



higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

MATHEMATICS N5

30 July 2026

This marking guideline consists of 10 pages.

QUESTION 1

$$\begin{aligned}
 1.1 \quad 1.1.1 \quad y &= \lim_{x \rightarrow 2} \left(\frac{1}{x-2} - \frac{1}{x^2 - 3x + 2} \right) : (\infty - \infty) \\
 &= \lim_{x \rightarrow 2} \left(\frac{1}{x-2} - \frac{1}{(x-1)(x-2)} \right) \\
 &= \lim_{x \rightarrow 2} \left(\frac{x-1-1}{(x-2)(x-1)} \right) \\
 &= \lim_{x \rightarrow 2} \left(\frac{x-2}{(x-2)(x-1)} \right) \checkmark \\
 &= 1 \checkmark
 \end{aligned} \tag{2}$$

$$\begin{aligned}
 1.1.2 \quad y &= \lim_{x \rightarrow \infty} \frac{\ln(x+2)}{\log_2 x} : \frac{\infty}{\infty} \\
 &= \lim_{x \rightarrow \infty} \frac{\left(\frac{1}{x+2} \right)}{\left(\frac{1}{x \ln 2} \right)} \checkmark = \lim_{x \rightarrow \infty} \frac{x \ln 2}{x+2} : \frac{\infty}{\infty} \\
 &= \lim_{x \rightarrow \infty} \frac{\ln 2}{1} \checkmark \\
 &= \ln 2 \checkmark \text{ OR } 0,693
 \end{aligned} \tag{3}$$

$$\begin{aligned}
 1.2 \quad f(x) &= \frac{x^2 + 5x - 24}{x^2 - x - 6} \\
 x &= -2 \checkmark \text{ OF } x = 3 \checkmark
 \end{aligned} \tag{2}$$

[7]

QUESTION 2

$$\begin{aligned}
 2.1 \quad f(x+h) &= \frac{1}{4}x^{-4} - x^{-5}h + \frac{5}{2}x^{-6}h^2 + \dots \checkmark \\
 f'(x) &= \lim_{h \rightarrow 0} \frac{\frac{1}{4}x^{-4} - x^{-5}h + \frac{5}{2}x^{-6}h^2 + \dots - \frac{1}{4}x^{-4}}{h} \checkmark \\
 &= \lim_{h \rightarrow 0} \frac{-x^{-5}h + \frac{5}{2}x^{-6}h^2 + \dots}{h} \checkmark \\
 &= \lim_{h \rightarrow 0} -x^{-5} + \frac{5}{2}x^{-6}h + \dots \checkmark \\
 &= -x^{-5} \checkmark
 \end{aligned}$$

2.2 2.2.1 $y = \operatorname{cosec}^4(\tan 2x)$

$$\begin{aligned} \frac{dy}{dx} &= 4 \operatorname{cosec}^3(\tan 2x) \times [-\operatorname{cosec}(\tan 2x) \cot(\tan 2x)] \\ &\quad \times \sec^2(\tan 2x) \times 2 \end{aligned} \quad (4)$$

2.2.2 $y = \frac{\sqrt[3]{x} - 2xe^x}{3x + 1}$

$$\frac{dy}{dx} = \frac{(3x + 1) \left[\frac{1}{3} x^{-\frac{2}{3}} - 2(e^x + xe^x) \right] - 3(\sqrt[3]{x} - 2xe^x)}{(3x + 1)^2} \quad (4)$$

2.3 $y = (\sec 3x)^{4x^2}$

$$\ln y = 4x^2 \ln(\sec 3x)$$

$$\frac{1}{y} \frac{dy}{dx} = 8x \ln(\sec 3x) + 4x^2 \times \frac{1}{\sec 3x} \times \sec 3x \tan 3x \times 3$$

$$\begin{aligned} \frac{dy}{dx} &= y[8x \ln(\sec 3x) - 12x^2 \tan 3x] \\ &= (\sec 3x)^{4x^2} [8x \ln(\sec 3x) - 12x^2 \tan 3x] \end{aligned} \quad (4)$$

2.4 $\sec(x - y) = y \operatorname{cosec} x$

$$\sec(x - y) \tan(x - y) \left(1 - \frac{dy}{dx} \right) = \operatorname{cosec} x \frac{dy}{dx} - \operatorname{cosec} x \cot x$$

$$\sec(x - y) \tan(x - y) - \sec(x - y) \tan(x - y) \frac{dy}{dx} = \operatorname{cosec} x \frac{dy}{dx} - \operatorname{cosec} x \cot x$$

$$[\sec(x - y) \tan(x - y) + \operatorname{cosec} x] \frac{dy}{dx} = \sec(x - y) \tan(x - y) + \operatorname{cosec} x \cot x$$

$$\frac{dy}{dx} = \frac{\sec(x - y) \tan(x - y) + \operatorname{cosec} x \cot x}{\sec(x - y) \tan(x - y) + \operatorname{cosec} x} \quad (5)$$

