



GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

PREPARATORY EXAMINATION 2019 MARKING GUIDELINES

MATHEMATICS (PAPER 1) (10611)

20 pages

GAUTENG DEPARTMENT OF EDUCATION

PREPARATORY EXAMINATION

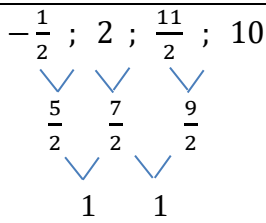
MATHEMATICS
(Paper 1)

MARKING GUIDELINES

QUESTION 1		
1.1.1	$2x^2 + 3 = 8x$ $2x^2 - 8x + 3 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4(a)(c)}}{2(a)}$ $x = \frac{-(-8) \pm \sqrt{(-8)^2 - 4(2)(3)}}{2(2)}$ $x = 3,58 \quad \text{or} \quad x = 0,42$ Penalise for rounding-off in this question ONLY.	✓ standard form ✓ correct substitution into correct formula ✓✓ answers (4)
1.1.2	$4x - 2x(x - 3) \leq 0$ $4x - 2x^2 + 6x \leq 0$ $2x^2 - 10x \geq 0$ $2x(x - 5) \geq 0$ $x \geq 5 \quad \text{or} \quad x \leq 0$ Both inequalities MUST be correct for allocating the marks.	✓ standard form ✓ factors ✓✓ answers (4)

1.1.3	$2^x - 5 \cdot 2^{x+1} = -144$ $2^x(1 - 5 \cdot 2) = -144$ $2^x(1 - 10) = -144$ $2^x(-9) = -144$ $2^x = 16$ OR $x = \log_2 16$ $2^x = 2^4$ $x = 4$	✓ factorise ✓ simplification (-9) ✓ simplification (2^4) OR correct use of logs ✓ answer (4)
1.2	$f(x) = (x - 2)(x + 6)$ $f(x) = x^2 + 4x - 12$	✓ both correct factors ✓ answer (2)
1.3	$2x + y = 17$(1) $xy = 8$ (2) from (1) $2x + y = 17$ $y = 17 - 2x$(3) substitute (3) into (2) $x(17 - 2x) = 8$ $17x - 2x^2 = 8$ $-2x^2 + 17x - 8 = 0$ $2x^2 - 17x + 8 = 0$ $(2x - 1)(x - 8) = 0$ $x = \frac{1}{2}$ or $x = 8$ substitute into (3)	✓ solve for y in equ. 1 ✓ substitute for y in equ. 2 ✓ standard form ✓ factors ✓ both x answers

	$y = 17 - 2\left(\frac{1}{2}\right)$ $y = 16$ or $y = 17 - 2(8)$ $y = 1$ OR $2x + y = 17 \dots\dots\dots(1)$ $xy = 8 \dots\dots\dots(2)$ from (2) $xy = 8$ $y = \frac{8}{x} \dots\dots\dots(3)$ substitute (3) into (1) $2x + \frac{8}{x} = 17$ $2x^2 - 17x + 8 = 0$ $(2x - 1)(x - 8) = 0$ $x = \frac{1}{2} \quad \text{or} \quad x = 8$ substitute into (2) $\frac{1}{2}y = 8 \qquad \qquad \mathbf{OR} \qquad \qquad 8y = 8$ $y = 16 \qquad \qquad \qquad \qquad y = 1$	✓ both y answers OR ✓ solve for y in equ. 2 ✓ substitute for y in equation 1 ✓ standard form ✓ factors ✓ both x answers ✓ both y answers (6)
--	--	---

1.4	$2mx^2 = 3x - 8$ $2mx^2 - 3x + 8 = 0$ $\Delta = (-3)^2 - 4(2m)(8)$ $\Delta = 9 - 64m$ for non-real roots, $\Delta < 0$ $9 - 64m < 0$ $9 < 64m \quad \text{OR} \quad -64m < -9$ $\frac{9}{64} < m \quad m > \frac{9}{64}$	✓ standard form ✓ correct substitution into correct formula ✓ $\Delta < 0$ ✓ answer (4)
		[24]
QUESTION 2		
2.1	 $2a = 1$ $a = \frac{1}{2}$ $T_n = \frac{1}{2}n^2 + n - 2$ $T_n = \frac{1}{2}(n^2 + 2n - 4)$ $3a + b = \frac{5}{2}$ $3(\frac{1}{2}) + b = \frac{5}{2}$ $b = 1$ $a + b + c = -\frac{1}{2}$ $\frac{1}{2} + 1 + c = -\frac{1}{2}$ $c = -2$	✓ $a = \frac{1}{2}$ ✓ $b = 1$ ✓ $c = -2$ ✓ $T_n = \frac{1}{2}n^2 + n - 2$ (4)
2.2	$T_{75} - T_{74} = [\frac{1}{2}\{(75)^2 + 75 - 2\}] - [\frac{1}{2}\{(74)^2 + 74 - 2\}]$ $T_{75} - T_{74} = \frac{151}{2}$	✓ correct substitution ✓ answer (2)

