education

Department of Education
FREE STATE PROVINCE

GRADE 12

MATHEMATICS

MARKING GUIDELINE

JUNE 2026

NOTE:

- If a candidate answers a question TWICE, only mark the FIRST attempt.
- If a candidate has crossed out an attempt of a question and not redone the question, mark the crossed-out version.
- Consistent accuracy applies in ALL aspects of the marking memorandum.
- Assuming answers/values to solve a problem is NOT acceptable.

NOTA:

- *As 'n kandidaat 'n vraag TWEE KEER beantwoord, merk slegs die EERSTE poging.*
- *As 'n kandidaat 'n antwoord van 'n vraag doodtrek en nie oordoen nie, merk die doodgetrekte poging.*
- *Volgehoue akkuraatheid word in ALLE aspekte van die nasienriglyne toegepas.*
- *Aanvaar van antwoorde/waardes om 'n probleem op te los, word NIE toegelaat nie.*

QUESTION 1

1.1.1	$x=\frac{4}{3}$ or $x=-\frac{7}{2}$	✓ $x=\frac{4}{3}$ ✓ $x=-\frac{7}{2}$ (2)
1.1.2	$x^2+4x+4=3x^2-6x$ $-2x^2+10x+4=0$ $x=\frac{-(10)\pm\sqrt{(10)^2-4(-2)(4)}}{2(-2)}$ $x=-0,37$ or $x=5,37$	✓ standard form ✓ correct substitution ✓ $x=-0,37$ ✓ $x=5,37$ (4)
1.1.3	$2x+3=\sqrt{25x-1}$ $(2x+3)^2=\left(\sqrt{25x-1}\right)^2$ $4x^2+12x+9=25x-1$ $4x^2-13x+10=0$ $(x-2)(4x-5)=0$ $x=2$ or $x=\frac{5}{4}$	✓ isolation ✓ squiring both sides ✓ standard form ✓ factors ✓ answers (5)
1.1.4	$x^2+2x-3>0$ $(x+3)(x-1)>0$ CV: -3 and 1 $x<-3$ or $x>1$	✓ standard form ✓ factors ✓ $x<-3$ ✓ $x>1$ (4)

1.1.5	$(2^x-4)(2^x-2)=0$ $2^x=4 \quad \text{or} \quad 2^x=2$ $2^x=2^2 \quad \text{or} \quad x=1$ $x=2$	✓ factors ✓ $2^x=2^2 \quad \text{or} \quad 2^x=2$ ✓ answers (3)
1.2	$x=3y+2$ $(3y+2)^2+y^2+2(3y+2)+2y=38$ $9y^2+12y+4+y^2+6y+4+2y-38=0$ $10y^2+20y-30=0$ $y^2+2y-3=0$ $(y-1)(y+3)=0$ $y=1 \quad \text{or} \quad y=-3$ $x=5 \quad \text{or} \quad x=-7$	✓ $x=3y+2$ ✓ substitution ✓ factors ✓ both y values ✓ both x values (5)
1.3	$1-2\sin^2\theta-\sin\theta-k=0$ $-2\sin^2\theta-\sin\theta-k+1=0$ $\Delta<0$ $(-1)^2-4(-2)(-k+1)<0$ $1-8k+8<0$ $k>\frac{9}{8}$	✓ double angle ✓ $\Delta<0$ ✓ substitution ✓ $k>\frac{9}{8}$ (4)
		[27]

QUESTION 2

2.1	72	✓ answer (1)
2.2	$2a=6 \qquad 3a+b=5 \qquad a+b+c=16$ $a=3 \qquad 3(3)+b=5 \qquad 3+(-4)+c=16$ $b=-4 \qquad c=17$ $T_n=3n^2-4n+17$	✓ $a=3$ ✓ $b=-4$ ✓ $c=17$ ✓ T_n (4)
2.3	$T_n=6n-1$ $T_n+T_{n+1}=304$ $6n-1+6(n+1)-1=304$ $6n-1+6n+6-1=304$ $12n=300$ $n=25$ $\therefore T_{25}$ and T_{26}	✓ $T_n=6n-1$ ✓ substitution ✓ $n=25$ ✓ answers (4)
2.4	$n=-\frac{-4}{2(3)}$ $=\frac{2}{3}$ Since the position of n in a sequence must be a positive integer. The sequence increases steadily from the first term. The **first term** will have the minimum value.	✓ Subst. ✓ $n\neq\frac{2}{3}$ ✓ answer (3)
		[12]

