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.**

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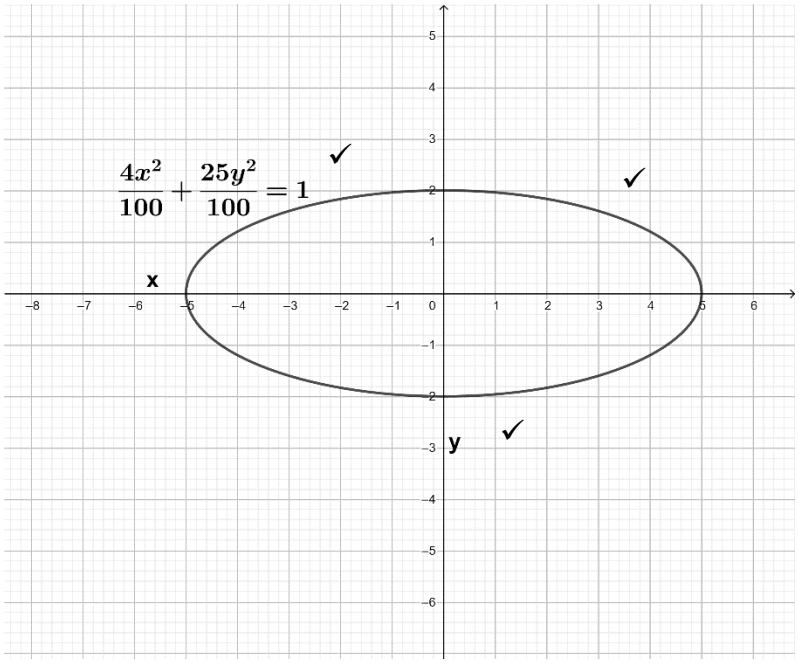
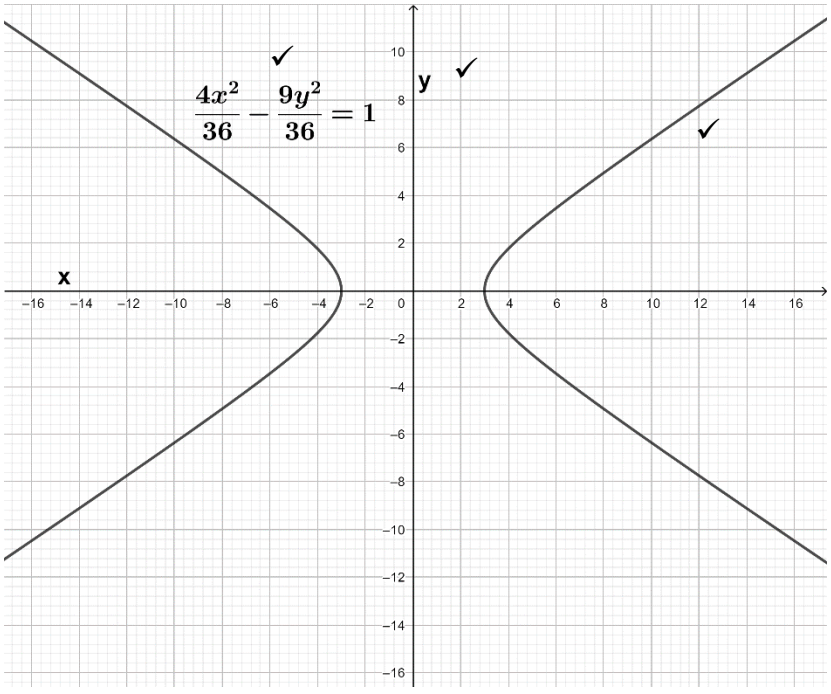
## QUESTION 1

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 :

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

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

$x^2 + 15 - 50 = 0$ ✓

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

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

$\therefore$ New measurement :

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

Width $= 5 + 2{,}808 = 7{,}808\ m$ ✓ (4)

1.3

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

$T(e^{2x}-1) = e^{2x}+1$ ✓

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

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

$e^{2x}(T-1) = T+1$ ✓

$$e^{2x} = \frac{T+1}{T-1}$$ ✓

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

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

$$\therefore x = \ln\sqrt{\frac{T+1}{T-1}}$$ ✓ (5)

1.4 $12^{x+1} = 36$

$(x+1)\ln 12 = \ln 36$ ✓

$2{,}485x + 2{,}485 = 3{,}584$ ✓

$2{,}485x = 1{,}099$ ✓

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

$= 0{,}442$ ✓ (5)

