



**higher education
& training**

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

MATHEMATICS N4

29 June 2022

This marking guideline consists of 8 pages.

QUESTION 1

$$\begin{aligned}
 1.1 \quad &= \frac{\sin x \cdot \cot x}{\sec x \cdot \cos x \cdot \cot x} \checkmark \\
 &= \frac{\sin x \cdot \cot x}{\frac{1}{\cos x} \cdot \cos x \cdot \cot x} \checkmark \checkmark \\
 &= \sin x \checkmark
 \end{aligned}
 \tag{4}$$

$$\begin{aligned}
 1.2 \quad \text{LHS} &= \frac{\sec \alpha}{1 + \tan \alpha} \\
 &= \frac{\frac{1}{\cos \alpha}}{1 + \frac{\sin \alpha}{\cos \alpha}} \checkmark \\
 &= \frac{1}{\cos \alpha} \times \frac{\cos \alpha}{\cos \alpha + \sin \alpha} \checkmark \\
 &= \frac{1}{\cos \alpha + \sin \alpha} \checkmark \\
 \text{RHS} &= \frac{\operatorname{cosec} \alpha}{1 + \cot \alpha} \\
 &= \frac{\frac{1}{\sin \alpha}}{1 + \frac{\cos \alpha}{\sin \alpha}} \checkmark \\
 &= \frac{1}{\sin \alpha} \times \frac{\sin \alpha}{\sin \alpha + \cos \alpha} \checkmark \\
 &= \frac{1}{\sin \alpha + \cos \alpha} \checkmark
 \end{aligned}
 \tag{6}$$

$$\begin{aligned}
 1.3 \quad &4 \cos^2 \left(\frac{x}{2} + 40^\circ \right) = 3 \\
 &\cos \left(\frac{x}{2} + 40^\circ \right) = \pm \frac{\sqrt{3}}{2} \checkmark \\
 &1^{\text{st}}: \frac{x}{2} + 40^\circ = 30^\circ \quad \text{or} \quad 2^{\text{nd}}: \frac{x}{2} + 40^\circ = 150^\circ \checkmark \\
 &x = -20^\circ \quad \text{or} \quad x = 220^\circ \checkmark \\
 &4^{\text{th}}: \frac{x}{2} + 40^\circ = 330^\circ \quad \text{or} \quad 3^{\text{rd}}: \frac{x}{2} + 40^\circ = 210^\circ \checkmark \\
 &x = 580^\circ \quad \text{or} \quad x = 340^\circ \checkmark \\
 &\text{General solution: } [-20^\circ; 220^\circ; 340^\circ; 580^\circ] \checkmark
 \end{aligned}
 \tag{6}$$

$$\begin{aligned}
 1.4 \quad \frac{1}{\cot 75^\circ} &= \tan 75^\circ \\
 &= \tan(45^\circ + 30^\circ) \checkmark \\
 &= \frac{\tan 45^\circ + \tan 30^\circ}{1 - \tan 45^\circ \cdot \tan 30^\circ} \checkmark \\
 &= \frac{1 + \frac{1}{\sqrt{3}}}{1 - 1 \cdot \frac{1}{\sqrt{3}}} \\
 &= \frac{\frac{\sqrt{3}+1}{\sqrt{3}}}{\frac{\sqrt{3}-1}{\sqrt{3}}} \checkmark \\
 &= \frac{\sqrt{3}+1}{\sqrt{3}-1} \checkmark
 \end{aligned}$$

(4)
[20]**QUESTION 2**

$$\begin{aligned}
 2.1 \quad \log_3(3-x) &= \log_{\frac{1}{3}}(5-2x) \\
 \log_3(3-x) &= -\log_3(5-2x) \checkmark \\
 \log_3(3-x) + \log_3(5-2x) &= 0 \checkmark \\
 (3-x)(5-2x) &= 1 \checkmark \\
 2x^2 - 11x + 14 &= 0 \\
 (2x-7)(x-2) &= 0 \checkmark \\
 x = \frac{7}{2} \quad \text{or} \quad x &= 2 \checkmark
 \end{aligned}$$

