \frac{1}{2}\right) = \sqrt{3}g(x)$ $g(x) = 3^x$ $g\left(x + \frac{1}{2}\right) = 3^{x+\frac{1}{2}}$ $= 3^x . 3^{\frac{1}{2}}$ $= \sqrt{3}g(x)$	✓ subt ✓ use of exp law	(2)
5.2	$y = a(x - x_1)(x - x_2)$ $y = a(x+3)(x-2)$ $y = ax^2 + ax - 6a$ $y = mx + c$ $0 = m(-6) + c$ $0 = m(-6) - 6a$ $6a = -6m$ $a = -m$ OR		✓ subt in formula ✓ simplifying ✓ subt in formula ✓ subt c in formula ✓ $a = -m$	(5)

	$x = \frac{-3+2}{2} = -\frac{1}{2}$ $f'(x) = 2ax + b$ $0 = 2\left(-\frac{1}{2}\right)a + b$ $a = b$ $(-6; 0)\ (0; c)$ $m = \frac{c}{6}$ $c = 6m$ $0 = 4a + 2b + 6m$ $0 = 4a + 2a + 6m$ $-6a = 6m$ $a = -m$	

[17]

QUESTION 6

6.1	$A(1: 0)$	✓ $x = 1$	(1)
6.2	$x > 0$	✓ answer	(1)
6.3	$y = log_{\frac{1}{2}}x$ $x = \log_{\frac{1}{2}} y$ $y = \left(\frac{1}{2}\right)^x$	✓ swop x and y ✓ answer Answer only full marks	(2)
6.4		✓ shape ✓ y-intercept ✓ one other point	(3)
6.5	$y = \log_{\frac{1}{2}} x$ $y = \log_{\frac{1}{2}} \frac{1}{2}$ $y = 1$	✓ answer	(1)

6.6	Reflection in the y-axis and translated one unit down	✓ reflection in y-axis ✓ translate one down	(2)
			[10]

QUESTION 7			
7.1	$1 + i_{eff} = \left(1 + \frac{i_{nom}}{m}\right)^m$ $i_{eff} = \left(1 + \frac{0{,}075}{4}\right)^4 - 1$ $r = 7{,}71\%$	✓ subt into formula ✓ simplify ✓ answer (accept i=0.0771)	(3)
7.2	$A = P(1-i)^n$ $4\,200 = 60\,000(1-i)^{42}$ $\frac{4\,200}{60\,000} = (1-i)^{42}$ $\sqrt[42]{\frac{4\,200}{60\,000}} = 1 - i$ $i = 1 - \sqrt[42]{\frac{4\,200}{60\,000}}$ $r = 6{,}14\%$	✓ n-value ✓ sub in form ✓ simplify ✓ r = 6,14% (accept in i form)	(4)
7.3	T0 T3 T10 27000 x 17614.76 $A = P\left(1 + \frac{i}{m}\right)^{n \times m}$ $17\,614{,}76 = P\left(1 + \frac{0.054}{12}\right)^{7 \times 12}$ $P = \text{R}12\,080{,}41$ $12\,080{,}41 + x = 27\,000\left(1 + \frac{0{,}054}{12}\right)^{3 \times 12}$ $12\,080{,}41 + x = 31\,736{,}69$ $x = \text{R}19\,656{,}28$ OR	✓ substitution (3 years) ✓ answer ✓ substitutions ✓ simplify ✓ answer Or	(5)

	$17\,614{,}76 = 27\,000(1+\frac{0{,}054}{12})^{120} - x(1+\frac{0{,}054}{12})^{84}$ $x(1+\frac{0{,}054}{12})^{84} = 27\,000\left(1+\frac{0{,}054}{12}\right)^{120} - 17\,614{,}76$ $x = \text{R}19\,656{,}28$	✓ i= $\frac{0{,}054}{12}$ ✓ n=120 ✓ -x ✓ n=84 ✓ answer

[12]

QUESTION 8 - Only penalise 1 mark for incorrect notation 8.1

8.1	$f(x) = 2 - 3x^2$ $f(x+h) = 2 - 3(x+h)^2$ $f(x+h) = 2 - 3x^2 - 6xh - 3h^2$ $f'(x) = \lim_{h\to 0} \frac{2 - 3x^2 - 6xh - 3h^2 - (2 - 3x^2)}{h}$ $= \lim_{h\to 0} \frac{-6xh - 3h^2}{h}$ $= \lim_{h\to 0} \frac{h(-6x-3h)}{h}$ $= \lim_{h\to 0}(-6x - 3h)$ $= -6x$		✓ f (x + h) ✓ substitution ✓ factors ✓ simplify ✓ answer
8.2	8.2.1	$f(x) = 2x^4 - 3x + a^2$ $f'(x) = 8x^3 - 3$	✓ $8x^3$ ✓ -3 ✓ 0 (implied)
	8.2.2	$D_x\left[\frac{2x^3 - \sqrt{x}}{x}\right]$ $D_x\left[2x^2 - x^{-\frac{1}{2}}\right]$ $= 4x + \frac{1}{2}x^{-\frac{3}{2}}$	✓ $D_x\left[2x^2 - x^{-\frac{1}{2}}\right]$ ✓ $4x$ ✓ $\frac{1}{2}x^{-\frac{3}{2}}$
8.3	$y = mx + c$ $y = 7x + c$ $5 = 7(4) + c$ $c = -23$ $y = 7x - 23$ OR $y - 5 = 7(x - 4)$ $y - 5 = 7x - 28$ $y = 7x - 23$		✓ gradient ✓ subt ✓ equation