QUESTION 3

3.1	$S_n = a + a + d + a + 2d + ... + [a + (n-2)d] + [a + (n-1)d]$ $S_n = [a + (n-1)d] + [+(n-2)d + ...a + 2d + a + d + a$ $\therefore 2S_n = [2a + (n-1)d] + ... + [2a + (n-1)d]$ $2S_n = n[2a + (n-1)d]$ $\therefore S_n = \frac{n}{2}[2a + (n-1)d]$	✓ setting up of S ✓ addition ✓ multiply by n terms (3)
3.2	$w - 3 = z - w$ $z = 2w - 3$ $z - w = 21 - z$ $2z = 21 + w$ $2(2w - 3) = 21 + w$ $4w - 6 = 21 + w$ $3w = 27$ $w = 9$ $z = 15$	✓ equating 1st diff ✓ 2nd equation ✓ subst. ✓ value of w ✓ Value of z (5)
3.2.2	$399 = 6n - 3$ $402 = 6n$ $n = 67$	✓ subst. ✓ answer (2)
3.3.1	$S_{67} = \frac{67}{2}[2(3) + (67-1) \times 6]$ $= 13\,467$	✓ subst. ✓ answer (2)
		[12]

QUESTION 4

4.1.1	$r = x-3$ $-1 < x-3 < 1$ $2 < x < 4$	✓ r ✓ subst. ✓ answer (3)
4.1.2	$\frac{x^2}{1-(x-3)} = \frac{49}{2}$ $\frac{x^2}{4-x} = \frac{49}{2}$ $2x^2 = 196 - 49x$ $2x^2 + 49x - 196 = 0$ $(2x-7)(x+28) = 0$ $x = \frac{7}{2}$ or $x \neq -28$	✓ correct subst. ✓ simplification ✓ standard form ✓ answer with rejection (4)
4.2.1	$T_4 = 5\,000(0.8)^{4-1}$ $= R2\,560$	✓ r ✓ subst. in the formula ✓ answer (3)
4.2.2	$S_5 = \frac{5\,000(0,8^5 - 1)}{0,8-1}$ $= R16\,808$	✓ subst. ✓ answer (2)

4.2.3	$\frac{5\,000\left(0.8^{n}-1\right)}{0.8-1}=22\,000$ $0.8^{n}-1=\frac{4400}{5000}$ $0,8^{n}=0,12$ $n=\log_{0,8}(0,12)$ $n\approx 9,51$ $n=9$	✓ subst. ✓ simplification ✓ correct application of log ✓ answer (4)
		[16]