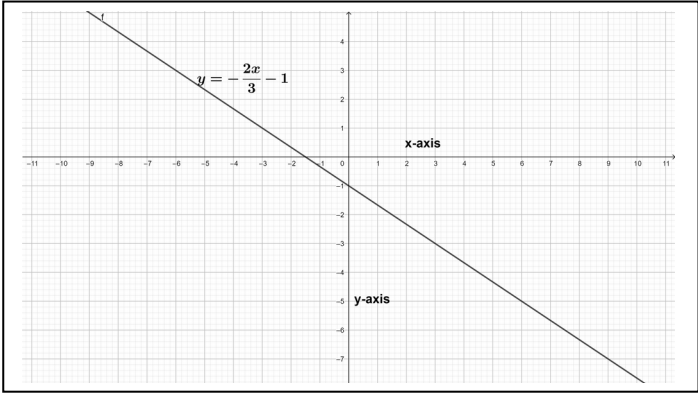
(5)

$$\begin{aligned}
 2.2 \quad P &= K \left(1 - 10^{\frac{-x}{y}} \right) \\
 1 - 10^{\frac{-x}{y}} &= \frac{P}{K} \checkmark \\
 10^{\frac{-x}{y}} &= 1 - \frac{P}{K} \checkmark \\
 \frac{-x}{y} \log 10 &= \log \left(1 - \frac{P}{K} \right) \checkmark
 \end{aligned}$$

(4)

$$y = \frac{-x}{\log\left(1 - \frac{P}{K}\right)} \checkmark$$

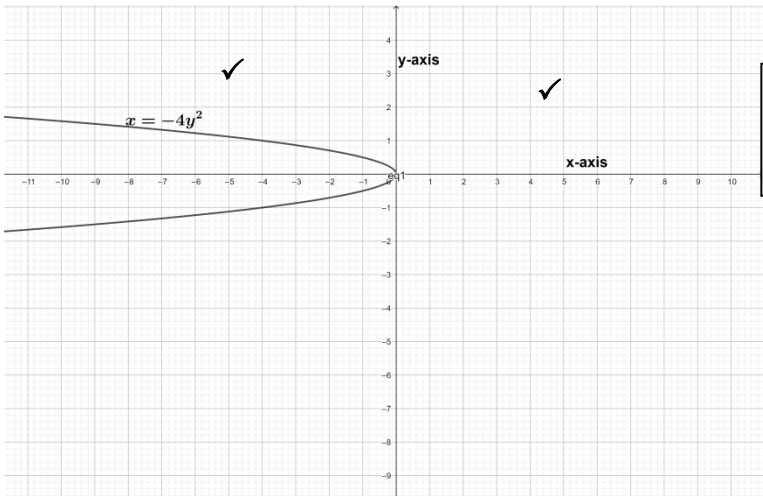
2.3 2.3.1



✓ for graph
✓ for both axes

2.3.2 Continuous (1)
2.3.3 Function (1)
2.3.4 Asymmetric (1)

2.4 2.4.1

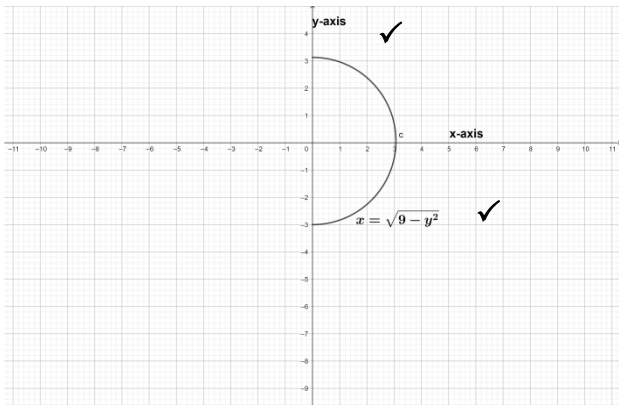


✓ for the graph
✓ for the axis

(2)

