KWAZULU-NATAL PROVINCE

EDUCATION
REPUBLIC OF SOUTH AFRICA

**NATIONAL
SENIOR CERTIFICATE**

GRADE 12

MATHEMATICS PRACTICE PAPER 1

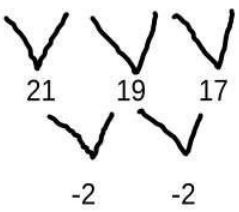**MARKING GUIDELINES**

QUESTION 1

No.	SOLUTION	MARK JUSTIFICATION	MARK
1.1.1	$(x-2)(5+x)=0$ $x = 2$ or $x = -5$	A ✓ $x = 2$ A ✓ $x = -5$	(2)
1.1.2	$3x^2 - 2x - 6 = 0$ $x = \dfrac{-(-2) \pm \sqrt{(-2)^2\, 4(3)(-6)}}{2(3)}$ $x = \dfrac{1 \pm \sqrt{19}}{3}$ $x = -1,12$ or $x = 1,79$	A ✓ substitution CA ✓ simplification CA ✓ $x = -1,12$ CA ✓ $x = 1,79$	(4)
1.1.3	$2\sqrt{x+6} + 2 = x$ $2\sqrt{x+6} = x - 2$ $4(x+6) = (x-2)^2$ $4x + 24 = x^2 - 4x + 4$ $x^2 - 8x - 20 = 0$ $(x-10)(x+2) = 0$ $x = 10$ or $x \neq -2$	A ✓ isolating the surd CA ✓ $4x + 24 = x^2 - 4x + 4$ CA ✓ $x = 10$ CA ✓ $x \neq -2$	(4)
1.1.4	$x^2 + 2x - 15 < 0$ $(x-3)(x+5) < 0$ $x = 3$ or $x = -5$ $-5 < x < 3$	A ✓ standard form CA ✓ critical values CA CA ✓✓ answer	(4)
1.1.5	$2^{x+2} - 3.2^{x-1} = 80$ $2^x\left(2^2 - 3.2^{-1}\right) = 80$ $2^x\left(\dfrac{5}{2}\right) = 80$ $2^x = 32$ $2^x = 2^5$ $x = 5$	A ✓ factorization CA ✓ simplifying bracket A ✓ $2^x = 32$ CA ✓ Exponential form CA ✓ answer	(5)

1.2	$3^{x+y} = 27.............(1)$		
	$x^2 + y^2 = 17.........(2)$		
	$3^{x+y} = 3^3$	A ✓ $3^{x+y} = 3^3$	
	$x + y = 3$	CA ✓ $x + y = 3$	
	$y = 3 - x.............(3)$		
	$sub.(3) into (2)$		
	$x^2 + (3 - x)^2 = 17$	CA ✓ substitution	
	$2x^2 - 6x - 8 = 0$		
	$x^2 - 3x - 4 = 0$	CA ✓ standard form	
	$(x - 4)(x + 1) = 0$	CA ✓ x values	
	$x = 4$ or $x = -1$	CA ✓ y values	
	$y = -1$ or $y = 4$		(6)
1.3	$2.5^n - 5^{n+1} + 5^{n+2} = 2.5^n - 5^n.5^1 + 5^n.5^2$	A ✓ exp. law	
	$\qquad = 5^n(2 - 5 + 25)$		
	$\qquad = 5^n(22)$	CA ✓ common factor	
	$\qquad = 2[5^n(11)]$	CA ✓ answer/explanation	
	OR		
	Any integer multiplied by an even number will be even.		(3)
1.4	$\dfrac{3^{y+1}}{32} = \sqrt{96^x}$		
	$\dfrac{3^{y+1}}{2^5} = (96)^{\frac{x}{2}}$	A ✓ $\dfrac{3^{y+1}}{2^5} = (96)^{\frac{x}{2}}$	
	$3^{y+1}.2^{-5} = 2^{\frac{5x}{2}}.3^{\frac{x}{2}}$	A ✓ $3^{y+1}.2^{-5} = 2^{\frac{5x}{2}}.3^{\frac{x}{2}}$	
	$-5 = \dfrac{5x}{2}$		
	$\therefore x = -2$	CA ✓ $x = -2$	
	$y + 1 = \dfrac{x}{2}$		
	$y + 1 = \dfrac{-2}{2}$	CA ✓ $y = -2$	
	$\therefore y = -2$		(4)