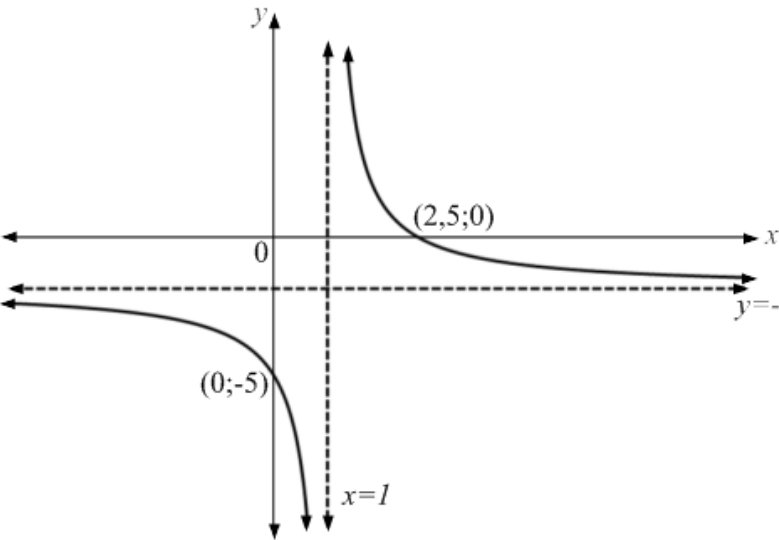
2.3.1	Arithmetic Constant difference between successive terms	✓ arithmetic ✓ correct reason (2)
2.3.2	74 th	✓ answer (1)
2.3.3	$T_n = a + (n-1)d$ $T_{30} = \frac{5}{2} + (30-1)(1)$ $T_{30} = \frac{63}{2}$	✓ correct substitution of a , n and d ✓ answer (2)
2.3.4	$Sn = \frac{n}{2}[2a + (n-1)d]$ $2176 = \frac{n}{2}[2(\frac{5}{2}) + (n-1)(1)]$ $0 = n^2 + 4n - 4352$ $0 = (n-64)(n+68)$ $n = 64$ $n \neq -68$ $64 + 1 = 65$ OR $-\frac{1}{2} + 2176 = \frac{1}{2}(n^2 + 2n - 4)$ $-1 + 4352 = n^2 + 2n - 4$ $n^2 + 2n - 4355 = 0$ $(n+67)(n-65) = 0$ $n \neq -67 \quad n = 65$	✓ substitute into correct formula ✓ standard form ✓ choice of $n = 64$ ✓ answer OR ✓✓ equating correctly ✓ standard form ✓ choosing correct n -value (4)
		[15]

QUESTION 3		
3.1	$r = \frac{2(3x-1)^2}{2(3x-1)}$ $r = 3x-1$ $-1 < 3x-1 < 1$ $0 < 3x < 2$ $0 < x < \frac{2}{3}$	✓ value of r ✓ $-1 < 3x-1 < 1$ ✓ correct constraints (3)
3.2	$T_2 = ar$ $6 = kr$ $r = \frac{6}{k} \quad \dots (1)$ sub. (1) into (2) $25 = \frac{k}{1 - \frac{6}{k}}$ $k = 25 \left(1 - \frac{6}{k} \right)$ $k = 25 - \frac{150}{k}$ $0 = k^2 - 25k + 150$ $0 = (k-10)(k-15)$ $\therefore k = 10 \text{ or } k = 15$	$S_\infty = 25$ $S_\infty = \frac{a}{1-r}$ $25 = \frac{k}{1-r} \quad \dots (2)$ ✓ $r = \frac{6}{k}$ ✓ substitution (a, r, S_∞) ✓ standard form ✓ factors ✓ answers (5)
3.3	$(1 \times 2) + (5 \times 6) + (9 \times 10) + (13 \times 14) + \dots + (81 \times 82)$ $(4n-3) \times (4n-2)$ $= 16n^2 - 20n + 6$ $4n-3 = 81 \quad \text{OR} \quad 4n-2 = 82$ $4n = 84 \quad \quad \quad 4n = 84$ $n = 21 \quad \quad \quad n = 21$ $\sum_{n=1}^{21} 16n^2 - 20n + 6 \quad \text{OR} \quad \sum_{n=1}^{21} (4n-3)(4n-2)$	✓ $(4n-3)$ ✓ $(4n-2)$ ✓ $n = 21$ ✓ answer (4)
		[12]