[22]

QUESTION 3

3.1 3.1.1 $f(x) = 3x^3 - 4x + 3$

$$f'(x) = 9x^2 - 4 = 0 \checkmark$$

$$(3x + 2)(3x - 2) = 0$$

$$x = -\frac{2}{3} \text{ OR } x = \frac{2}{3}$$

$$y = 1,222 \quad y = 4,778 \checkmark$$

Thus, the coordinates of the turning points are $\left(\frac{2}{3}; 1,222\right)$ and $\left(-\frac{2}{3}; 4,778\right) \checkmark$

(3)

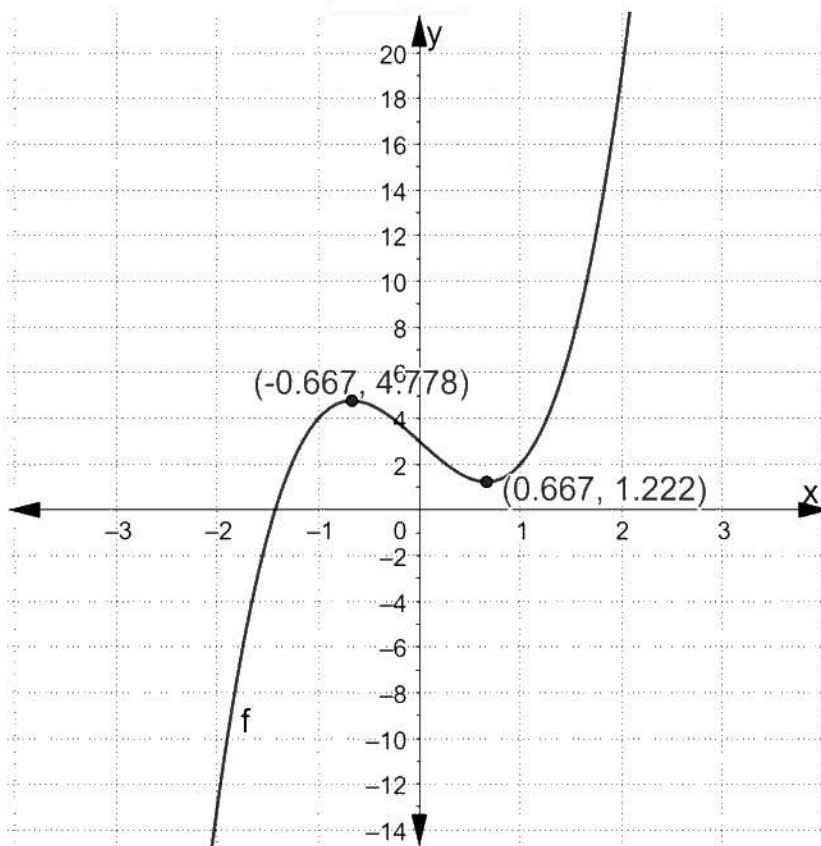
3.1.2

x	-2	-1	0	1	2
y	-13	4	3	2	19

$\checkmark\checkmark = 1$ mark for every 2 correct answers.

(2)

3.1.3



1 mark for the shape.

1 mark for the indication of the turning points on the graph.

3.1.4 Let $x_0 = -1,3$

$$f(-1,3) = 1,609$$

$$f'(-1,3) = 11,21✓$$

$$x_1 = -1,3 - \frac{1,609}{11,21}✓$$

$$= -1,444✓$$

$$x_2 = -1,444 - \frac{-0,256}{14,74}$$

$$x_2 = -1,427✓$$

(4)

3.2 $P = 2x + y$

$$100 = 2x + y$$

$$y = 100 - 2x✓$$

$$A = xy$$

$$A = x(100 - 2x)$$

$$A = 100x - 2x^2✓$$

$$A' = 100 - 4x = 0✓$$

$$4x = 100$$

$$x = 25m✓$$

$$y = 50m✓$$

Largest area

$$A = xy = 25 \times 50 = 1250 \text{ m}^2✓$$

(6)

3.3 $h = 2 + 24,5t - 4,9t^2$

$$h' = 24,5 - 9,8t = 0✓$$

$$9,8t = 24,5✓$$

$$t = 2,5s✓$$

(3)

[20]