OR $$\frac{3^{y+1}}{32} = \sqrt{96^x}$$ $$\left(\frac{3^{y+1}}{2^5}\right)^2 = \left(\sqrt{96^x}\right)^2$$ $$\frac{3^{2y+2}}{2^{10}} = 2^{5x}.3^x$$ $$3^{2y+2}.2^{-10} = 2^{5x}.3^x$$ $$-10 = 5x$$ $$\therefore x = -2$$ $$2y + 2 = -2$$ $$\therefore y = -2$$	OR $$A\checkmark \left(\frac{3^{y+1}}{2^5}\right)^2 = \left(\sqrt{96^x}\right)^2$$ $$A\checkmark \; 3^{2y+2}.2^{-10} = 2^{5x}.3^x$$ $$CA\checkmark \; x = -2$$ $$CA\checkmark \; y = -2$$	(4)
		[32]

QUESTION 2

2.1.1	$-120 \quad -90 \quad -80 \quad -63$ The next TWO terms: -48 ; -35	$A\checkmark -48$ $A\checkmark -35$	(2)
2.1.2	$\qquad\qquad 3a + b = 21 \qquad\qquad a + b + c = -120$ $2a = -2$ $\qquad 3(-1) + b = 21 \qquad (-1) + (24) + c = -120$ $a = -1$ $\qquad\qquad\qquad b = 24 \qquad\qquad\qquad c = -143$ $T_n = -2n + 24n + 143$	$A\checkmark \; 2^{nd} \text{ diff} = -2$ $CA\checkmark \; a = -1$ $CA\checkmark \; b = 24$ $CA\checkmark \; c = -143$	(4)
2.1.3	$T'(n) = -2n + 24 = 0$ $n = 12$ $T_n = -(12)^2 + 24(12) - 143$ $T_n = 1$ A maximum of 1 Add -1 to T_n **OR**	$A\checkmark \text{method}$ $A\checkmark \; n = 12$ $CA\checkmark \text{maximum } 1$ $CA\checkmark -1$ $A\checkmark \text{method}$ $A\checkmark \; n = 12$	(4)

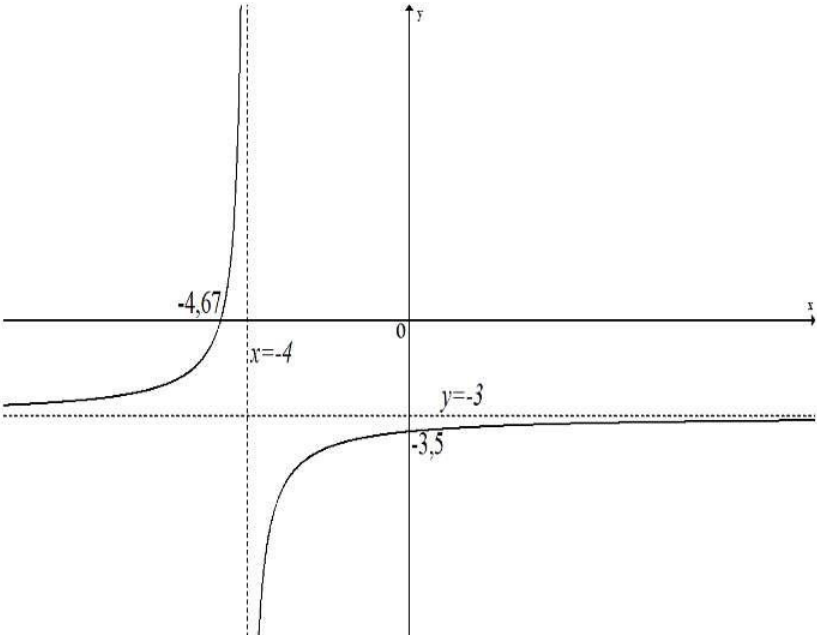|		
$n = \dfrac{-(24)}{2(-1)} = 12$ $T_n = -(12)^2 + 24(12) - 143$ $T_n = 1$ A maximum of 1 Add -1 to T_n **OR** $T_n = -n^2 + 23n - 143 + k$ $\Delta = (24)^2 - 4(-1)(k - 143)$ $\quad = 4k + 4$ but $\Delta = 0, \qquad 4k + 4 = 0$ $\qquad\qquad\qquad\qquad k = -1$	CA✓ maximum 1 CA✓ -1 A✓ method CA✓ $\Delta = 4k + 4$ CA✓ $\Delta = 0$ CA✓ -1	(4) (4)
		[10]

