KWAZULU-NATAL PROVINCE

EDUCATION
REPUBLIC OF SOUTH AFRICA

MATHEMATICS P1

JUNE 2025

MARKING GUIDELINES

NATIONAL SENIOR CERTIFICATE

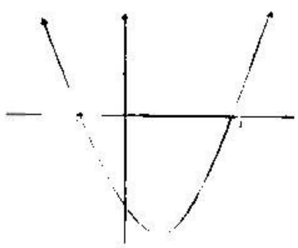
GRADE 12

MARKS: 150

These marking guidelines consist of 15 pages.

GRADE 12
Marking Guidelines

QUESTION 1

1.1.1	$x=-3$ or $x=\dfrac{2}{5}$	✓A answer ✓A answer (2)
1.1.2	$7x^2+5x-8=0$ $x=\dfrac{-b\pm\sqrt{b^2-4ac}}{2a}$ $x=\dfrac{-(5)\pm\sqrt{(5)^2-4(7)(-8)}}{2(7)}$ $x=-1,48$ or $x=0,77$ Penalise for incorrect rounding only in this sub-question.	✓A substitution into formula ✓CA answer ✓CA answer (3)
1.1.3	$\dfrac{7}{x^2-2x-8}>0$ $\therefore x^2-2x-8>0$ $(x-4)(x+2)>0$  **OR**  $x<-2$ or $x>4$	✓A $x^2-2x-8>0$ ✓A critical values ✓✓CA answer (4)
1.1.4	$3^{x+2}=42-5.3^x$ $3^x.3^2+5.3^x=42$ $3^x(9+5)=42$ $3^x=3^1$ $x=1$	✓A splitting exponents ✓CA factorising ✓CA answer (3)
1.1.5	$-\sqrt{5x-1}=5-x$ $\left(-\sqrt{5x-1}\right)^2=(5-x)^2$ $5x-1=25-10x+x^2$ $x^2-15x+26=0$ $(x-2)(x-13)=0$ $x\neq 2$ or $x=13$	✓A isolating the surd ✓CA squaring both sides ✓CA standard form ✓CA rejecting $x=2$ ✓CA answer $x=13$ (5)

1.2	$x=3+y$ $(3+y)^2-y(3+y)=2y^2+7$ $9+6y+y^2-3y-y^2-2y^2-7=0$ $2y^2-3y-2=0$ $(2y+1)(y-2)=0$ $y=-\frac{1}{2}$ or $y=2$ $x=3+\left(-\frac{1}{2}\right)$ or $x=3+2$ $x=\frac{5}{2}$ or $x=5$	✓A making x the subject of the formula ✓CA substitution ✓CA standard form ✓CA factors ✓CA y-values ✓CA x-values (6)
	OR	**OR**
	$y=x-3$ $x^2-x(x-3)=2(x-3)^2+7$ $x^2-x^2+3x-2x^2+12x-18-7=0$ $2x^2-15x+25=0$ $(2x-5)(x-5)=0$ $x=\frac{5}{2}$ or $x=5$ $y=\frac{5}{2}-3$ or $y=5-3$ $y=-\frac{1}{2}$ or $y=2$	✓A making y the subject of the formula ✓CA substitution ✓CA standard form ✓CA factors ✓CA x-values ✓CA y-values (6)
1.3	$2x^2+px-p^2=0$ $\Delta=b^2-4ac$ $=(p)^2-4(2)(-p^2)$ $=p^2+8p^2$ $=9p^2$ $=(3p)^2$ $\therefore$ The roots are rational	✓A substitution into b^2-4ac ✓CA $9p^2$ ✓CA $(3p)^2$ [showing that Δ is a perfect square] (3)
	OR	**OR**

	$2x^2+px-p^2=0$ $x=\dfrac{-b\pm\sqrt{b^2-4ac}}{2a}$ $=\dfrac{-(p)\pm\sqrt{(p)^2-4(2)(-p^2)}}{2(2)}$ $=\dfrac{-p\pm\sqrt{9p^2}}{4}$ $=\dfrac{-p\pm 3p}{4}$ $=\dfrac{p}{2}$ or $-p$ $\therefore$ The roots are rational	✓A substitution into quadratic formula ✓CA $\dfrac{-p\pm\sqrt{9p^2}}{4}$ ✓CA $\dfrac{-p\pm 3p}{4}$ (3)
		[26]