QUESTION 4		
4.1	$4500 = 3000 \left(1 + \frac{0,08}{12} \right)^n$ $\frac{3}{2} = \left(1 + \frac{0,08}{12} \right)^n$ $\log_{\left(1 + \frac{0,08}{12} \right)} \frac{3}{2} = n$ $n = 61,02 \text{ months} \quad / \quad (\text{accept } 62)$ $n = 5,09 \text{ years} \quad / \quad (\text{accept } 5,17)$ NOTE: (5,08 is NOT accepted.)	✓ correct substitution ✓ simplification ✓ correct use of logs ✓ correct answer in years (4)
4.2.1	$P_v = \frac{x[1 - (1+i)^{-n}]}{i}$ $40\,000 = \frac{x[1 - (1 + \frac{0,24}{12})^{-240}]}{\frac{0,24}{12}}$ $x = R806,96$	✓ $n = 240$ ✓ $i = \frac{0,24}{12}$ ✓ correct sub. into correct formula ✓ correct answer (4)
4.2.2	$P_o = \frac{x[1 - (1+i)^{-n}]}{i}$ $P_o = \frac{806,96 \left[1 - \left(1 + \frac{0,24}{12} \right)^{-180} \right]}{\frac{0,24}{12}}$ $= R39205,67$ OR $P_o = P(1+i)^n - \frac{x[(1+i)^n - 1]}{i}$ $P_o = 40\,000 \left(1 + \frac{0,24}{12} \right)^{60} - \frac{806,96 \left[\left(1 + \frac{0,24}{12} \right)^{60} - 1 \right]}{\frac{0,24}{12}}$	✓ correct substitution into correct formula ✓ $n = 180$ ✓ $i = \frac{0,24}{12}$ ✓ answer OR ✓ correct substitution into correct formula ✓ $n = 60$ ✓ $i = \frac{0,24}{12}$ ✓ answer (4)

	= R39 206,20	
4.2.3	$P_v = \frac{x[1 - (1+i)^{-n}]}{i}$ $39205,67 = \frac{x[1 - (1 + \frac{0,18}{12})^{-180}]}{\frac{0,18}{12}}$ $x = R631,38$ NOTE: If the candidate uses R39 206,20 then the answer is R631,39.	✓ $n = 180$ ✓ $i = \frac{0,18}{12}$ ✓ correct substitution into correct formula ✓ correct answer (4)
		[16]

QUESTION 5

5.1	$f(x) = \frac{3}{x-1} - 2$ $0 = \frac{3}{x-1} - 2$ $2(x-1) = 3$ $2x - 2 = 3$ $2x = 5$ $x = \frac{5}{2}$ $\therefore \left(\frac{5}{2}; 0 \right)$ NOTE: Must be in coordinate form.	✓ equate to 0 ✓ answer (2)
5.2	$f(0) = \frac{3}{0-1} - 2$ $y = -5$ $\therefore (0; -5)$ NOTE: Not necessarily in coordinate form.	✓ answer (1)
5.3		✓ shape ✓ x- and y-intercepts ✓ correct asymptotes (3)

5.4	$f(x) = \frac{3}{x-1} - 2$ Point of intersection (1 ; -2) $y = -x + q$ $-2 = -(1) + q$ $q = -1$ $\therefore y = -x - 1$	✓ $m = -1$ ✓ substitute point (1;-2) ✓ answer (3)
		[9]