2.4.2 y-axis (1)

2.5 2.5.1



✓ for the graph
✓ for the axis

(2)

2.5.2 $[-3 \leq y \leq 3]$ (1)

QUESTION 3

3.1 $\frac{2}{3}\theta^6 - \theta^4 + 6\theta^2 + c$ (4)

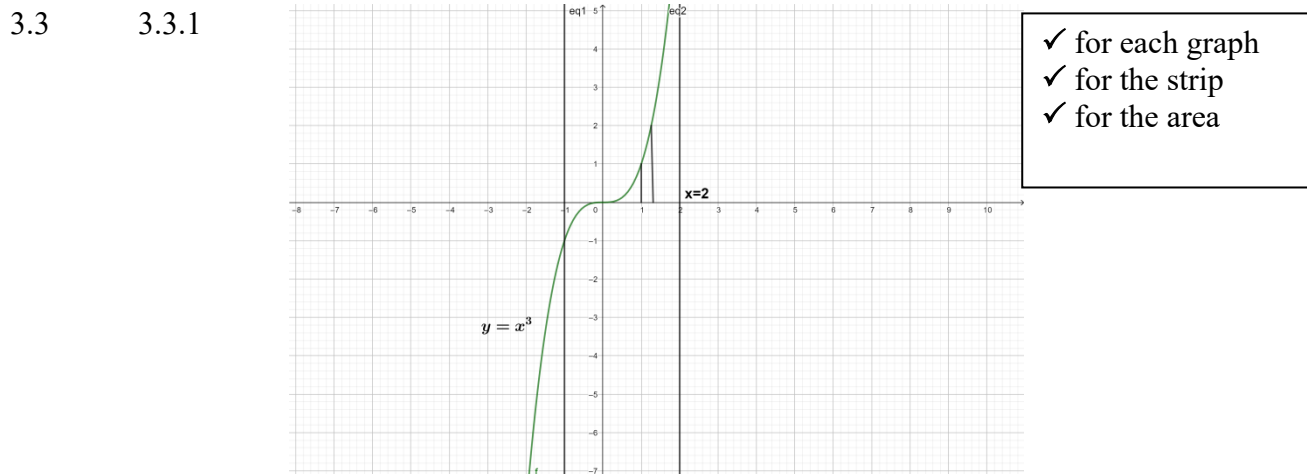
3.2
$$\int_{\frac{1}{e}}^e \left(\frac{p^2 + 2p - 1}{p^2} \right) dp$$

$$= \int_{\frac{1}{e}}^e \left(1 + \frac{2}{p} - \frac{1}{p^2} \right) dp \quad \checkmark$$

$$= \left[p + 2 \ln p + \frac{1}{p} \right]_{\frac{1}{e}}^e \quad \checkmark$$

$$= e + \ln e + \frac{1}{e} - \left(\frac{1}{e} + 2 \ln \left(\frac{1}{e} \right) + \frac{1}{\frac{1}{e}} \right) \quad \checkmark$$

$$= 4 \quad \checkmark$$
 (4)



3.3.2

$$\text{Area} = \left| \int_{-1}^0 x^3 dx \right| + \left| \int_0^2 x^3 dx \right| \quad \checkmark$$

$$= \left| \left[\frac{x^4}{4} \right]_{-1}^0 \right| + \left| \left[\frac{x^4}{4} \right]_0^2 \right| \quad \checkmark$$

$$= \left| 0 - \frac{(-1)^4}{4} \right| + \left| \frac{(2)^4}{4} - 0 \right| \quad \checkmark$$

$$= \frac{1}{4} + 4$$

$$= \frac{17}{4} \text{ or } 4,25 \quad \checkmark$$

(2 × 4) (8)

$$3.4 \quad = -\cot \alpha + 2 \tan \alpha - 3 \ln \alpha + c \quad (4)$$

[20]