QUESTION 2

2.1.1	$T_5=-14$	✓A answer (1)
2.1.2	$T_n=a+(n-1)d$ $6+(n-1)(-5)=-239$ $6-5n+5=-239$ $5n=250$ $n=50$ $S_n=\dfrac{n}{2}[a+l]$ OR $S_n=\dfrac{n}{2}[2a+(n-1)d]$ $S_{50}=\dfrac{50}{2}[6+(-239)]$ $=-5825$ OR $S_{50}=\dfrac{50}{2}[2(6)+(50-1)(-5)]$ $S_{50}=25[-233]$ $=-5825$	✓A substitution in T_n ✓CA equating T_n to -239 ✓CA value of n ✓CA substitution in S_n ✓CA answer (5)
2.2.1	$-9 \quad -5 \quad x \quad 15$ $4 \quad x+5 \quad 15-x$ $x+5-4=15-x-(x+5)$ $3x=9$ $x=3$	✓A 1st differences: 4; $x+5$; $15-x$ ✓CA $x+5-4=15-x-(x+5)$ ✓CA answer (3)

2.2.2	1st differences: 4; 8; 12 2nd difference $=4=2a$ $\therefore a=2$ $3a+b=4$ $3(2)+b=4$ $b=-2$ $a+b+c=-9$ $2-2+c=-9$ $c=-9$ $T_n=2n^2-2n-9$	✓A $a=2$ ✓CA $b=-2$ ✓CA $c=-9$ ✓ CA $T_n=2n^2-2n-9$ (4)
2.2.3	$T_n=2n^2-2n-9=2(n^2-n-4)-1$ $2(n^2-n-4)$ is **even** An even number minus 1 is an odd number **OR** $T_n=2n^2-2n-9=2(n^2-n)-9$ $2(n^2-n)$ is even; 9 is odd. An even number minus an odd number is an odd number	✓CA $T_n=2(n^2-n-4)-1$ ✓CA conclusion (2) **OR** ✓CA $T_n=2(n^2-n)-9$ ✓CA conclusion (2)
		[15]

QUESTION 3

3.1.1	$4+4.p^{-1}+4.p^{-2}+\ldots=6$ $4+\frac{4}{p}+\frac{4}{p^2}+\ldots=6$ $\therefore r=\frac{1}{p}$ $S_\infty=\frac{a}{1-r}$ $\therefore \frac{4}{1-\frac{1}{p}}=6$ $4=6\left(1-\frac{1}{p}\right)$ $4=6-\frac{6}{p}$ $\frac{6}{p}=2$ $p=3$	✓A $r=\frac{1}{p}$ ✓CA substitution in S_∞ ✓CA simplification ✓CA answer (4)

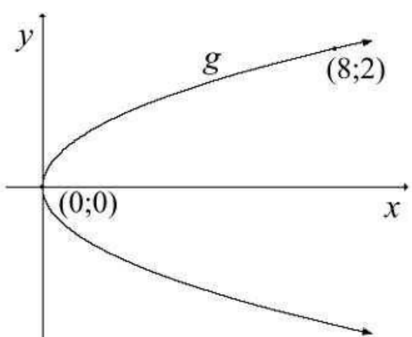
3.1.2	$4;\ 4.3^{-1};\ 4.3^{-2}$ **OR** $4;\ \frac{4}{3};\ \frac{4}{3^2}$ **OR** $4;\ \frac{4}{3};\ \frac{4}{9}$	✓CA answer (1)
3.2.1	$5^4 = 625$ Answer only: Full marks.	✓A 5^4 ✓A 625 (2)
3.2.2	$5^1 + 5^2 + 5^3 + ... + 5^{11}$ $S_n = \frac{a(r^n - 1)}{r-1}$ $S_{11} = \frac{5(5^{11}-1)}{5-1}$ $= 61\ 035\ 155$	✓A $r = 5$ ✓A substituting $n = 11$ into S_n formula ✓CA answer (3)
		[10]