QUESTION 3

3.1.1	$9 + 14 + 19 + \ldots + 124$ $T_n = (9) + (n-1)(5)$ $T_n = 5n + 4$	A✓ substitution into the correct formula A✓ $T_n = 5n + 4$	(2)
3.1.2	$T_n = 5n + 4 = 124$ $5n = 120$ $n = 24$ $\displaystyle\sum_{n=1}^{24} (5n + 4)$	CA✓ $= 124$ CA✓ $n = 24$ CA✓ answer	(3)
3.2	$S_n = a + a + d + a + 2d + \ldots\ldots + a + (n-2)d + a + (n-1)d$ ....(1) $S_n = a + (n-1)d + a + (n-2)d + \ldots\ldots + a + 2d + a + d + a$ ....(2) (1) + (2) $2S_n = 2a + (n-1)d + 2a + (n-1)d + \ldots\ldots + 2a + (n-1)d$ $2S_n = n[2a + (n-1)d]$ $S_n = \dfrac{n}{2}[2a + (n-1)d]$	A✓ equation 1 A✓ equation 2 A✓ adding A✓ $2S_n = n[2a + (n-1)d]$	(4)

			[9]

QUESTION 4

4.1.1	$5;\ 10;\ 20;....$ $T_n = ar^{n-1}$ $T_n = (5)(2)^{n-1}$	A✓ answer	(1)
4.1.2	$S_n = \dfrac{a(r^n - 1)}{r - 1}$ $S_{18} = \dfrac{5\left[(2)^{18} - 1\right]}{2 - 1}$ $S_{18} = 1\ 310\ 715$	A✓ substitution into the correct formula A✓ answer	(2)
4.2	$r = \dfrac{(2x+4)(2x-4)}{2x-4}$ $r = 2x + 4$ converge : $-1 < r < 1$ $-1 < 2x + 4 < 1$ $-5 < 2x < -3$ $-\dfrac{5}{2} < x < -\dfrac{3}{2}$	A✓ $r = 2x + 4$ A✓ $-1 < r < 1$ A✓ substitution A✓ answer	(4)
4.3	$\dfrac{S_\infty}{S_2} = \dfrac{\dfrac{2}{1 - \dfrac{1}{\sqrt{2}}}}{\dfrac{2\left(1 - \left(\dfrac{1}{\sqrt{2}}\right)^2\right)}{1 - \dfrac{1}{\sqrt{2}}}}$ $= \dfrac{1}{1 - \dfrac{1}{2}}$ $= 2$	A✓ S_∞ A✓ S_2 A✓ answer	(3)
			[10]

QUESTION 5

5.1	$x+1=-x-7$		✓ $x+1=-x-7$	
	$2x=-8$		A	
	$x=-4$		✓ $x=-4$	
	$\therefore y=-3$		A	
	$\therefore f(x)=\dfrac{-2}{x+4}-3$		✓ $\therefore y=-3$ A	
	$\therefore p=4$ and $q=-3$			(3)
5.2	$f(x)=\dfrac{-2}{x+4}-3$		✓ $y=0$ A	
	$0=\dfrac{-2}{x+4}-3$			
	$-2-3(x+4)=0$		✓ $x=-\dfrac{14}{3}$	
	$-3x-14=0$		CA	
	$\therefore x=-\dfrac{14}{3}$			(2)
5.3			✓ Horizontal asymptote A ✓ Vertical asymptote A ✓ Y-intercept CA ✓ Shape A	(4)

5.4	$h(x) = \dfrac{-2}{(x+5+4)} - 3$ $h(x) = \dfrac{-2}{(x+9)} - 3$ $x = -9$	✓ $h(x) = \dfrac{-2}{(x+5+4)} - 3$ A ✓ $x = -9$ CA	(2)
5.5	$-\dfrac{14}{3} < x < -4$	✓ Correct inequality A ✓ Critical values CA	(2)
			[13]

QUESTION 6

6.1	$(0\,;\,3)$	✓ $(0\,;\,3)$ A	(1)
6.2	$x = -\dfrac{b}{2a}$ $x = -\dfrac{(-2)}{2(-1)}$ $x = -1$ $y = -(-1)^2 - 2(-1) + 3$ $y = 4$	✓ $x = -\dfrac{(-2)}{2(-1)}$ A ✓ Simplification A ✓ In the context of a turning point A	(3)
6.3	$B(1\,;\,0)$ by symmetry $A(-3\,;\,0)$	✓ $A(-3\,;\,0)$ A	(1)

