



**higher education
& training**

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

MATHEMATICS N4

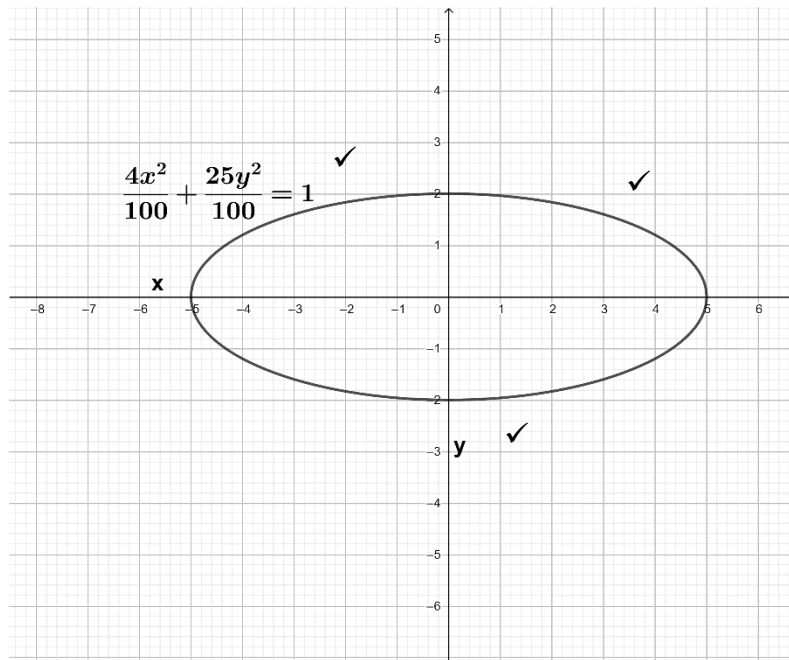
22 November 2023

This marking guideline consists of 9 pages.

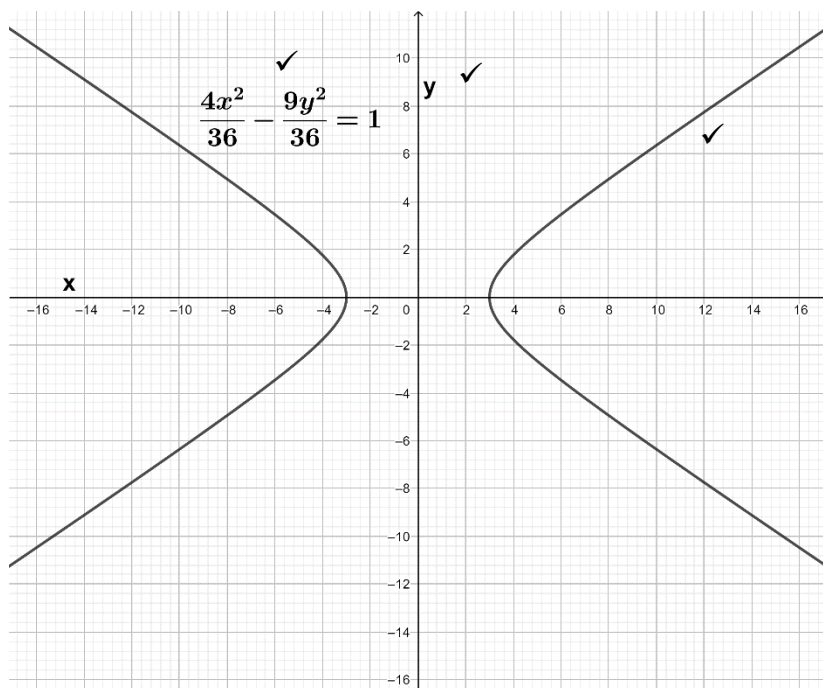
QUESTION 1

1.1

1.1.1



1.1.2



(2 × 3)

(6)