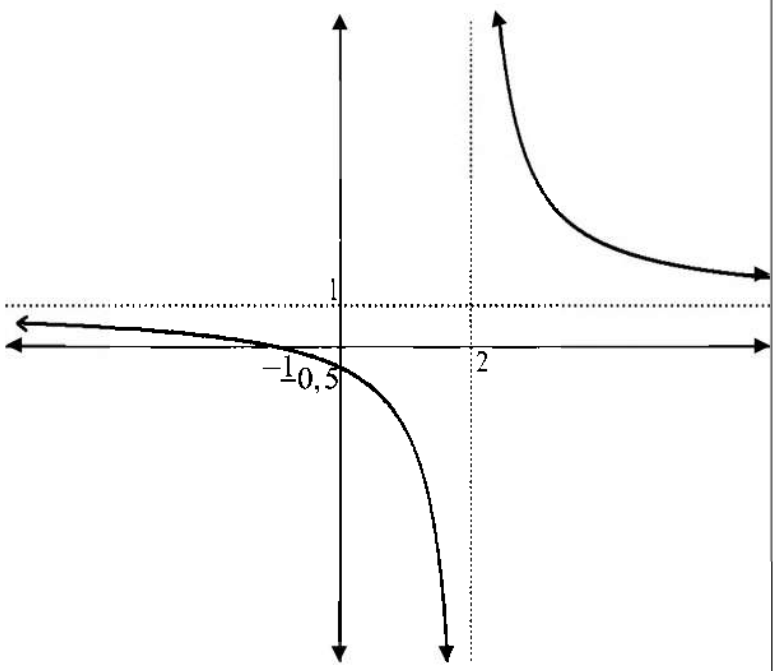
QUESTION 5

5.1	$y\varepsilon\left(-\infty;36\right]$ or $y\leq 36$	✓ $y\varepsilon\left(-\infty;36\right]$ (1)
5.2	$x=4$	✓ $x=4$ (1)
5.3	$0=-\left(x-4\right)^{2}+36$ $\left(x-4\right)^{2}=36$ $\left(x-4\right)=\pm 6$ $x=10$ or $x=-2$ $\therefore$ Length of CD $=12$ units	✓ $y=0$ ✓ factors ✓ both x values ✓ answer (4)

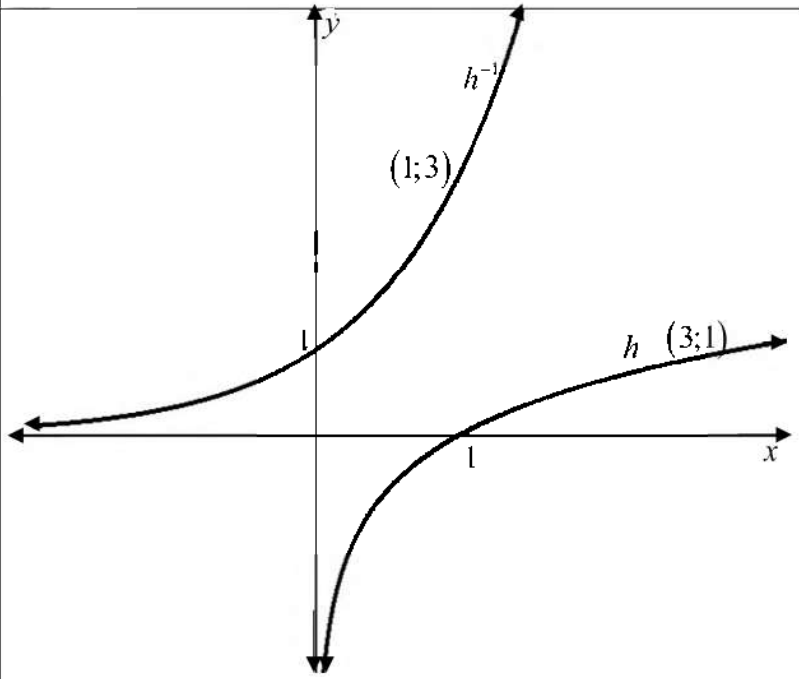
5.4	$\text{EM} = -(x-4)^2 + 36 - (4x+8)$ $= -x^2 + 8x + 20 - 4x - 8$ $= -x^2 + 4x + 12$ $= -(x-2)^2 + 16$ Maximum length $= 16$	✓ $\text{EM} = y_f - y_g$ ✓ Method (completing the square/derivative/ $x = \frac{-b}{2a}$) ✓ answer (3)
5.5	$-x^2 + 8x - 16 + 36 = 4x + k$ $-x^2 + 4x + 20 - k = 0$ $\Delta = (4)^2 - 4(-1)(20-k)$ $16 + 80 - 4k < 0$ $-4k < -96$ $k > 24$	✓ equating ✓ correct subst. ✓ $\Delta < 0$ ✓ answer (4)
		[13]

QUESTION 6

6.1	$x = 2$ $y = 1$	✓ $x = 2$ ✓ $y = 1$ (2)

6.2	$y=\frac{3}{0-2}+1$ $y=-\frac{1}{2}$ $\left(0;-\frac{1}{2}\right)$ $0=\frac{3}{x-2}+1$ $-1=\frac{3}{x-2}$ $3=-x+2$ $x=-1$ $(-1;0)$	✓ $y=-\frac{1}{2}$ ✓ sub $y=0$ ✓ $x=-1$ (3)
6.3		✓ intercepts ✓ asymptotes ✓ shape (no c/a) (3)
6.4	$y=(x-2)+1$ $y=x-1$	✓ sub *m* and point ✓ answer (2)
6.5	$0\leq x<3$	✓ 0 & ✓3 ✓ notation (3)
		[13]