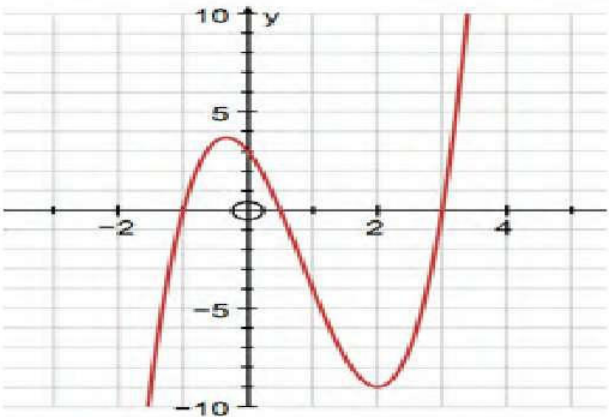| 6.4	$m = \dfrac{4-0}{-1+3}$ $= 2$ $y - 0 = 2(x+3)$ $y = 2x+6$ $E(0 \ ; \ 6)$ $C(-1 \ ; \ 4)$ $CE = \sqrt{(0+1)^2 + (6-4)^2}$ $= \sqrt{5}$ units	✓ $m = 2$ CA ✓ subs of $A(-3 \ ; \ 0)$ or $C(-1 \ ; \ 4)$ A ✓ $y = 2x+6$ CA ✓ $E(0 \ ; \ 6)$ CA ✓ Substitution into distance formula CA ✓ Answer CA	(6)
6.5	$f'(x) = -2x - 2$ but $m_{tan} = 2$ $2 = -2x - 2$ $x = -2$ $f(-2) = 3$ $y = 2x + k$ $3 = 2(-2) + k$ $k = 7$	✓ $-2x - 2$ A ✓ $2 = -2x - 2$ A ✓ $x = -2$ CA ✓ $y = 3$ CA ✓ Answer CA	(5)
6.6	$g(x) = 2x + 6$ $x = 2y + 6$ $2y = x - 6$ $y = \dfrac{x}{2} - 3$	✓ $x = 2y + 6$ A ✓ $y = \dfrac{x}{2} - 3$ A	(2)
6.7	$2x + 6 \geq \dfrac{x-6}{2}$ $4x + 12 \geq x - 6$ $x \geq -6$	✓ $2x + 6 \geq \dfrac{x-6}{2}$ CA ✓ $4x + 12 \geq x - 6$ CA ✓ $x \geq -6$ CA	(3)
			[21]

QUESTION 7

7.1	$-1 = \log_a \frac{1}{3}$ $a^{-1} = \frac{1}{3}$ $a = \left(\frac{1}{3}\right)^{-1}$ $\therefore a = 3$	✓ subt $\left(\frac{1}{3}; -1\right)$ A ✓ $a = \left(\frac{1}{3}\right)^{-1}$ A	(2)
7.2	$x = \log_3 y$ $y = 3^x$	✓ Swop x and y A ✓ Answer A	(2)
7.3	$g(x) = -\log_3 x$	✓ Answer A	(1)
7.4	$x > 0$	✓ Answer A	(1)
7.5	$\log_3 x = -3$ $x = 3^{-3}$ $x = \frac{1}{27}$ $x \geq \frac{1}{27}$	✓ exponential form A ✓ simplification A ✓ answer CA	(3)
			[09]

QUESTION 8

8.1	$f(x+h) = 3(x+h)^2 - 2$ $\qquad = 3(x^2 + 2xh + h^2) - 2$ $\qquad = 3x^2 + 6xh + 3h^2 - 2$	A✓ $f(x+h)$ CA✓ substitution in the correct formula CA✓ $\frac{6xh + 3h^2}{h}$ CA✓ $\frac{h(6x + 3h)}{h}$ CA✓ $6x$	

