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	$3x^2-2x-6=0$ $x=\frac{-(-2)\pm\sqrt{(-2)^2\,4(3)(-6)}}{2(3)}$ $x=\frac{1\pm\sqrt{19}}{3}$ $x=-1{,}12$ 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	$2^{x+2}-3.2^{x-1}=80$ $2^x\left(2^2-3.2^{-1}\right)=80$ $2^x\left(\frac{5}{2}\right)=80$ $2^x=32$ $2^x=2^5$ $x=5$	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) $3^{x+y}=3^3$ $x+y=3$ $y=3-x$.....(3) sub.(3) into (2) $x^2+(3-x)^2=17$ $2x^2-6x-8=0$ $x^2-3x-4=0$ $(x-4)(x+1)=0$ $x=4$ or $x=-1$ $y=-1$ or $y=4$	A ✓ $3^{x+y}=3^3$ CA ✓ $x+y=3$ CA ✓ substitution CA ✓ standard form CA ✓ x values CA ✓ y values	(6)
1.3	$2.5^n-5^{n+1}+5^{n+2}=2.5^n-5^n.5^1+5^n.5^2$ $=5^n(2-5+25)$ $=5^n(22)$ $=2\left[5^n(11)\right]$ OR Any integer multiplied by an even number will be even.	A ✓ exp. law CA ✓ common factor CA ✓ answer/explanation	(3)
1.4	$\frac{3^{y+1}}{32}=\sqrt{96^x}$ $\frac{3^{y+1}}{2^5}=(96)^{\frac{x}{2}}$ $3^{y+1}.2^{-5}=2^{\frac{5x}{2}}.3^{\frac{x}{2}}$ $-5=\frac{5x}{2}$ $\therefore x=-2$ $y+1=\frac{x}{2}$ $y+1=\frac{-2}{2}$ $\therefore y=-2$	A ✓ $\frac{3^{y+1}}{2^5}=(96)^{\frac{x}{2}}$ A ✓ $3^{y+1}.2^{-5}=2^{\frac{5x}{2}}.3^{\frac{x}{2}}$ CA ✓ $x=-2$ CA ✓ $y=-2$	(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 ✓ $\left(\frac{3^{y+1}}{2^5}\right)^2 = \left(\sqrt{96^x}\right)^2$ A ✓ $3^{2y+2}.2^{-10} = 2^{5x}.3^x$ CA ✓ $x = -2$ CA ✓ $y = -2$	(4)
			[32]

QUESTION 2

2.1.1	$-120 \quad -90 \quad -80 \quad -63$ 21 19 17 -2 -2 The next TWO terms: -48 ; -35	A✓ -48 A✓ -35	(2)
2.1.2	$2a = -2$ $a = -1$ $3a + b = 21$ $3(-1) + b = 21$ $b = 24$ $a + b + c = -120$ $(-1) + (24) + c = -120$ $c = -143$ $T_n = -2n + 24n + 143$	A✓ 2nd diff $= -2$ CA✓ $a = -1$ CA✓ $b = 24$ CA✓ $c = -143$	(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✓method A✓ $n = 12$ CA✓maximum 1 CA✓ -1 A✓method A✓ $n = 12$	(4)

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

QUESTION 3

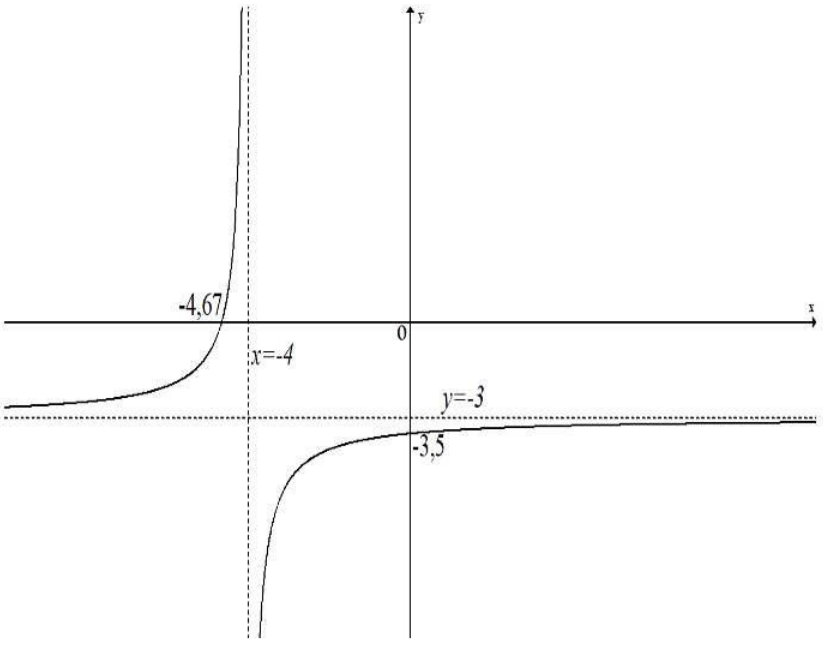
3.1.1	$9+14+19+....+124$ $T_n=(9)+(n-1)(5)$ $T_n=5n+4$	A✓substitution into the correct formula A✓ $T_n=5n+4$	(2)
3.1.2	$T_n=5n+4=124$ $5n=120$ $n=24$ $\sum_{n=1}^{24}(5n+4)$	CA✓ $=124$ CA✓ $n=24$ CA✓answer	(3)
3.2	$S_n=a+a+d+a+2d+.....+a+(n-2)d+a+(n-1)d$ ....(1) $S_n=a+(n-1)d+a+(n-2)d+.....+a+2d+a+d+a$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