QUESTION 7

7.1	$y = \log_3 x$ $x = \log_3 y$ $y = 3^x$	✓swapping x and y ✓ answer (2)
7.2		✓ shape & x-int of h ✓ any point on h ✓ shape & y-int of h^{-1} ✓ point on the inverse (4)
7.3	$0 < x \leq 3$	✓ 0 & 3 ✓ Notation (2)
7.4	$g(x) = -[h^{-1}(x) - 4]$ $g(x) = -3^x + 4$ $Range: y < 4$	✓ $g(x) = -3^x + 4$ ✓ $y < 4$ (2)
		[10]

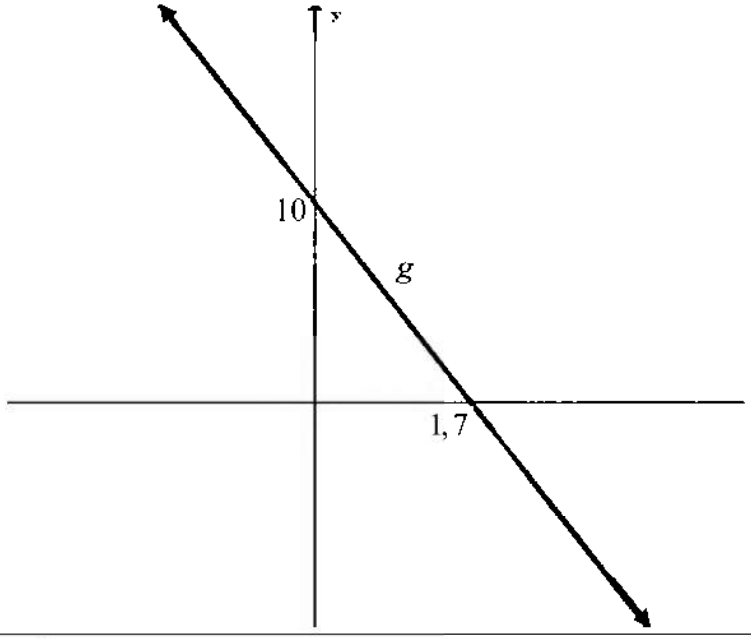
QUESTION 8

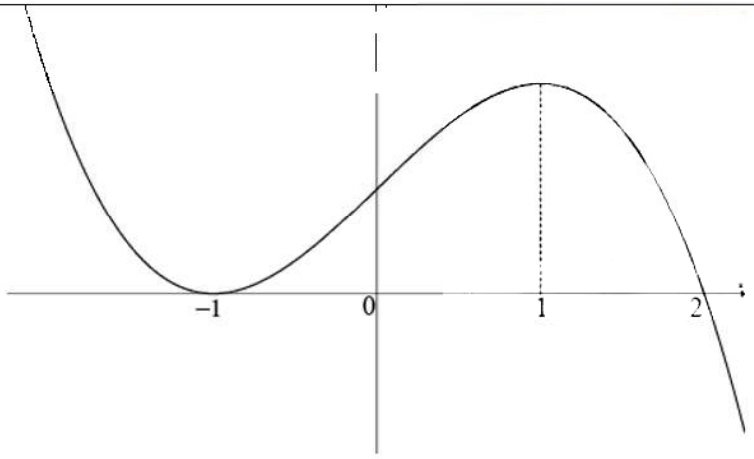
8.1	$f'(x)=\lim\limits_{h\to 0}\dfrac{f(x+h)-f(x)}{h}$ $f(x)=\dfrac{-2}{x}$ $\therefore f(x+h)=\dfrac{-2}{x+h}$ $f'(x)=\lim\limits_{h\to 0}\dfrac{\frac{-2}{x+h}+\frac{2}{x}}{h}$ $=\lim\limits_{h\to 0}\dfrac{-2x+2x+2h}{x(x+h)}\div h$ $=\lim\limits_{h\to 0}\dfrac{2h}{x(x+h)}\times\dfrac{1}{h}$ $=\lim\limits_{h\to 0}\dfrac{2}{x(x+h)}$ $=\dfrac{2}{x^2}$	✓ $f(x+h)$ ✓ subst. ✓ simplification ✓ $\dfrac{2}{x(x+h)}$ ✓Answer (5)
8.2	$D_x\left[4x^{\frac{1}{3}}+\dfrac{1}{3}x^{-1}+2\right]$ $=\dfrac{4}{3}x^{-\frac{2}{3}}-\dfrac{1}{3}x^{-2}$	✓ $4x^{\frac{1}{3}}$ ✓ $\dfrac{1}{3}x^{-1}$ ✓ $\dfrac{4}{3}x^{-\frac{2}{3}}$ ✓ $-\dfrac{1}{3}x^{-2}$ (4)