	$f'(x) = \lim\limits_{h \to 0} \dfrac{f(x+h) - f(x)}{h}$ $= \lim\limits_{h \to 0} \dfrac{3x^2 + 6xh + 3h^2 - 2 - (3x^2 - 2)}{h}$ $= \lim\limits_{h \to 0} \dfrac{6xh + 3h^2}{h}$ $= \lim\limits_{h \to 0} \dfrac{h(6x + 3h)}{h}$ $= \lim\limits_{h \to 0} 6x + 3h$ $= 6x$		(5)
8.2.1	$\dfrac{dy}{dx} = 18x^2 - 10x + 13$	A✓ $18x^2$ A✓ $-10x$ A✓ 13	(3)
8.2.2	$D_x\left[8x^2 + 2x^{-3}\right]$ $= 16x - 6x^{-4}$	A✓ $2x^{-3}$ CA✓ $-6x^{-4}$ A✓ $16x$	(3)
8.2.3	$m = 6x^2 - 4x + 4$ when $x = 2$ $\quad m = 6(2)^2 - 4(2) + 4$ $\quad\quad = 20$ $f(2) = 15$ $\quad y = mx + c$ $\quad 15 = 20(2) + c$ $\quad\quad c = -25$ $\therefore y = 20x - 25$	A✓ $m = 6x^2 - 4x + 4$ A✓ $f(2) = 15$ CA✓ $15 = 20(2) + c$ CA✓ $y = 20x - 25$	(4)
			[15]

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QUESTION 9

9.1.1	$2x^3 - 5x^2 - 4x + 3 = 0$ $(x-3)(x+1)(2x-1) = 0$ $x = 3$ or $x = \dfrac{1}{2}$ or $x = -1$ $(3;0), \left(\dfrac{1}{2};0\right)$ and $(-1;0)$	A✓factors A✓equating to 0 CA✓ x values CA✓coordinates	(4)
9.1.2	$(0;3)$	A✓$(0;3)$	(1)
9.1.3	$f'(x) = 6x^2 - 10x - 4$ $f'(x) = 0$ $6x^2 - 10x - 4 = 0$ $(x-2)(3x+1) = 0$ $x = 2$ or $x = -\dfrac{1}{3}$ $f(2) = -9$ $f\left(-\dfrac{1}{3}\right) = \dfrac{100}{27}$ $\therefore$ TP are $(2;-9)$ and $\left(-\dfrac{1}{3};\dfrac{100}{27}\right)$	A✓ $f'(x) = 6x^2 - 10x - 4$ CA✓factors and equation to 0 CA✓ x values CA✓y values	(4)
9.1.4		A✓shape CA✓intercepts CA✓turning points	(3)
9.2.1	concave up	A✓ $f''(x) > 0$ CA✓ $12x - 10 > 0$	

	$f''(x) > 0$ $12x - 10 > 0$ $x > \dfrac{5}{6}$	CA✓ $x > \dfrac{5}{6}$	(3)
9.2.2	$x < -\dfrac{1}{3}$ or $x > 2$	CACA✓✓ $x < -\dfrac{1}{3}$ CA✓ $x > 2$	(3)

QUESTION 10

10.1	$h(x) = a(x-1)(x-3)(x-5)$ $a = 1$ $h(x) = (x-1)(x^2 - 8x + 15)$ \ $\quad = x^3 - 8x^2 + 15x - x^2 + 8x - 15$ $\quad = x^3 - 9x^2 + 23x - 15$ $b = 9 \quad c = 23 \quad d = 15$	A✓ $a(x-1)(x-3)(x-5)$ A✓ $x^3 - 9x^2 + 23x - 15$ CA✓ $b = 9$ CA✓ $c = 23$ CA✓ $d = 15$	(5)
10.2	$1 \le x \le 3$ or $x \ge 5$	CACA✓✓ $1 \le x \le 3$ CA✓ $x \ge 5$	(3)
			[8]

QUESTION 11

11.1	$V = \pi r^2 h$ $225 = \pi r^2 h$ $h = \dfrac{225}{\pi r^2}$	A✓ $225 = \pi r^2 h$ A✓ $h = \dfrac{225}{\pi r^2}$	(2)
11.2	$SA = 2\pi r^2 + 2\pi rh$ $\quad = 2\pi r^2 + 2\pi r\left(\dfrac{225}{\pi r^2}\right)$ $\quad = 2\pi r^2 + \dfrac{450}{r}$	A✓ $SA = 2\pi r^2 + 2\pi rh$ A✓ $2\pi r^2 + 2\pi r\left(\dfrac{225}{\pi r^2}\right)$	(2)

| 11.3 | $SA = 2\pi r^2 + 450r^{-1}$

 $SA'(x) = 4\pi r - \dfrac{450}{r^2} = 0$

 $4\pi r = \dfrac{450}{r^2}$

 $r^3 = \dfrac{450}{4\pi}$

 $r = \sqrt[3]{\dfrac{450}{4\pi}}$

 $r = 3,30$ | A✓ $SA'(x) = 4\pi r - \dfrac{450}{r^2}$

 A✓ equating to 0

 A✓ $r = 3,30$ | (3) |
| | | | **[7]** |