QUESTION 4

4.1	$\text{A}(-4;3)$	✓A answer (1)
4.2	For x-intercept, let $y = 0$: $0 = \frac{-9}{x+4} + 3$ $-3 = \frac{-9}{x+4}$ $x + 4 = 3$ $x = -1$ $\text{B}(-1\ ;\ 0)$	✓A substitute $y = 0$ ✓A answer (2)
4.3	For y-intercept, let $x = 0$: $y = \frac{-9}{0+4} + 3$ $y = \frac{3}{4}$ $\text{C}\left(0\ ;\ \frac{3}{4}\right)$	✓A substitute $x = 0$ ✓A answer (2)
4.4	Translate h 4 units to the right, and 3 units down.	✓A 4 units to the right ✓A 3 units down (2)

4.5	The points of intersection between j and the axis of symmetry of j, i.e. between $y=\frac{-9}{x}$ and $y=-x$: $\frac{-9}{x}=-x$ $x^2=9$ $x=3$ or $x=-3$ $y=-3$ or $y=3$ The points are $(3\,;-3)$ and $(-3\,;3)$ OR Distance between origin and any point on the graph $=\sqrt{(0-x)^2+\left(0-\left(\frac{9}{x}\right)\right)^2}$ $=\sqrt{x^2+\frac{81}{x^2}}$ For a minimum distance, $\frac{d}{dx}\left(x^2+\frac{81}{x^2}\right)=0$ $2x-162x^{-3}=0$ $2x^4=162$ $x^4=81$ $x=3$ or $x=-3$ Therefore, the points on j closest to the origin are: $(3\,;-3)$ and $(-3\,;3)$.	✓A points of intersection ✓A $\frac{-9}{x}=-x$ ✓A $(3\,;-3)$ ✓A $(-3\,;3)$ (4) OR ✓A $\sqrt{(0-x)^2+\left(0-\left(\frac{9}{x}\right)\right)^2}$ ✓A $\frac{d}{dx}\left(x^2+\frac{81}{x^2}\right)=0$ ✓A $(3\,;-3)$ ✓A $(-3\,;3)$ (4)
		[11]

QUESTION 5

5.1	Substitute $\left(-\frac{1}{2}\ ;\ \frac{1}{2}\right)$ in $f(x)=a^x$: $a^{-\frac{1}{2}}=\left(\frac{1}{2}\right)$ $\frac{1}{\sqrt{a}}=\frac{1}{2}$ $\therefore \sqrt{a}=2$ $a=4$ Substitute $\left(-\frac{1}{2}\ ;\ \frac{1}{2}\right)$ in $g(x)=bx^2$: $\frac{1}{2}=b\left(-\frac{1}{2}\right)^2$ $\frac{1}{2}=\frac{1}{4}b$ $\therefore b=2$	✓A substitution ✓A value of a ✓A substitution ✓A value of b (4)
5.2	 	✓A shape ✓A coordinates of any point on the graph, e.g. $(0;0)$, $(8;2)$, $(2;1)$, $(8;-2)$, $(2;-1)$. (2)
5.3	No	✓A answer (1)
5.4	$f(x)=4^x$ or $y=4^x$ Inverse: $x=4^y$ $y=\log_4 x$ domain of inverse = range of function Therefore: $y=\log_4 x,\ x\in\left[\frac{1}{4};16\right]$	✓CA $x=4^y$ (swopping x and y) ✓CA $y=\log_4 x$ ✓CA ✓CA $x\in\left[\frac{1}{4};16\right]$ (4)
5.5	$-\frac{1}{2}<x<0$	✓A ✓A answer (2)
		[13]