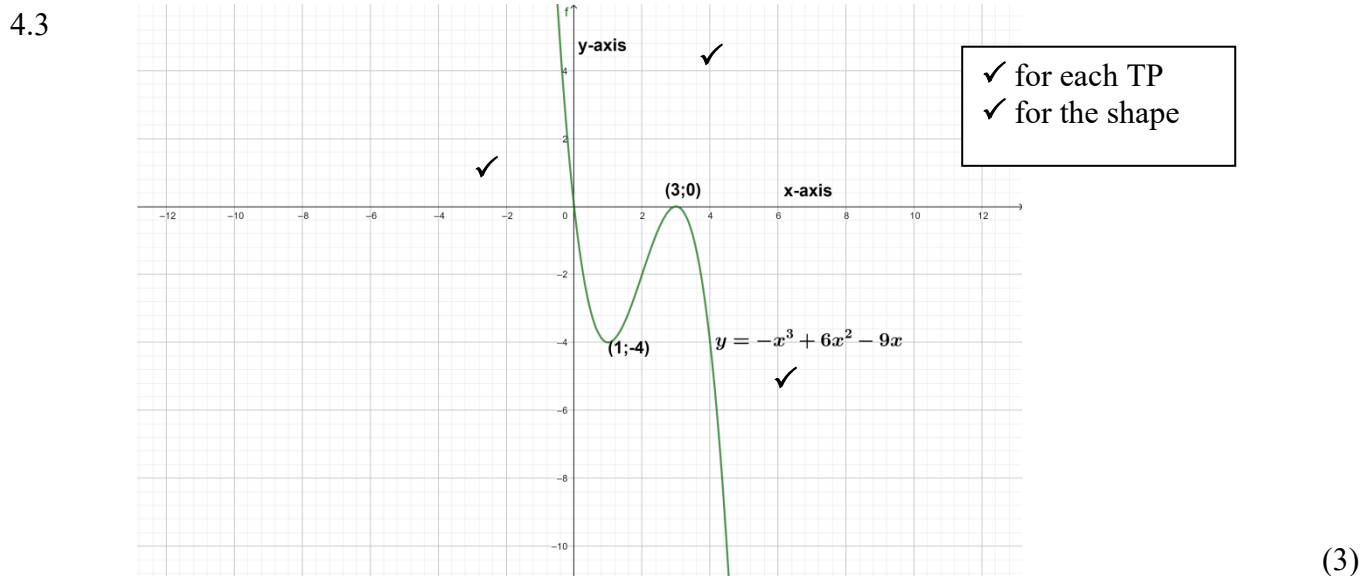
QUESTION 4

$$4.1 \quad \frac{1}{\sqrt[4]{x^3}} + \frac{3}{2\sqrt[4]{x^7}} + \frac{21}{8\sqrt[4]{x^{11}}} + \frac{32}{48\sqrt[4]{x^{15}}} \quad (4)$$

$$4.2 \quad = \frac{(\sin \theta - 2)(\sin^2 \theta + 2 \sin \theta + 4)}{(\sin \theta - 2)}$$

$$= (1)^2 + 2(1) + 4$$

$$= 6 \quad (3)$$

For TP $y' = 0$

$$-3x^2 + 12x - 9 = 0$$

$$(x-1)(x-3) = 0$$

$$x=1 \text{ or } x=3$$

y-values

$$\text{if } x=1 \text{ then } y = -(1)^3 + 6(1) - 9(1) = -4$$

$$\therefore \text{TP}_1 = (1; -4) \quad \checkmark$$

$$\text{if } x=3 \text{ then } y = -(3)^3 + 6(3) - 9(3) = 0$$

$$\therefore \text{TP}_2 = (3; 0) \quad \checkmark$$

$$\frac{d^2x}{dx^2} = -6x + 12$$

$$\begin{aligned}
 &= -6(1) + 12 \\
 &= +6 \therefore TP_1(1; -4) \text{ Minimum } \checkmark \\
 \frac{d^2 y}{dx^2} &= -6(3) + 12 \\
 &= -6 \therefore TP_2(3; 0) \text{ Maximum } \checkmark
 \end{aligned}$$

$$\frac{d^2 y}{dx^2} = 0 \therefore 6x + 12 = 0$$

$$x = 2$$

$$\therefore y = -(2)^2 + 6(2) - 9(2)$$

$$y = -2$$

The points of inflection (2; 2)