8.3	$h(x) = ax^2 \quad ; x \geq 0$ $h^{-1}(8) = h'(4)$ $h^{-1}(x) = \sqrt{\frac{1}{a}x} \qquad h'(x) = 2ax$ $h^{-1}(8) = \sqrt{\frac{1}{a}(8)} \qquad h'(4) = 2a(4)$ $\therefore \sqrt{\frac{8}{a}} = 8a$ $\frac{8}{a} = 64a^2$ $64a^3 = 8$ $a^3 = \frac{1}{8}$ $a = \frac{1}{2}$	✓ $h^{-1}(x) = \sqrt{\frac{1}{a}x}$ ✓ $h'(x) = 2ax$ ✓ sub of 8 ✓ sub of 4 ✓ simplification ✓ answer (6)
		[15]

QUESTION 9

9.1	$D(0;-12)$	✓ answer (1)
9.2	$y = -x^3 + 5x^2 + 8x - 12$ $0 = -x^3 + 5x^2 + 8x - 12$ $0 = x^3 - 5x^2 - 8x + 12$ $0 = (x+2)(x-1)(x-6)$ $x = -2 \quad or \quad x = 1 \quad or \quad x = 6$ $A(-2;0) \quad B(1;0) \quad C(6;0)$	✓ $y = 0$ ✓ factors ✓ $x = -2$ ✓ $x = 1$ ✓ $x = 6$ (5)

9.3	$f(x) = -x^3 + 5x^2 + 8x - 12$ $At\ TP: f'(x) = 0$ $\therefore \quad -3x^2 + 10x + 8 = 0$ $3x^2 - 10x - 8 = 0$ $(3x + 2)(x - 4) = 0$ $x = -\frac{2}{3} \quad or \quad x = 4$ $y\ at \quad E:$ $y = -\left(-\frac{2}{3}\right)^3 + 5\left(-\frac{2}{3}\right)^2 + 8\left(-\frac{2}{3}\right) - 12$ $y = -\frac{400}{27} / -14,81$ $E\left(-\frac{2}{3}; -\frac{400}{27}\right)$	✓ $f'(x) = 0$ ✓ factors ✓ x values ✓ coordinates of E (4)
9.4	$f''(x) = -6x + 10$ $\therefore g(x) = -6x + 10$  	✓ $g(x) = -6x + 10$ ✓ shape ✓ intercepts (3)
9.5.1	$f''(x) > 0$ $-6x + 10 > 0$ $-6x > -10$ $x < \frac{5}{3}$	✓ $\frac{5}{3}$ ✓ $x < \frac{5}{3}$ (2)

9.5.2	$-\frac{2}{3} < x < 4$	✓✓ $-\frac{2}{3} < x < 4$ (2)
9.5.3	$-2 \le x \le -\frac{2}{3}$ $1 \le x \le 4$ $x \ge 6$	✓✓ $-2 \le x \le -\frac{2}{3}$ ✓ $1 \le x \le 4$ ✓ $x \ge 6$ (4)
9.6	$-f(x) = k$ $-\frac{400}{27} < -k < 36$ $\therefore -36 < k < \frac{400}{27}$	✓ 36 ✓✓ $-36 < k < \frac{400}{27}$ (3)
9.7	$f(x) = -x^3 + 5x^2 + 8x - 12$ $y = -(5)^3 + 5(5)^2 + 8(5) - 12$ $y = 28$ $f'(5) = -3(5)^2 + 10(5) + 8$ $f'(5) = -17$ $y - 28 = -17(x - 5)$ $y = -17x + 113$	✓ $y = 28$ ✓ $f'(5) = -17$ ✓ subst. ✓ answer (4)
9.8		✓ $x = -1$ and $x = 2$ ✓ *TP at* $x = -1$ ✓ *TP at* $x = 1$ ✓ shape (4)