**[20]**

## QUESTION 2

2.1 $-2xj-(-3yj)=2(x-y)-(-4j)$

$-2xj+3yj=2x-2y+4j$ ✓

$-2x+3y=4.....(1)$ ✓

$2x-2y=0.....(2)$ ✓

ADD $...(1)$ and $.....(2)\therefore y=4$ ✓

Substitute $y$ in $(2)$

$2x-2(4)=0$

$2x=8$

$\therefore x=4$ ✓ (5)

2.2 2.2.1 $= \overset{\checkmark}{4}\times 2\,\angle 30^0+60^0$

$=8\,\angle 90^0$ ✓

2.2.2 $=\dfrac{\angle 4\ 30^0}{\angle 2\ 60^0}$ ✓

$=2\ \angle 30^0-60^0$

$=2\ -\angle 30^0$ ✓

(2 × 3) (6)

2.3 . $=2\left(j^2\right)^8-9j^2.j$

$=2(-1)^8-9(-1)j$ ✓

$=2+9j$ ✓ (2)

2.4

$$\Delta_0 = \begin{vmatrix} 1 & 2 & 1 \\ 4 & 2 & -3 \\ 3 & -4 & 4 \end{vmatrix}$$

$$= \begin{vmatrix} 2 & -3 \\ -4 & 4 \end{vmatrix} - 2\begin{vmatrix} 4 & -3 \\ 3 & 4 \end{vmatrix} + \begin{vmatrix} 4 & 2 \\ 3 & -4 \end{vmatrix} \checkmark$$

$$= -4 - 50 - 22$$

$$= -76 \checkmark$$

$$\Delta_{1/x} = \begin{vmatrix} 1/2 & 2 & 1 \\ 2/3 & 2 & -3 \\ 1/3 & -4 & 4 \end{vmatrix} \checkmark$$

$$= \frac{1}{2}\begin{vmatrix} 2 & -3 \\ -4 & 4 \end{vmatrix} - 2\begin{vmatrix} 2/3 & -3 \\ 1/3 & 4 \end{vmatrix} + \begin{vmatrix} 2/3 & 2 \\ 1/3 & -4 \end{vmatrix} \checkmark$$

$$= -2 - \frac{22}{3} - \frac{10}{3} \checkmark$$

$$= -\frac{38}{3} \checkmark$$

$$\therefore \frac{1}{x} = \frac{\Delta_{1/x}}{\Delta_0} = \frac{-38/3}{-76} \checkmark = \frac{1}{6} = 6 \checkmark$$

(7)
**[20]**

## QUESTION 3

3.1

$$\frac{\sec^2\theta - \tan^2\theta}{1 - \cos^2(360^0 - \theta)}$$

$$= \frac{1}{\sin^2(360^0 - \theta)} \checkmark \quad \checkmark$$

$$= \frac{1}{-\sin^2\theta} \checkmark$$

$$= -\operatorname{cosec}^2\theta \checkmark$$

(4)

3.2 $\cos B = \frac{1}{2}$

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

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

$y = \sqrt{3}$ ✓

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

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

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

$= \frac{3}{4}$ ✓ (5)

3.3 $\sec 2A + \tan 2A = \frac{\sin A + \cos A}{\cos A - \sin A}$

$\therefore LHS = \sec A + \tan 2A$

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

$= \frac{1 + \sin 2A}{\cos 2A}$ ✓

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

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

$= \frac{\sin A + \cos A}{\cos A - \sin A} = RHS$ ✓ (5)

3.4 $2\sin^2 x - \sin x - 1 = 0$

$(2\sin x + 1)(\sin x - 1) = 0$ ✓

$\sin x = -\frac{1}{2}$ or $\sin x = 1$ ✓

$ref \angle x = 30^0$ ✓ or $x = 90^0; -270^0$ ✓

$= 210^0; 330^0$ and $90^0; -270^0$ ✓

$GS[\pm 90^0; \pm 210^0; \pm 270^0; 330^0]$ ✓ (6)

**[20]**

## QUESTION 4

4.1
$$\lim_{x\to 0}\left(\frac{\sin^2 x}{1-\cos x}\right)$$
$$= \frac{1-\cos^2 x}{\cos x} \checkmark$$
$$= \frac{(1-\cos x)(1+\cos x)}{(1-\cos x)} \checkmark$$
$$= 1+\cos x$$
$$= 1+\cos 0^0$$
$$= 2 \checkmark$$
(3)