1.2 Let the increase be x then Area $= (10+x)(5+x)$ ✓

Area doubles:

$$\therefore (x+10)(x+5) = 2 \times 50 \checkmark$$

$$x^2 + 15x + 50 = 100$$

$$x^2 + 15x - 50 = 0 \checkmark$$

$$x = \frac{-15 \pm \sqrt{(15)^2 - 4(-50)}}{2}$$

$$x = 2,808 \text{ or } x = -17,808 \text{ (Not applicable)}$$

$\therefore$ New measurement :

$$\text{Length} = 10 + 2,808 \text{ m} = 12,808 \checkmark$$

$$\text{Width} = 5 + 2,808 = 7,808 \text{ m} \checkmark$$

(4)

1.3

$$T = \frac{e^{2x} + 1}{e^{2x} - 1}$$

$$T(e^{2x} - 1) = e^{2x} + 1 \checkmark$$

$$Te^{2x} - T = e^{2x} + 1$$

$$Te^{2x} - e^{2x} = T + 1$$

$$e^{2x}(T - 1) = T + 1 \checkmark$$

$$e^{2x} = \frac{T + 1}{T - 1} \checkmark$$

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

$$2x = \ln \left(\frac{T + 1}{T - 1} \right)$$

$$\therefore x = \ln \sqrt{\frac{T + 1}{T - 1}} \checkmark$$

(5)

1.4

$$12^{x+1} = 36$$

$$(x+1) \ln 12 = \ln 36 \checkmark$$

$$2,485x + 2,485 = 3,584 \checkmark$$

$$2,485x = 1,099 \checkmark$$

$$\therefore x = \frac{1,099}{2,485} \checkmark$$

$$= 0,442 \checkmark$$

(5)

[20]

QUESTION 2

$$\begin{aligned}
 2.1 \quad & -2xj - (-3yj) = 2(x-y) - (-4j) \\
 & -2xj + 3yj = 2x - 2y + 4j \checkmark \\
 & -2x + 3y = 4 \dots\dots\dots (1) \checkmark \\
 & 2x - 2y = 0 \dots\dots\dots (2) \checkmark \\
 & \text{ADD ... (1) and (2) } \therefore y = 4 \checkmark \\
 & \text{Substitute } y \text{ in (2)} \\
 & 2x - 2(4) = 0 \\
 & 2x = 8 \\
 & \therefore x = 4 \checkmark
 \end{aligned}$$

(5)

$$\begin{aligned}
 2.2 \quad 2.2.1 \quad & = 4 \times 2 \sqrt{30^0 + 60^0} \\
 & = 8 \sqrt{90^0} \checkmark
 \end{aligned}$$

$$\begin{aligned}
 2.2.2 \quad & = \frac{4 \sqrt{30^0}}{2 \sqrt{60^0}} \checkmark \\
 & = 2 \sqrt{30^0 - 60^0} \\
 & = 2 \sqrt{-30^0} \checkmark
 \end{aligned}$$

(2 × 3) (6)

$$\begin{aligned}
 2.3 \quad & = 2(j^2)^8 - 9j^2 \cdot j \\
 & = 2(-1)^8 - 9(-1)j \checkmark \\
 & = 2 + 9j \checkmark
 \end{aligned}$$

(2)

2.4

$$\begin{aligned}
 \Delta_0 &= \begin{vmatrix} 1 & 2 & 1 \\ 4 & 2 & -3 \\ 3 & -4 & 4 \end{vmatrix} \\
 &= \begin{vmatrix} 2 & -3 \\ -4 & 4 \end{vmatrix} - 2 \begin{vmatrix} 4 & -3 \\ 3 & 4 \end{vmatrix} + \begin{vmatrix} 4 & 2 \\ 3 & -4 \end{vmatrix} \checkmark \\
 &= -4 - 50 - 22 \\
 &= -76 \checkmark \\
 \Delta_{1/x} &= \begin{vmatrix} \frac{1}{2} & 2 & 1 \\ \frac{2}{3} & 2 & -3 \\ \frac{1}{3} & -4 & 4 \end{vmatrix} \checkmark \\
 &= \frac{1}{2} \begin{vmatrix} 2 & -3 \\ -4 & 4 \end{vmatrix} - 2 \begin{vmatrix} \frac{2}{3} & -3 \\ \frac{1}{3} & 4 \end{vmatrix} + \begin{vmatrix} \frac{2}{3} & 2 \\ \frac{1}{3} & -4 \end{vmatrix} \checkmark \\
 &= -2 - \frac{22}{3} - \frac{10}{3} \checkmark \\
 &= -\frac{38}{3} \checkmark \\
 \therefore \frac{1}{x} &= \frac{\Delta_{1/x}}{\Delta_0} = \frac{-\frac{38}{3}}{-76} = \frac{1}{6} = 6 \checkmark
 \end{aligned}$$