QUESTION 6

6.1	$f(x) = -2x^2 - 5x + 3$ $x = \frac{-(-5)}{2(-2)}$ $x = -\frac{5}{4}$ $f\left(-\frac{5}{4}\right) = -2\left(-\frac{5}{4}\right)^2 - 5\left(-\frac{5}{4}\right) + 3$ $f\left(-\frac{5}{4}\right) = \frac{49}{8}$ $\therefore TP\left(-\frac{5}{4}; \frac{49}{8}\right)$ OR $f'(x) = 0$ $-4x - 5 = 0$ $x = -\frac{5}{4}$ $f\left(-\frac{5}{4}\right) = -2\left(-\frac{5}{4}\right)^2 - 5\left(-\frac{5}{4}\right) + 3$ $f\left(-\frac{5}{4}\right) = \frac{49}{8}$ $\therefore TP\left(-\frac{5}{4}; \frac{49}{8}\right)$ OR $f(x) = -2x^2 - 5x + 3$ $f(x) = -2\left[x^2 + \frac{5}{2}x - \frac{3}{2}\right]$ $f(x) = -2\left[x^2 + \frac{5}{2}x + \left(\frac{5}{4}\right)^2 - \left(\frac{5}{4}\right)^2 - \frac{3}{2}\right]$ $f(x) = -2\left[\left(x + \frac{5}{4}\right)^2 - \frac{49}{16}\right]$ $f(x) = -2\left(x + \frac{5}{4}\right)^2 + \frac{49}{8}$ $\therefore TP\left(-\frac{5}{4}; \frac{49}{8}\right)$	✓ correct substitution into $x = \frac{-b}{2a}$ ✓ x-value ✓ y-value OR ✓ derivative ✓ equate to zero ✓ y-value OR ✓ determine $\frac{25}{16}$ or $\left(\frac{5}{4}\right)^2$ ✓ factorisation $\left(x + \frac{5}{4}\right)^2$ ✓ y-value (3)
-----	--	--

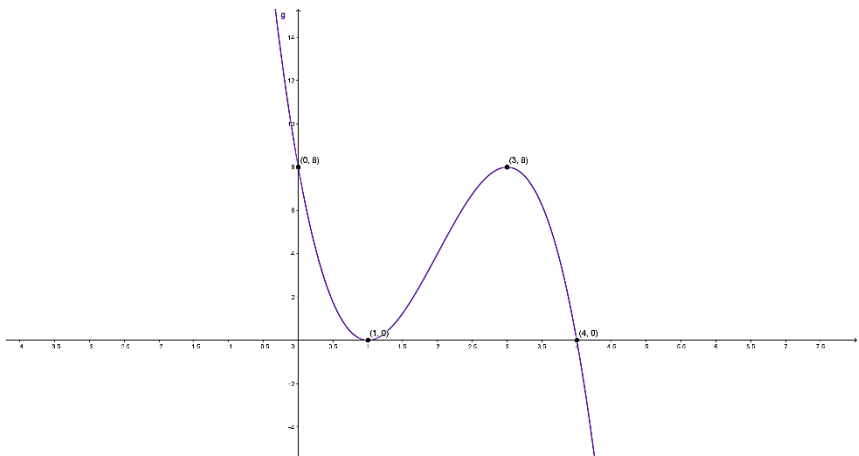
6.2	$y \in (-\infty; \frac{49}{8}]$ OR $y \leq \frac{49}{8}$	✓ answer (1)
6.3	$\tan 135^\circ = -1$ $m = -1$ $f'(x) = -1$ $-4x - 5 = -1$ $\therefore x = -1$ $f(-1) = -2(-1)^2 - 5(-1) + 3$ $y = 6$ $\therefore P(-1; 6)$	✓ $m = -1$ ✓ $f'(x) = -1$ ✓ $x = -1$ ✓ $y = 6$ (4)
6.4	$k < -\frac{49}{8}$ or $k > -\frac{49}{8}$	✓ answer ✓ answer (2)
		[10]

QUESTION 7		
7.1	$f(x) = a^x$ $\frac{1}{4} = a^2$ $\sqrt{\frac{1}{4}} = a$ $\frac{1}{2} = a$	✓ correct substitution ✓ square root (2)
7.2	$y = \left(\frac{1}{2}\right)^x$ $x = \left(\frac{1}{2}\right)^y$ $y = \log_{\frac{1}{2}} x$	✓ interchange x and y ✓ answer (2)
7.3	$y = \left(\frac{1}{2}\right)^x$ $-y = \left(\frac{1}{2}\right)^x$ $h(x) = -\left(\frac{1}{2}\right)^x$ OR $h(x) = -a^x$ OR $h(x) = -f(x)$	✓ answer (1)
7.4	$x \leq 0$ OR $x > 0$ OR $x < 0$ OR $x \geq 0$	✓✓ answer (2)
		[7]

QUESTION 8			
8.1	8.1.1	$x < 2$	✓✓ answer (2)
	8.1.2	$0 < x \leq 1$	✓ critical values ✓ answer in correct notation (2)
8.2	8.2.1	$g(x) = \log_2 x$ $y = \log_2 x$ $\therefore x = 2^y$ $\therefore y = 2^x$ $\therefore g^{-1}(x) = 2^x$	✓ interchange x and y ✓ answer (2)
	8.2.2	$\log_2(3-x) = x$ $2^x = 3-x$ therefore point of intersection of g^{-1} and f	✓ g^{-1} (inverse) ✓ point of intersection (2)
	8.2.3	$x = 1$	✓ answer (1)
			[9]