QUESTION 6

6.1	$x^2+5x-6=0$ $(x+6)(x-1)=0$ $x=-6$ or $x=1$ $A(-6;0)$; $B(1;0)$ If A and B are not mentioned, max. 2/3	✓A factors ✓CA answer ✓CA answer (3)
6.2	$C(0;-6)$ $m=\frac{-6-0}{0+6}$ $=-1$ $y=-x-6$	✓A $C(0;-6)$ ✓CA $m=-1$ ✓CA answer (3)
6.3	The x-values of the points of intersection are the roots of: $g(x)=f(x)+k$ $-x-6=x^2+5x-6+k$ $x^2+6x+k=0$ If there are no points of intersection, the equation will have no real roots, i.e.: $b^2-4ac<0$ $6^2-4(1)(k)<0$ $-4k<-36$ $\therefore k>9$ **OR** f is translated upwards until there are no points of intersection between f and h. Just before they do not intersect any more, h will be a tangent to f. Calculating the value of k when h will be a tangent to f: $m_g=h'(x)$ $\therefore -1=2x+5$ $x=-3$ $g(-3)=-(-3)-6=-3$ $\therefore$ The contact point will be: $(-3;-3)$. $f(-3)=(-3)^2+5(-3)-6=-12$ From -12 to -3 indicates an upward translation of 9 units. $\therefore$ For g and h not to intersect, it means that f has to be translated upwards by **more than 9 units**. $\therefore k>9$	✓CA $-x-6=x^2+5x-6+k$ ✓CA standard form ✓A $b^2-4ac<0$ ✓CA substitution ✓CA answer (5) **OR** ✓CA $-1=2x+5$ ✓CA $x=-3$ ✓CA calculating $g(-3)$ ✓CA calculating $f(-3)$ ✓CA answer (5)
		[11]

QUESTION 7

7.1.1	Bank B. Because interest is compounded more frequently, she will get more interest from Bank B. If the candidate calculated amounts of money from the two banks, and then conclude correctly **OR** If the candidate calculates effective interest rates and then conclude correctly AWARD THE MARKS	✓A Bank B ✓A more interest (2)
7.1.2	$1+i_e=\left(1+\frac{i_N}{m}\right)^m$ $i_e=\left(1+\frac{0,085}{12}\right)^{12}-1$ $i_e=8,84\%$ p.a.	✓A formula ✓A substitution ✓CA answer (3)
7.2	$\mathrm{A}=\mathrm{P}(1-i)^n$ $230\ 476{,}05=\mathrm{P}(1-0{,}13)^3$ $\mathrm{P}=\frac{230\ 476{,}05}{(1-0{,}13)^3}$ $\mathrm{P}=\mathrm{R}\ 350\ 000$	✓A substitution ✓CA answer (2)
7.3	$8\ 944{,}97=x\left(1+\frac{0,087}{4}\right)^{14}\left(1+\frac{0,092}{12}\right)^{30}-1\ 750\left(1+\frac{0,092}{12}\right)^{24}$ $x\left(1+\frac{0,087}{4}\right)^{14}\left(1+\frac{0,092}{12}\right)^{30}=8\ 944{,}97+1\ 750\left(1+\frac{0,092}{12}\right)^{24}$ $x=\mathrm{R}6\ 500$ **OR**	✓A $x\left(1+\frac{0,087}{4}\right)^{14}$ ✓A $\times\left(1+\frac{0,092}{12}\right)^{30}$ ✓A $-1\ 750\left(1+\frac{0,12}{12}\right)^{24}$ ✓CA equated to R8944,97 ✓CA answer (5) **OR**

	Amount after 3½ years $= x\left(1+\frac{0,087}{4}\right)^{14} = 1,351528006x$	✓A $x\left(1+\frac{0,087}{4}\right)^{14}$
	Six months interest added: $1,351528006x\left(1+\frac{0,092}{12}\right)^{6}$	✓A $\times\left(1+\frac{0,092}{12}\right)^{6}$
	Withdrawal of R1750: $1,414902142x-1750$	
	Two more years' interest added: $(1,414902142x-1750)\left(1+\frac{0,092}{12}\right)^{24}$	✓A $-1\ 750\left(1+\frac{0,12}{12}\right)^{24}$
	$(1,414902142x-1750)(1,201172602)=8944,97$	✓CA equated to R8944,97
	$1,699541693x-2102,05=8944,97$	
	$x=$ R6 500	✓CA answer (5)
		[12]

QUESTION 8

Penalise once only for incorrect notation in this question.

