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

1.1.3	$2^x - 5.2^{x+1} = -144$ $2^x(1-5.2) = -144$ $2^x(1-10) = -144$ $2^x(-9) = -144$ $2^x = 16$ **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** $y = 17 - 2(8)$ $y = 1$	✓ both y answers
	OR	**OR**
	$2x + y = 17$ ……..(1) $xy = 8$ ……..(2)	
	from (2) $xy = 8$ $y = \frac{8}{x}$ …….(3)	✓ solve for y in equ. 2
	substitute (3) into (1) $2x + \frac{8}{x} = 17$ $2x^2 - 17x + 8 = 0$ $(2x-1)(x-8) = 0$ $x = \frac{1}{2}$ or $x = 8$	✓ substitute for y in equation 1 ✓ standard form ✓ factors ✓ both x answers
	substitute into (2) $\frac{1}{2}y = 8$ **OR** $8y = 8$ $y = 16$ $y = 1$	✓ 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, $\Delta < 0$ $9 - 64m < 0$ $9 < 64m$ **OR** $-64m < -9$ $\frac{9}{64} < m$ $\quad$ $m > \frac{9}{64}$	✓ standard form ✓ correct substitution into correct formula ✓ $\Delta < 0$ ✓ answer (4)
		[24]

QUESTION 2

2.1	$-\frac{1}{2}$; 2 ; $\frac{11}{2}$; 10 $\frac{5}{2}$ $\frac{7}{2}$ $\frac{9}{2}$ 1 1 $2a = 1$ $\quad$ $3a + b = \frac{5}{2}$ $\quad$ $a + b + c = -\frac{1}{2}$ $a = \frac{1}{2}$ $\quad$ $3(\frac{1}{2}) + b = \frac{5}{2}$ $\quad$ $\frac{1}{2} + 1 + c = -\frac{1}{2}$ $b = 1$ $\quad$ $c = -2$ $T_n = \frac{1}{2}n^2 + n - 2$ $T_n = \frac{1}{2}(n^2 + 2n - 4)$	✓ $a = \frac{1}{2}$ ✓ $b = 1$ ✓ $c = -2$ ✓ $T_n = \frac{1}{2}n^2 + n - 2$ (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	$T_2=ar$ $6=kr$ $r=\frac{6}{k}$ ... (1) sub. (1) into (2) $25=\frac{k}{1-\frac{6}{k}}$ $k=25\left(1-\frac{6}{k}\right)$ $k=25-\frac{150}{k}$ $0=k^2-25k+150$ $0=(k-10)(k-15)$ $\therefore k=10$ **or** k = 15 $S_\infty=25$ $S_\infty=\frac{a}{1-r}$ $25=\frac{k}{1-r}$ ... (2)	✓ $r=\frac{6}{k}$ ✓ substitution (a,r,S_∞) ✓ standard form ✓ factors ✓ answers (5)
3.3	$(1\times2)+(5\times6)+(9\times10)+(13\times14)+...+(81\times82)$ $(4n-3)\times(4n-2)$ $=16n^2-20n+6$ $4n-3=81$ **OR** $4n-2=82$ $4n=84$ $4n=84$ $n=21$ $n=21$ $\sum_{n=1}^{21}16n^2-20n+6$ **OR** $\sum_{n=1}^{21}(4n-3)(4n-2)$	✓ $(4n-3)$ ✓ $(4n-2)$ ✓ $n=21$ ✓ answer (4)
		[12]

QUESTION 4		
4.1	$4500 = 3000\left(1+\frac{0,08}{12}\right)^n$ $\frac{3}{2} = \left(1+\frac{0,08}{12}\right)^n$ $\log_{\left(1+\frac{0,08}{12}\right)} \frac{3}{2} = n$ $n = 61,02$ months / (accept 62) $n = 5,09$ years / (accept 5,17) **NOTE: (5,08 is NOT accepted.)**	✓ correct substitution ✓ simplification ✓ correct use of logs ✓ correct answer in years (4)
4.2.1	$P_v = \frac{x[1-(1+i)^{-n}]}{i}$ $40\ 000 = \frac{x[1-(1+\frac{0,24}{12})^{-240}]}{\frac{0,24}{12}}$ $x = \text{R}806,96$	✓ $n = 240$ ✓ $i = \frac{0,24}{12}$ ✓ 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** $P_o = P(1+i)^n - \frac{x[(1+i)^n-1]}{i}$ $P_o = 40\,000(1+\frac{0,24}{12})^{60} - \frac{806,96\left[\left(1+\frac{0,24}{12}\right)^{60}-1\right]}{\frac{0,24}{12}}$	✓ 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	$P_v = \frac{x[1-(1+i)^{-n}]}{i}$ $39205,67 = \frac{x[1-(1+\frac{0,18}{12})^{-180}]}{\frac{0,18}{12}}$ $x = \text{R}631,38$ **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