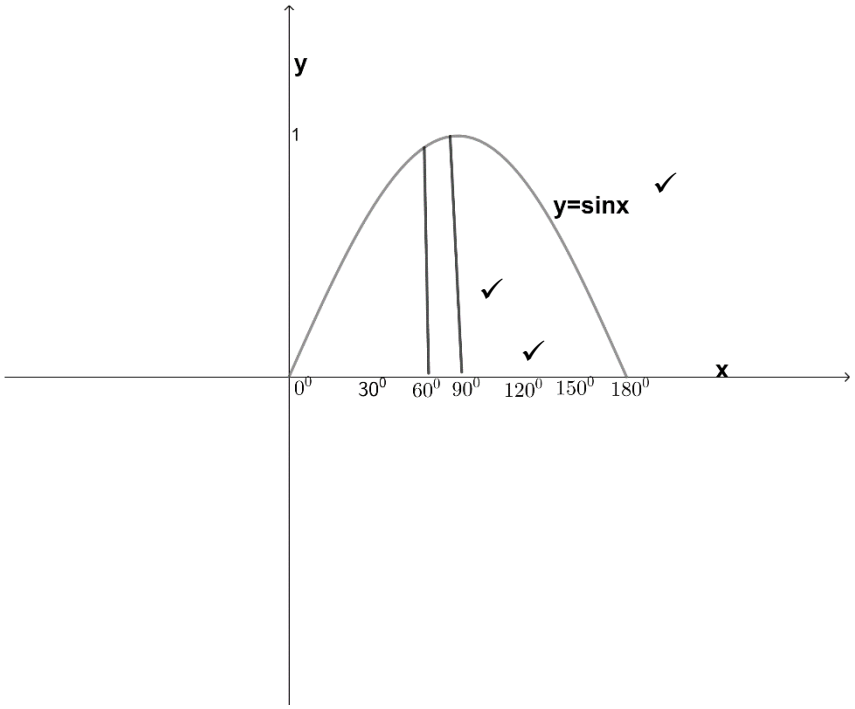
4.2 4.2. $x^{-5} - 5x^{-6}h - 15x^{-7}.h^2 - 35x^{-8}.h^3$ ✓ ✓ ✓ ✓
(4)

4.3
$$\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$$
$$\lim_{h\to 0} = \frac{(x+h)^4 - 3(x+h) + 6 - (x^4 - 3x + 6)}{h} \checkmark$$
$$\lim_{h\to 0} = \frac{x^4 + \frac{4x^3h}{1!} + \frac{4.3x^2h^2}{2!} + \frac{4.3.2x.h^3}{3!} - 3x - 3h + 6 - x^4 + 3x - 6}{h} \checkmark$$
$$\lim_{h\to 0} = \frac{h(4x^3 + 6x^2h + 4xh^3 - 3)}{h} \checkmark\checkmark$$
$$= 4x^3 - 3 \checkmark$$
(5)

4.4
$$\frac{dy}{dx} = 3.2^x.\ln 2 - 3\pi e^{-3x} - 3\cos 3x + \sec^2 x + \sin x + 2\cos x + \frac{3}{2x} - 0 \checkmark$$
(8)
**[20]**

## QUESTION 5

5.1




(3)

$$\int_0^{180} \sin x\,dx$$
$$= \left[-\cos x + c\right]_0^{180} \checkmark$$
$$= -\cos 180^0 + c - \left(-\cos 0^0 + c\right) \checkmark$$
$$= -(-1) + c - (-1) - c \checkmark$$
$$= 2u^2 \checkmark$$

(4)

5.2
$$\int_0^{-1} 3^{-2x}\,dx$$
$$= \left[\frac{3^{-2x}}{-2\ln 3} + c\right]_0^{-1} \checkmark$$
$$= \frac{3^{-2(-1)}}{-2\ln 3} + c - \left(\frac{3^{-2(0)}}{-2\ln 3} + c\right) \checkmark\checkmark$$
$$= \frac{9}{-2\ln 3} + c + \frac{1}{2\ln 3} - c \checkmark$$
$$= -3{,}641 \checkmark$$

(4)

5.3 .
$$\frac{e^{3x}}{3} \checkmark + \frac{3a^{3x}}{3\ln a} \checkmark - \frac{10^{2x}}{2\ln 10} \checkmark + \frac{3}{2} x^{\frac{2}{3}} \checkmark + c \checkmark$$

(5)

5.4 $\int \left(\cos^2 x - \sin^2 x\right) dx$

$= \int \cos 2x dx$ ✓

$= \frac{\sin 2x}{2} + c$ ✓ ✓

(4)
**[20]**

**TOTAL: 100**

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