8.1.1	$f'(x)=\lim_{h\to0}\frac{f(x+h)-f(x)}{h}$	
	$=\lim_{h\to0}\frac{-7(x+h)^2-3-(-7x^2-3)}{h}$	✓A substitution into the formula
	$=\lim_{h\to0}\frac{-7x^2-14xh-7h^2-3-(-7x^2-3)}{h}$	✓CA $f(x+h)=-7x^2-14xh-7h^2-3$
	$=\lim_{h\to0}\frac{-14xh-7h^2}{h}$	✓CA simplification
	$=\lim_{h\to0}\frac{h(-14x-7h)}{h}$	✓CA factors
	$=\lim_{h\to0}(-14x-7h)$	
	$=-14x$	✓CA answer (5)
8.1.2	gradient of tangent at $x=-\frac{1}{2}$	
	$=f'\left(-\frac{1}{2}\right)$	
	$=-14\left(-\frac{1}{2}\right)$	✓CA $-14\left(-\frac{1}{2}\right)$
	$=7$	✓CA answer (2)
8.2.1	$y=3x(x^2-2)$	
	$=3x^3-6x$	✓A $3x^3-6x$
	$\frac{dy}{dx}=9x^2-6$	✓CA $9x^2$ CA ✓-6 (3)

8.2.2	$D_x\left[\dfrac{\sqrt[3]{x^2}-8x}{x}\right]$	
	$=D_x\left[\dfrac{x^{\frac{2}{3}}-8x}{x}\right]$	✓A $x^{\frac{2}{3}}$
	$=D_x\left[x^{-\frac{1}{3}}-8\right]$	✓CA $D_x\left[x^{-\frac{1}{3}}-8\right]$
	$=-\dfrac{1}{3}x^{-\frac{4}{3}}$	✓CA answer (3)
		[13]

QUESTION 9

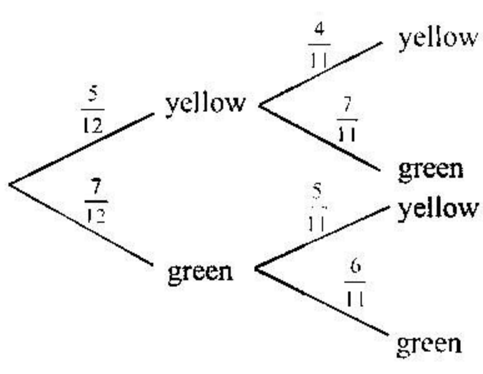
9.1	$f(x)=x^3+px^2+qx+30$ $f'(x)=3x^2+2px+q=0$ $f'(-1)=3(-1)^2+2p(-1)+q=0$ $q=2p-3 \ldots\ldots\ldots \to (1)$ $f(-1)=(-1)^3+p(-1)^2+q(-1)+30=36$ $p-q=7 \ldots\ldots\ldots \to (2)$ Substitute (1) into (2) $p-(2p-3)=7$ $p=-4$ $q=2(-4)-3$ $q=-11$	✓A derivative ✓A $f'(-1)=0$ ✓A $q=2p-3$ ✓A $p-q=7$ ✓A solving simultaneously (5)
	OR	**OR**
	$f(2)=(2)^3+p(2)^2+q(2)+30=0$ $p-q=7 \ldots\ldots\ldots \to (1)$ $f(-1)=(-1)^3+p(-1)^2+q(-1)+30=36$ $2p+q=-19$ $q=-2p-19 \ldots\ldots\ldots \to (2)$ substitute (2) into (1): $p-(-2p-19)=7$ $p=-4$ $q=-11$	✓A substitute in $f(2)=0$ ✓A $p-q=7$ ✓A substitute in $f(-1)=36$ ✓A $2p+q=-19$ ✓A solving simultaneously (5)