$$f(0) = \frac{3}{0-1} - 2$$

$$y = -5$$

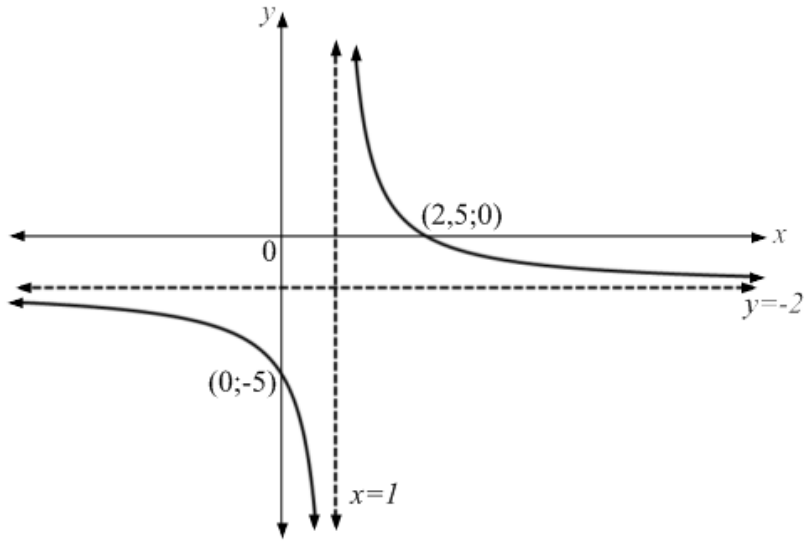
$$\therefore (0\ ;\ -5)$$

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

$f(x) = -2x^2 - 5x + 3$

$x = \frac{-(-5)}{2(-2)}$

$x = -\frac{5}{4}$

✓ correct substitution into $x = \frac{-b}{2a}$

✓ x-value

$f(\frac{-5}{4}) = -2(\frac{-5}{4})^2 - 5(\frac{-5}{4}) + 3$

$f(\frac{-5}{4}) = \frac{49}{8}$

$\therefore TP(\frac{-5}{4}; \frac{49}{8})$

✓ y-value

OR

OR

$f'(x) = 0$

$-4x - 5 = 0$

$x = \frac{-5}{4}$

✓ derivative

✓ equate to zero

$f(\frac{-5}{4}) = -2(\frac{-5}{4})^2 - 5(\frac{-5}{4}) + 3$

$f(\frac{-5}{4}) = \frac{49}{8}$

$\therefore TP(\frac{-5}{4}; \frac{49}{8})$

✓ y-value

OR

OR

$f(x) = -2x^2 - 5x + 3$

$f(x) = -2[x^2 + \frac{5}{2}x - \frac{3}{2}]$

$f(x) = -2[x^2 + \frac{5}{2}x + (\frac{5}{4})^2 - (\frac{5}{4})^2 - \frac{3}{2}]$

$f(x) = -2[(x + \frac{5}{4})^2 - \frac{49}{16}]$

$f(x) = -2(x + \frac{5}{4})^2 + \frac{49}{8}$

$\therefore \text{TP}(\frac{-5}{4}; \frac{49}{8})$

✓ determine $\frac{25}{16}$ or $\left(\frac{5}{4}\right)^2$

✓ factorisation $\left(x + \frac{5}{4}\right)^2$

✓ y-value

(3)