(5)

$$4.4 \quad \frac{ds}{dt} = 5 \cos t + \frac{1}{5} \cos t \cdot \cot t + 1 + 0 + 14\pi t$$

(5)

[20]

QUESTION 5

$$\begin{aligned}
 5.1 \quad &(3-j2)(1+j3) - (1+j)(1-j3) = m + jp \checkmark \\
 &\Rightarrow 3 + j9 - j2 - j^2 6 - 1 + j3 - j + j^2 3 = m + jp \checkmark \\
 &m = 5 \checkmark \\
 &p = 9 \checkmark
 \end{aligned}$$

(4)

$$\begin{aligned}
 5.2 \quad &= \frac{4 \angle 60^\circ \cdot 27 \angle 180^\circ}{8 \angle 80^\circ \cdot 9 \angle 80^\circ \cdot 3 \angle 50^\circ} \checkmark \\
 &= \frac{108 \angle 240^\circ}{216 \angle 160^\circ} \checkmark \\
 &= \frac{108^\circ}{216^\circ} \angle 240^\circ - 160^\circ \checkmark \\
 &= 0.5 \angle 80^\circ \checkmark
 \end{aligned}$$

(4)

$$\begin{aligned}
 5.3 \quad &\frac{3-j2}{2+j} \times \frac{2-j}{2-j} \\
 &= \frac{6-j3-j4+j^2 2}{4-j2+j2-j^2} \checkmark \\
 &= \frac{4-j7}{5} \checkmark \\
 &= \frac{4}{5} - \frac{j7}{5} \checkmark
 \end{aligned}$$

(3)

$$\begin{aligned}
 5.4 \quad & \begin{vmatrix} 3 & -4 & 1 \\ 2 & -3 & 2 \\ 1 & -6 & -3 \end{vmatrix} \\
 &= 3 \begin{vmatrix} -3 & 2 \\ -6 & -3 \end{vmatrix} + 4 \begin{vmatrix} 2 & 2 \\ 1 & 3 \end{vmatrix} + 2 \begin{vmatrix} 2 & -3 \\ 1 & -6 \end{vmatrix} \checkmark \\
 &= 22 \checkmark \\
 & \begin{vmatrix} 3 & -4 & 2 \\ 2 & -3 & 4 \\ 1 & -6 & -7 \end{vmatrix} \\
 &= 3 \begin{vmatrix} -3 & 4 \\ -6 & -7 \end{vmatrix} + 4 \begin{vmatrix} 2 & 4 \\ 1 & -7 \end{vmatrix} + 2 \begin{vmatrix} 2 & -3 \\ 1 & -6 \end{vmatrix} \checkmark \\
 &= 45 \checkmark \\
 & \therefore z = \frac{D_z}{D} = \frac{45}{22} = 2,05 \checkmark \checkmark
 \end{aligned} \tag{6}$$

$$\begin{aligned}
 5.5 \quad & \Rightarrow 2 \begin{vmatrix} m & -1 \\ -4 & 6 \end{vmatrix} - \begin{vmatrix} -1 & \frac{1}{2} \\ -4 & 6 \end{vmatrix} + 6 \begin{vmatrix} \frac{1}{2} & \frac{1}{2} \\ m & -1 \end{vmatrix} = 0 \checkmark \\
 & \Rightarrow 2(6m - 4) - (-4) + 6\left(1 - \frac{m}{2}\right) = 0 \checkmark \\
 & \Rightarrow 9m = -2 \\
 & \therefore m = \frac{-2}{9} \text{ or } -0,222 \checkmark
 \end{aligned} \tag{3}$$

TOTAL: 100