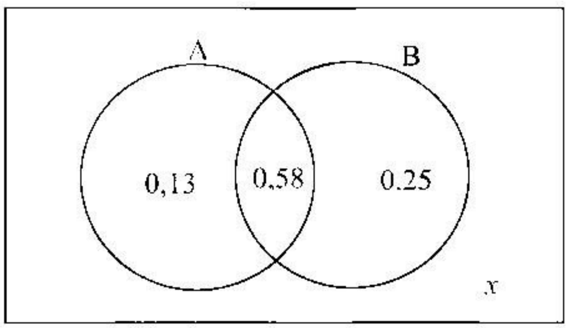
9.2	$f'(x)=3x^2-8x-11=0$ $(3x-11)(x+1)=0$ $x=\frac{11}{3}$ or $x\neq-1$ $f\left(\frac{11}{3}\right)=\left(\frac{11}{3}\right)^3-4\left(\frac{11}{3}\right)^2-11\left(\frac{11}{3}\right)+30=-\frac{400}{27}=-57,14$ $\therefore \text{T}\left(\frac{11}{3};-\frac{400}{27}\right)=\text{T}\left(\frac{11}{3};-57,14\right)$	✓A $f'(x)=3x^2-8x-11=0$ ✓CA factors ✓CA $x=\frac{11}{3}$ only ✓CA $f\left(\frac{11}{3}\right)=-\frac{400}{27}=-57,14$ (4)
9.3	For x-intercepts, let $y=0$: $x^3-4x^2-11x+30=0$ $(x-2)(x^2-2x-15)=0$ $(x-2)(x-5)(x+3)=0$ $x=2$ or $x=5$ or $x=-3$ Length of $\text{AC}=8$ units	✓A $(x-2)$ ✓A $(x^2-2x-15)$ ✓CA x-values ✓CA answer (4)
9.4	$f''(x)=6x-8=0$ $\therefore x_R=\frac{4}{3}$ **OR** $x_R=\frac{-1+\frac{11}{3}}{2}$ $=\frac{4}{3}$	✓A $f''(x)=6x-8=0$ ✓CA answer (2) **OR** ✓A using midpoint formula ✓CA answer (2)
9.5.1	$x<-1$ or $x>\frac{11}{3}$ **OR** $x\in(-\infty\ ;\ -1)$ or $x\in\left(\frac{11}{3}\ ;\ \infty\right)$	✓A✓CA answer **OR** ✓A✓CA answer (2)
9.5.2	$0<x<\frac{4}{3}$ **OR** $x\in\left(0;\frac{4}{3}\right)$	✓A✓CA answer **OR** ✓A✓CA answer (2)
		[19]

QUESTION 10

10.1	$B\left(t\ ;\ 9-\frac{t^2}{9}\right)$	✓A t ✓A $9-\frac{t^2}{9}$ (2)
10.2	$\text{Area}=\frac{1}{2}bh$ $A(t)=\frac{1}{2}t\left(9-\frac{t^2}{9}\right)$ $=\frac{9}{2}t-\frac{t^3}{18}$	✓A $\frac{1}{2}bh$ ✓A $\frac{1}{2}t\left(9-\frac{t^2}{9}\right)$ (2)
10.3	For a maximum: $A'(t)=0$ $\frac{9}{2}-\frac{1}{6}t^2=0$ $t^2=27$ $t=5,2$ units $A(5,2)=\frac{9}{2}(5,2)-\frac{(5,2)^3}{18}$ $=15,59$	✓A $A'(t)=0$ ✓A $A'(t)=\frac{9}{2}-\frac{1}{6}t^2$ ✓CA value of t ✓CA substitution ✓CA answer (5)
		[9]

QUESTION 11

11.1.1	 **Combined Outcomes**: yellow; yellow yellow; green green; yellow green; green	✓A first branch ✓A second branch ✓A probability values on diagram (3)
11.1.2	Probability of 1 green and 1 yellow ball in any order $=\frac{5}{12}\times\frac{7}{11}+\frac{7}{12}\times\frac{5}{11}$ $=\frac{70}{132}=\frac{35}{66}=0,53$	✓CA $\frac{5}{12}\times\frac{7}{11}$ ✓CA $+\frac{7}{12}\times\frac{5}{11}$ ✓CA answer (3)

11.2.1	No, because $P(A \text{ and } B) \neq 0$	✓A No ✓A $P(A \text{ and } B) \neq 0$ (2)
11.2.2	$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$ $= 0,71 + 0,83 - 0,58$ $= 0,96$ Probability that smoke is not detected $= P[\text{not}(A \text{ or } B)]$ $= 1 - P(A \text{ or } B)$ $= 1 - 0,96$ $= 0,04$ **OR**  $P(A \text{ or } B) = 0,13 + 0,58 + 0,25$ $= 0.96$ $\therefore P[\text{not}(A \text{ or } B)] = 1 - 0,96$ $= 0,04$	✓A $0,71 + 0,83 - 0,58$ ✓A $0,96$ ✓CA answer (3) **OR** ✓A Venn diagram with probability values ✓A $P(A \text{ or } B)$ ✓CA answer (3)
		[11]

TOTAL: 150