QUESTION 9		
9.1	9.1.1	$f(x) = 3x - x^2$ $f(x+h) = 3(x+h) - (x+h)^2$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{3(x+h) - (x+h)^2 - (3x - x^2)}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{3x + 3h - x^2 - 2xh + h^2 - 3x + x^2}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{3h - 2xh + h^2}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{h(3 - 2x + h)}{h}$ $f'(x) = 3 - 2x$ NOTE: Answer only $\left(\frac{0}{5}\right)$
	9.1.2	$f(1) = 2$ $f(3) = 0$ $\frac{f(3) - f(1)}{2}$ $= \frac{0 - 2}{2}$ $= -1$
9.2	9.2.1	$y = \frac{8 - 3x^6}{8x^5}$ $y = x^{-5} - \frac{3}{8}x$ $\frac{dy}{dx} = -5x^{-6} - \frac{3}{8}$

	9.2.2	$D_x \left[\sqrt[3]{x^2} + \frac{1}{x} + 2x \right]$ $D_x \left[x^{\frac{2}{3}} + x^{-1} + 2x \right]$ $D_x \left[\frac{2}{3} x^{-\frac{1}{3}} - x^{-2} + 2 \right]$	✓ simplification ✓ $\frac{2}{3} x^{-\frac{1}{3}}$ ✓ $-x^{-2}$ ✓ 2 (4)
			[15]

QUESTION 10		
10.1		✓ shape ✓ x and y-intercepts ✓ turning points (3)
10.2	$f(x) = a(x-1)^2(x-4)$ $8 = a(3-1)^2(3-4)$ $8 = a(-4)$ $a = -2$ $f(x) = -2(x-1)^2(x-4)$ $f(x) = -2(x^2 - 2x + 1)(x-4)$ $f(x) = -2x^3 + 12x^2 - 18x + 8$	✓ substitution ✓ $a = -2$ ✓ substitution ✓ simplification (4)
10.3	$f(x) = -2x^3 + 12x^2 - 18x + 8$ $f'(x) = -6x^2 + 24x - 18$ $f''(x) = -12x + 24$ $f''(x) < 0$ $-12x + 24 < 0$ $-x < -2$ $x > 2$	✓ second derivative ✓ $f''(x) < 0$ ✓ answer (3)
		[10]

QUESTION 11		
11.1	$P = \pi r + 4x + 2l$ $32 = \pi \cdot 2x + 4x + 2l$ $16 = \pi x + 2x + l$ $l = 16 - \pi x - 2x$	✓ correct formula ✓ correct substitution ✓ answer (3)
11.2	$A = 4x \cdot l + \frac{1}{2} \pi (2x)^2$ $A = 4x[16 - \pi x - 2x] + 2\pi x^2$ $= -8x^2 - 2\pi x^2 + 64x$	✓ correct formula ✓ correct substitution and simplification (2)
11.3	$A'(x) = 0$ $-16x - 4\pi x + 64 = 0$ $4x + \pi x - 16 = 0$ $x(4 + \pi) = 16$ $x = \frac{16}{4 + \pi}$ $x = 2, 24m$ OR $x = \frac{-64}{2(-8 - 2\pi)}$ $x = 2, 24$	✓ derivative ✓ derivative = 0 ✓ answer OR ✓✓ sub. a and b into A.o.S. formula ✓ answer (3)
		[8]

QUESTION 12			
12.1		$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$ $0,6 = 0,3 + 0,4 - P(A \text{ and } B)$ $P(A \text{ and } B) = 0,1$	✓ substitution ✓ answer (2)
12.2	12.2.1	$A = 32$ $B = 48$	✓ answer ✓ answer (2)
	12.2.2	$P(\text{iPhone}) = \frac{101}{166}$ $= 0,61$	✓✓ $\frac{101}{166}$ (2)
	12.2.3	$P(\text{iPhone/Gr 12}) = \frac{48}{101}$ $= 0,48$	✓✓ $\frac{48}{101}$ (2)
			[8]

QUESTION 13			
13.1	$9!$ $= 362\,880$ OR $9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1$ $= 362\,880$	✓✓ $9!$ OR ✓✓ $9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1$	(2)
13.2	$4! \times 3! \times 2! \times 3!$ $= 1\,728$	✓✓ $4! \times 3! \times 2! \times 3!$ ✓ answer	(3)
13.3	From left to right and from right to left Therefore 2 ways NOTE: If answer is 1 way, award 1 mark ONLY	✓✓ answer	(2)
			[7]

TOTAL: 150