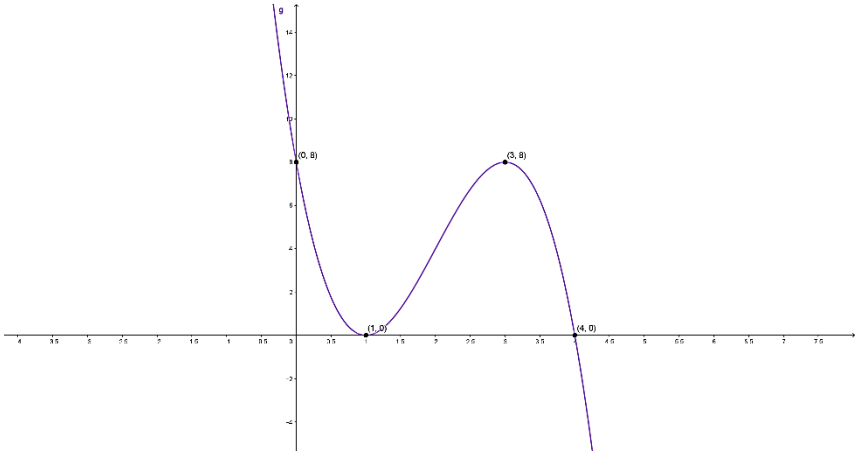
6.2	$y \in (-\infty; \frac{49}{8}]$ **OR** $y \leq \frac{49}{8}$	✓ answer (1)
6.3	$\tan 135^0 = -1$ $m = -1$ $f'(x) = -1$ $-4x - 5 = -1$ $\therefore x = -1$ $f(-1) = -2(-1)^2 - 5(-1) + 3$ $y = 6$ $\therefore P(-1\ ;\ 6)$	✓ $m = -1$ ✓ $f'(x) = -1$ ✓ $x = -1$ ✓ $y = 6$ (4)
6.4	$k < -\frac{49}{8}$ **or** $k > -\frac{49}{8}$	✓ 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	$f(x) = 3x - x^2$ $f(x+h) = 3(x+h) - (x+h)^2$ $f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$ $f'(x) = \lim_{h \to 0} \frac{3(x+h) - (x+h)^2 - (3x - x^2)}{h}$ $f'(x) = \lim_{h \to 0} \frac{3x + 3h - x^2 - 2xh + h^2 - 3x + x^2}{h}$ $f'(x) = \lim_{h \to 0} \frac{3h - 2xh + h^2}{h}$ $f'(x) = \lim_{h \to 0} \frac{h(3 - 2x + h)}{h}$ $f'(x) = 3 - 2x$ **NOTE: Answer only** $(\frac{0}{5})$	✓ $f(x + h)$ ✓correct substitution ✓simplification ✓common factor h ✓correct answer (5)
	9.1.2	$f(1) = 2$ $f(3) = 0$ $\frac{f(3) - f(1)}{2}$ $= \frac{0 - 2}{2}$ $= -1$	✓ $f(1)$ and $f(3)$ both correct ✓ substitution ✓ answer (3)
9.2	9.2.1	$y = \frac{8 - 3x^6}{8x^5}$ $y = x^{-5} - \frac{3}{8}x$ $\frac{dy}{dx} = -5x^{-6} - \frac{3}{8}$	✓ simplification ✓ $-5x^{-6}$ ✓ $-\frac{3}{8}$ (3)

	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	$P = \pi r + 4x + 2l$ $32 = \pi .2x + 4x + 2l$ $16 = \pi x + 2x + l$ $l = 16 - \pi x - 2x$	✓ correct formula ✓ correct substitution ✓ answer (3)
11.2	$A = 4x.l + \frac{1}{2}\pi (2x)^2$ $A = 4x\left[16 - \pi x - 2x\right] + 2\pi x^2$ $= -8x^2 - 2\pi x^2 + 64x$	✓ 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 or B) = P(A) + P(B) – P(A and B) 0,6 = 0,3 + 0,4 - P(A and B) P(A and B) = 0,1	✓ substitution ✓ answer (2)
12.2	12.2.1	*A* = 32 *B* = 48	✓ answer ✓ answer (2)
	12.2.2	P(iPhone) $= \frac{101}{166}$ $= 0,61$	✓✓ $\frac{101}{166}$ (2)
	12.2.3	P(iPhone/Gr 12) $= \frac{48}{101}$ $= 0,48$	✓✓ $\frac{48}{101}$ (2)
			[8]

QUESTION 13		
13.1	9! = 362 880 **OR** 9×8×7×6×5×4×3×2×1 = 362 880	✓✓ 9! **OR** ✓✓ $9\times8\times7\times6\times5\times4\times3\times2\times1$ (2)
13.2	4! × 3! × 2! × 3! = 1 728	✓✓ $4!\times3!\times2!\times3!$ ✓ 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