			[9]

QUESTION 4

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

QUESTION 5

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

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

QUESTION 6

6.1	$(0\ ;3)$	✓ $(0\ ;3)$ A	(1)
6.2	$x=-\frac{b}{2a}$ $x=-\frac{(-2)}{2(-1)}$ $x=-1$ $y=-(-1)^2-2(-1)+3$ $y=4$	✓ $x=-\frac{(-2)}{2(-1)}$ 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	$m = \frac{4-0}{-1+3}$ $= 2$ $y-0 = 2(x+3)$ $y = 2x+6$ $E(0\ ;\ 6)$ $C(-1\ ;\ 4)$ $CE = \sqrt{(0+1)^2+(6-4)^2}$ $= \sqrt{5}$ 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	$g(x) = 2x+6$ $x = 2y+6$ $2y = x-6$ $y = \frac{x}{2}-3$	✓ $x = 2y+6$ A ✓ $y = \frac{x}{2}-3$ A	(2)
6.7	$2x+6 \geq \frac{x-6}{2}$ $4x+12 \geq x-6$ $x \geq -6$	✓ $2x+6 \geq \frac{x-6}{2}$ CA ✓ $4x+12 \geq x-6$ CA ✓ $x \geq -6$ CA	(3)
			[21]

QUESTION 7

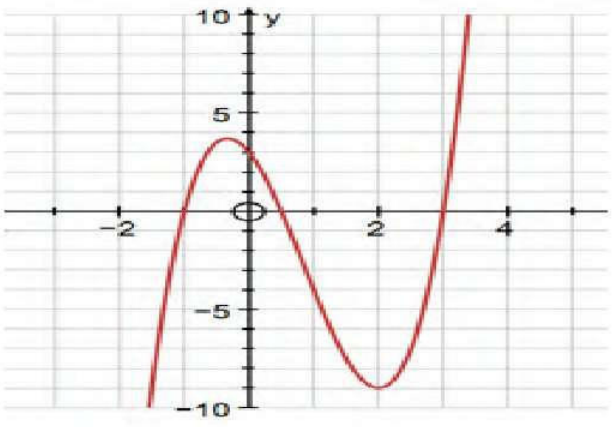
7.1	$-1=\log_a \frac{1}{3}$ $a^{-1}=\frac{1}{3}$ $a=\left(\frac{1}{3}\right)^{-1}$ $\therefore a=3$	✓ subt $\left(\frac{1}{3};-1\right)$ A ✓ $a=\left(\frac{1}{3}\right)^{-1}$ A	(2)
7.2	$x=\log_3 y$ $y=3^x$	✓ Swop x and y A ✓ Answer A	(2)
7.3	$g(x)=-\log_3 x$	✓ Answer A	(1)
7.4	$x>0$	✓ Answer A	(1)
7.5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

QUESTION 8

8.1	$f(x+h)=3(x+h)^2-2$ $=3(x^2+2xh+h^2)-2$ $=3x^2+6xh+3h^2-2$	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 $x\ =2$ $m=6(2)^2-4(2)+4$ $=20$ $f(2)=15$ $y=mx+c$ $15=20(2)+c$ $c=-25$ $\therefore y=20x-25$	A✓ $m=6x^2-4x+4$ A✓ $f(2)=15$ CA✓ $15=20(2)+c$ CA✓ $y=20x-25$	(4)
			[15]

QUESTION 9

9.1.1	$2x^3-5x^2-4x+3=0$ $(x-3)(x+1)(2x-1)=0$ $x=3$ or $x=\frac{1}{2}$ or $x=-1$ $(3;0),\left(\frac{1}{2};0\right)$ 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 $x=-\frac{1}{3}$ $f(2)=-9$ $f\left(-\frac{1}{3}\right)=\frac{100}{27}$ $\therefore$ TP are $(2;-9)$ and $\left(-\frac{1}{3};\frac{100}{27}\right)$	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✓ $12x-10>0$	

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

QUESTION 10

10.1	$h(x) = a(x-1)(x-3)(x-5)$ $a = 1$ $h(x) = (x-1)(x^2 - 8x + 15)$ \ $= x^3 - 8x^2 + 15x - x^2 + 8x - 15$ $= x^3 - 9x^2 + 23x - 15$ $b = 9 \quad c = 23 \quad d = 15$	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	$V = \pi r^2 h$ $225 = \pi r^2 h$ $h = \frac{225}{\pi r^2}$	A✓ $225 = \pi r^2 h$ A✓ $h = \frac{225}{\pi r^2}$	(2)
11.2	$SA = 2\pi r^2 + 2\pi rh$ $= 2\pi r^2 + 2\pi r\left(\frac{225}{\pi r^2}\right)$ $= 2\pi r^2 + \frac{450}{r}$	A✓ $SA = 2\pi r^2 + 2\pi rh$ A✓ $2\pi r^2 + 2\pi r\left(\frac{225}{\pi r^2}\right)$	(2)

11.3	$SA = 2\pi r^2 + 450r^{-1}$ $SA'(x) = 4\pi r - \frac{450}{r^2} = 0$ $4\pi r = \frac{450}{r^2}$ $r^3 = \frac{450}{4\pi}$ $r = \sqrt[3]{\frac{450}{4\pi}}$ $r = 3,30$	A✓ $SA'(x) = 4\pi r - \frac{450}{r^2}$ A✓equating to 0 A✓ $r = 3,30$	(3)
			[7]