(7)
[20]**QUESTION 3**

3.1

$$\begin{aligned}
 &\frac{\sec^2 \theta - \tan^2 \theta}{1 - \cos^2(360^\circ - \theta)} \\
 &= \frac{1}{\sin^2(360^\circ - \theta)} \checkmark \\
 &= \frac{1}{-\sin^2 \theta} \checkmark \\
 &= -\operatorname{cosec}^2 \theta \checkmark
 \end{aligned}$$

(4)

3.2

$$\cos B = \frac{1}{2}$$

$$\therefore y^2 = r^2 - x^2$$

$$y^2 = 2^2 - 1^2$$

$$y = \sqrt{3} \checkmark$$

$$\therefore \frac{\frac{1}{\sqrt{3}} + \frac{2}{\sqrt{3}}}{\sqrt{3} + \frac{1}{\sqrt{3}}} \checkmark$$

$$\checkmark$$

$$= \frac{\frac{3}{\sqrt{3}}}{\frac{4}{\sqrt{3}}} \checkmark$$

$$= \frac{3}{\sqrt{3}} \times \frac{\sqrt{3}}{4}$$

$$= \frac{3}{4} \checkmark$$

$$\checkmark$$

(5)

3.3

$$\sec 2A + \tan 2A = \frac{\sin A + \cos A}{\cos A - \sin A}$$

$$\therefore \text{LHS} = \sec A + \tan 2A$$

$$= \frac{1}{\cos 2A} + \frac{\sin 2A}{\cos 2A} \checkmark$$

$$= \frac{1 + \sin 2A}{\cos 2A} \checkmark$$

$$= \frac{\sin^2 A + \cos^2 A + 2 \sin A \cos A}{\cos^2 A - \sin^2 A} \checkmark$$

$$= \frac{(\sin A + \cos A)^2}{(\cos A + \sin A)(\cos A - \sin A)} \checkmark$$

$$= \frac{\sin A + \cos A}{\cos A - \sin A} = \text{RHS} \checkmark$$

(5)

3.4

$$2 \sin^2 x - \sin x - 1 = 0$$

$$(2 \sin x + 1)(\sin x - 1) = 0 \checkmark$$

$$\sin x = -\frac{1}{2} \quad \checkmark \quad \text{or} \quad \sin x = 1 \quad \checkmark$$

(6)

$$\begin{aligned} \text{ref } \angle x &= 30^0 \text{ or } x = 90^0; -270^0 \checkmark \\ &= 210^0; 330^0 \text{ and } 90^0; -270^0 \checkmark \\ \text{GS}[\pm 90^0; \pm 210^0; \pm 270^0; 330^0] \checkmark \end{aligned}$$

[20]**QUESTION 4**

4.1

$$\begin{aligned} \lim_{x \rightarrow 0} \left(\frac{\sin^2 x}{1 - \cos x} \right) \\ &= \frac{1 - \cos^2 x}{\cos x} \checkmark \\ &= \frac{(1 - \cos x)(1 + \cos x)}{(1 - \cos x)} \checkmark \\ &= 1 + \cos x \\ &= 1 + \cos 0^0 \\ &= 2 \checkmark \end{aligned} \quad (3)$$

4.2

$$4.2. \quad x^{-5} - 5x^{-6}h - 15x^{-7} \cdot h^2 - 35x^{-8} \cdot h^3 \checkmark \checkmark \checkmark \checkmark \quad (4)$$

4.3

$$\begin{aligned} \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h} \\ \lim_{h \rightarrow 0} &= \frac{(x+h)^4 - 3(x+h) + 6 - (x^4 - 3x + 6)}{h} \checkmark \\ &= \frac{x^4 + \frac{4x^3h}{1!} + \frac{4 \cdot 3x^2h^2}{2!} + \frac{4 \cdot 3 \cdot 2x \cdot h^3}{3!} - 3x - 3h + 6 - x^4 + 3x - 6}{h} \checkmark \\ \lim_{h \rightarrow 0} &= \frac{h(4x^3 + 6x^2h + 4xh^3 - 3)}{h} \checkmark \checkmark \\ &= 4x^3 - 3 \checkmark \end{aligned} \quad (5)$$