QUESTION 4

4.1 4.1.1

$$I = \int \frac{\tan x \sec^2 x}{1 - \tan^2 x} dx$$

ALTERNATIVE WORKINGS

$$\text{let } u = 1 - \tan^2 x$$

$$\text{let } f(x) = 1 - \tan^2 x$$

$$-\frac{1}{2} du = \tan x \sec^2 x dx \checkmark$$

$$f'(x) = -2 \tan x \sec^2 x dx \checkmark$$

$$I = -\frac{1}{2} \int \frac{1}{u} du \checkmark$$

$$= -\frac{1}{2} \int \frac{-2 \times \tan x \sec^2 x}{1 - \tan^2 x} dx \checkmark$$

$$= -\frac{1}{2} [\ln u] + C$$

$$= -\frac{1}{2} \ln(1 - \tan^2 x) + C \checkmark$$

$$= -\frac{1}{2} \ln(1 - \tan^2 x) + C \checkmark$$

(3)

4.1.2

$$\int \cos^2 6x dx$$

$$= \frac{1}{2} \int (1 + \cos 12x) dx \checkmark$$

$$= \frac{1}{2} x \checkmark + \frac{1}{24} \sin 12x \checkmark + C$$

(3)

4.1.3

$$\int \sin(3x) \sin\left(\frac{4}{3}x\right) dx$$

$$= \int \frac{1}{2} \left[\cos \frac{5}{3}x + \cos \frac{13}{3}x \right] dx \checkmark$$

$$= \frac{1}{2} \left[\frac{3}{5} \sin \frac{5}{3}x \checkmark + \frac{3}{13} \sin \frac{13}{3}x \checkmark \right] + C$$

$$= \frac{3}{10} \sin \frac{5}{3}x + \frac{3}{26} \sin \frac{13}{3}x + C$$

(3)

4.1.4

$$\int \frac{x^3 - 3x + 2}{x + 1} dx$$

$$= \int \left(x^2 - x - 2 + \frac{4}{x + 1} \right) dx \checkmark$$

$$= \frac{1}{3} x^3 \checkmark - \frac{1}{2} x^2 \checkmark - 2x \checkmark + 4 \ln(x + 1) \checkmark + C$$

$$4.1.5 \quad \int 2 \sin x \ln(\sec x) dx$$

$let\ u\ or\ f(x) = \ln(\sec x)$ $du\ or\ f'(x) = \tan x\ dx$	$dv\ or\ g'(x) = \sin x\ dx$ $v\ or\ g(x) = -\cos x\ \checkmark$
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$$\begin{aligned}
 \int 2 \sin x \ln(\sec x) dx &= 2 \left[-\cos x \ln(\sec x) - \int -\cos x \tan x dx \right] \checkmark \\
 &= 2 \left[-\cos x \ln(\sec x) + \int \sin x dx \right] \checkmark \\
 &= -2\cos x \ln(\sec x) - 2\cos x \checkmark + C
 \end{aligned}
 \tag{4}$$

$$4.2 \quad \int \frac{x-7}{x^2+x-2} dx$$

$$\frac{x-7}{(x+2)(x-1)} = \frac{A}{x+2} + \frac{B}{x-1}$$

$$x-7 = A(x-1) + B(x+2) \checkmark$$

$let\ x = 1; \quad B = -2 \checkmark$

$let\ x = -2; \quad A = 3 \checkmark$

$$\begin{aligned}
 &\int \left(\frac{3}{x+2} - \frac{2}{x-1} \right) dx \\
 &= 3\ln(x+2) \checkmark - 2\ln(x-1) \checkmark + C
 \end{aligned}
 \tag{5}$$

[23]

QUESTION 5

5.1

$$\begin{aligned} & \int_0^{\frac{\pi}{4}} 5x \sin 2x dx \\ &= 5 \int_0^{\frac{\pi}{4}} x \sin 2x dx \\ &= 5 \left\{ \left[-x \frac{\cos 2x}{2} \right]_0^{\frac{\pi}{4}} \checkmark + \int_0^{\frac{\pi}{4}} \frac{\cos 2x}{2} dx \right\} \checkmark \\ &= 5 \left\{ \left[-x \frac{\cos 2x}{2} + \frac{\sin 2x}{4} \right]_0^{\frac{\pi}{4}} \right\} \checkmark \\ &= \frac{5}{4} \text{ OR } 1,25 \checkmark \end{aligned} \quad (4)$$