(5)

(3)

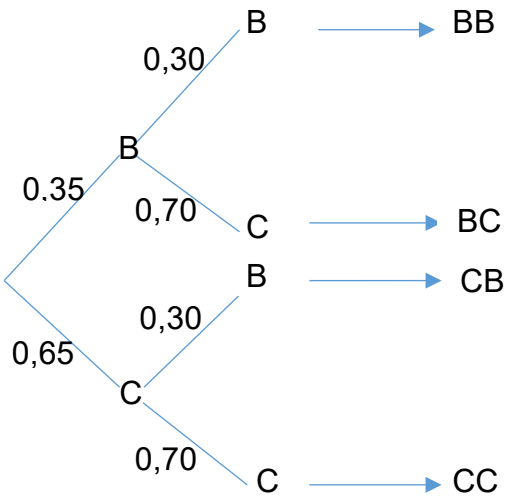
(3)

(3)

QUESTION 9			
9.1	$f(x) = 2x^3 + px^2 + qx + 3$ N(2;-9) $-9 = 2(2)^3 + p(2)^2 + q(2) + 3$ $-9 = 16 + 4p + 2q + 3$ $-28 = 4p + 2q$ ……① $f'(x) = 6x^2 + 2px + q$ $0 = 6(2)^2 + 2p(2) + q$ $0 = 24 + 4p$ +q $-24 = 4p + q$ …… ② Equation ① – ② ∴ $-4 =$ q $-24 = 4p - 4$ $4p = -20$ $p = -5$	✓ sub in f ✓ $f(x) = 0$ ✓ sub in f' ✓ solve for q ✓ solve for p	(5)
9.2	G(0;3)	✓ y-value 3 ✓ x-value 0	(2)
9.3	$f(x) = 2x^3 - 5x^2 - 4x + 3$ $0 = (x-3)(2x^2 + x - 1)$ $0 = (x-3)(2x-1)(x+1)$ $x = 3$ *or* $x = \frac{1}{2}$ *or* $x = -1$ AB = 1,5 units	✓ $(2x^2 + x - 1)$ ✓ factors ✓ roots ✓ 1,5	(4)
9.4	$f'(x) = 6x^2 - 10x - 4$ $0 = 3x^2 - 5x - 2$ $(3x+1)(x-2) = 0$ $x = -\frac{1}{3}$	✓ $f'(x)$ ✓ factors ✓ x value	(3)
9.5	$f''(x) = 12x - 10$ $0 = 12x - 10$ $x = \frac{10}{12} = \frac{5}{6}$ OR $x = \frac{-\frac{1}{3} + 2}{2}$ $x = \frac{5}{6}$ OR	✓ f'' ✓ = 0 ✓ $\frac{5}{6}$	(3)

	$y'' = 6ax + 2b = 0$ $6ax = -2b$ $x = -\frac{2b}{6a}$ $x = \frac{-2(-5)}{6(2)} = \frac{5}{6}$		
9.6	$f'' > 0$ $6x - 5 > 0$ $x > \frac{5}{6}$	✓ $x > \frac{5}{6}$	(1)
9.7	$x < -1 \ or \ -\frac{1}{3} < x < \frac{1}{2} \ or \ 2 < x < 3$	✓ $x < -1$ ✓ $-\frac{1}{3} < x < \frac{1}{2}$ ✓ $2 < x < 3$	(3)
			[21]

QUESTION 10

10.1	10.1.1	$P(\text{S and T}) = \frac{1}{6}$ $P(\text{not S}) = \frac{3}{4}$ $P(S) = \frac{1}{4}$ $P(S \text{ and } T) = P(S) \times P(T)$ $\frac{1}{6} = \frac{1}{4} \times P(T)$ $P(T) = \frac{2}{3}$	✓ $P(S)$ ✓ subst in formula ✓ $P(T)$	(3)
	10.1.2	$P(S \text{ or } T) = P(S) + P(T) - P(S \text{ and } T)$ $P(S \text{ or } T) = \frac{1}{4} + \frac{2}{3} - \frac{1}{6}$ $P(S \text{ or } T) = \frac{3}{4}$	✓ sub into formula ✓ answer	(2)
	10.2.1		✓ Branch B or C 30% and 65% ✓ Branch B or C 30% and 70% ✓ outcomes	(3)
10.2	10.2.2	P(same meal) = $(0,35)(0,30) + (0,65)(0,70)$ P(same meal) = $0,105 + 0,455 = 0,56$ Number of people = 200 x 0.56 =112	✓ $(0,35)(0,30) + (0,65)(0,7)$ ✓ 0,56 ✓ 112	(3)
				[11]

TOTAL: 150