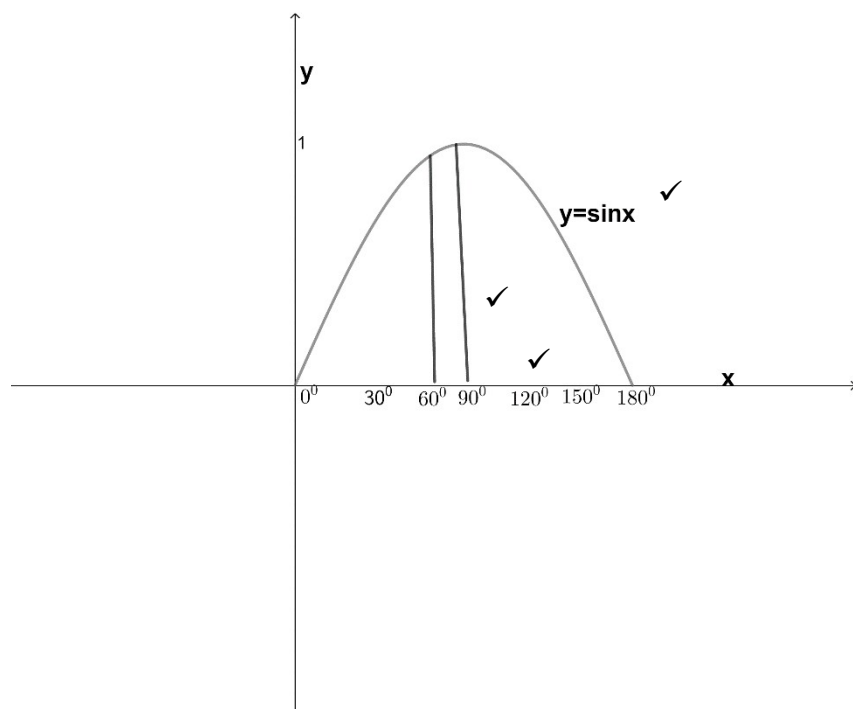
4.4

$$\frac{dy}{dx} = 3 \cdot 2^x \cdot \ln 2 - 3\pi e^{-3x} - 3\cos 3x + \sec^2 x + \sin x + 2\cos x + \frac{3}{2x} - 0 \checkmark \quad (8)$$

[20]

QUESTION 5

5.1



(3)

$$\begin{aligned}
 & \int_0^{180} \sin x \, dx \\
 &= [-\cos x + c]_0^{180} \checkmark \\
 &= -\cos 180^\circ + c - (-\cos 0^\circ + c) \checkmark \\
 &= -(-1) + c - (-1) - c \checkmark \\
 &= 2 \checkmark
 \end{aligned}$$

(4)

5.2

$$\begin{aligned}
 & \int_0^{-1} 3^{-2x} \, dx \\
 &= \left[\frac{3^{-2x}}{-2 \ln 3} + c \right]_0^{-1} \checkmark
 \end{aligned}$$

(4)

$$= \frac{3^{-2(-1)}}{-2 \ln 3} + c - \left(\frac{3^{-2(0)}}{-2 \ln 3} + c \right) \checkmark \checkmark$$

$$= \frac{9}{-2 \ln 3} + c + \frac{1}{2 \ln 3} - c \checkmark$$

$$= -3,641 \checkmark$$

5.3

$$\frac{e^{3x} \checkmark}{3} + \frac{3a^{3x} \checkmark}{3 \ln a} - \frac{10^{2x} \checkmark}{2 \ln 10} + \frac{3}{2} x^{\frac{2}{3} \checkmark} + c \checkmark$$

(5)

$$\begin{aligned} 5.4 \quad & \int (\cos^2 x - \sin^2 x) dx \\ &= \int \cos 2x dx \checkmark \\ &= \frac{\sin 2x}{2} + c \checkmark \end{aligned}$$

(4)
[20]

TOTAL: 100