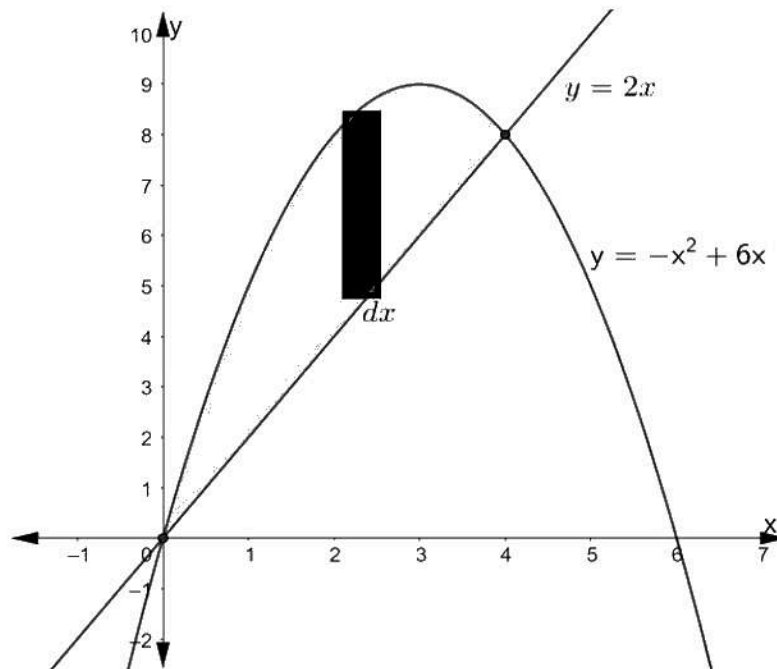
5.2

5.2.1

$$\begin{aligned} 2x &= -x^2 + 6x \\ x^2 - 4x &= 0 \\ x(x - 4) &= 0 \checkmark \\ x &= 0 \quad \text{or} \quad x = 4 \\ y &= 0 \quad \text{or} \quad y = 8 \checkmark \end{aligned}$$

Thus, the coordinates of the points of intersection are (0; 0) and (4; 8). $\checkmark$ (3)

5.2.2



✓ = 1 mark for indication of each enclosed area

✓ = 1 mark for indication of the vertical strip

(2)

5.2.3

$$\begin{aligned}
 A &= \int_a^b (y_1 - y_2) dx \\
 &= \int_0^4 [(-x^2 + 6x) - 2x] dx \checkmark \\
 &= \int_0^4 (-x^2 + 4x) dx \\
 &= \left[-\frac{1}{3}x^3 + 2x^2 \right]_0^4 \checkmark \\
 &= 10,667 \text{ units}^2 \text{ OR } \frac{32}{3} \checkmark
 \end{aligned}$$

(3)

5.2.4

$$\begin{aligned}
 V &= \pi \int_a^b (y_1^2 - y_2^2) dx \\
 &= \pi \int_0^4 [(-x^2 + 6x)^2 - (2x)^2] dx \checkmark \\
 &= \pi \int_0^4 (x^4 - 12x^3 + 32x^2) dx \checkmark \checkmark \\
 &= \pi \left[\frac{1}{5}x^5 - 3x^4 + \frac{32}{3}x^3 \right]_0^4 \checkmark \\
 &= \frac{1792\pi}{15} = 375,316 \text{ units}^3 \checkmark
 \end{aligned}$$

$$\begin{aligned}
 5.3 \quad I_z &= \frac{1}{2} m R^2 \checkmark \\
 &= \frac{1}{2} \times 30 (1.2)^2 \checkmark \\
 &= 21,6 \text{ kg} \cdot \text{m}^2 \checkmark
 \end{aligned}$$

(3)
[20]

QUESTION 6

$$\begin{aligned}
 6.1 \quad \frac{dy}{dx} &= x e^{2x^2} (1 + y) \\
 \frac{1}{1 + y} dx &= x e^{2x^2} dx \checkmark \\
 \ln(1 + y) \checkmark &= \frac{1}{4} e^{2x^2} + C \checkmark
 \end{aligned}$$

(3)

$$\begin{aligned}
 6.2 \quad \frac{d^2y}{dx^2} &= 6x + 8 \cos 2x, \text{ with } \frac{dy}{dx} = 3 \text{ and } y = 2 \text{ at } x = 0 \\
 \frac{dy}{dx} &= 3x^2 + 4 \sin 2x + A \checkmark \\
 3 &= 3(0)^2 + 4 \sin 2(0) + A \\
 A &= 3 \checkmark \\
 \frac{dy}{dx} &= x^3 + 4 \sin 2x + 3 \\
 y &= \frac{1}{4} x^4 - 2 \cos 2x + 3x + B \checkmark \\
 2 &= \frac{1}{4} (0)^4 - 2 \cos 2(0) + 3(0) + B \\
 B &= 4 \checkmark \\
 y &= \frac{1}{4} x^4 - 2 \cos 2x + 3x + 4 \checkmark
 \end{aligned}$$

(5)
[8]

TOTAL: 100