higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

MATHEMATICS N4

20 November 2024

This marking guideline consists of 7 pages.

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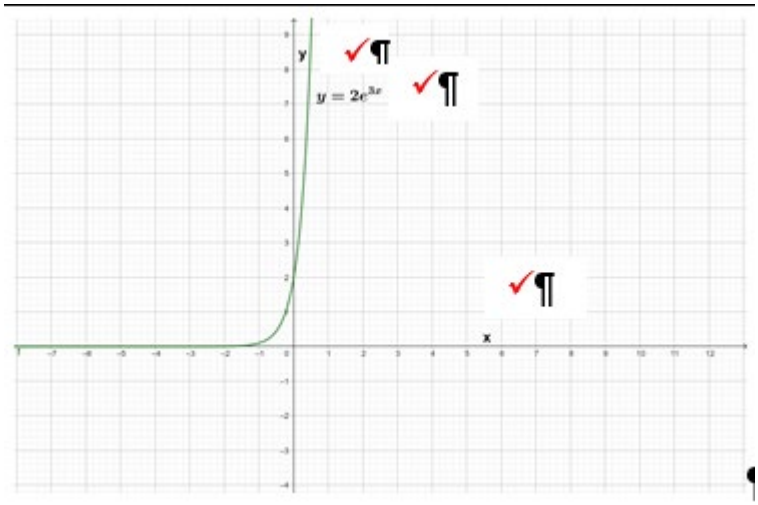
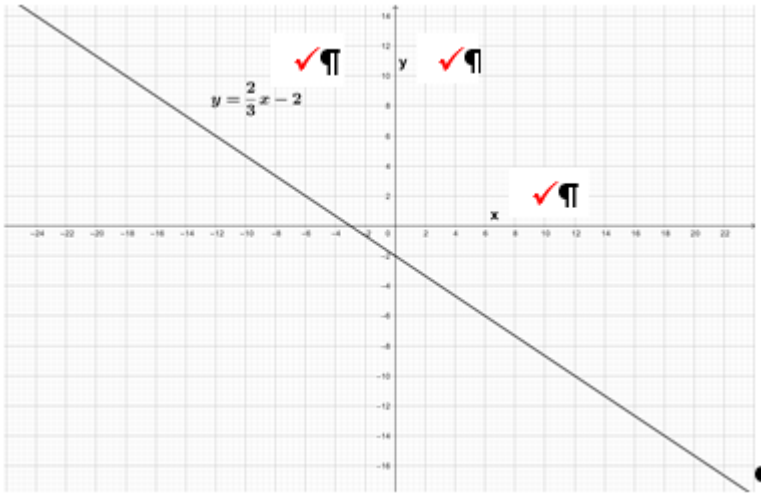
QUESTION 1

1.1



(3)

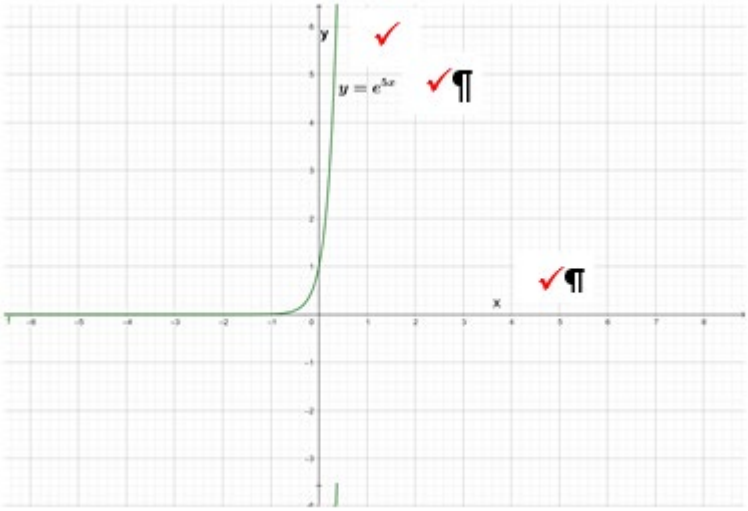
1.2 1.2.1



(3)

1.2.2 Function.✓ (1)

1.3



(3)
[10]

QUESTION 2

2.1 $-18+3j-12j+2j^2=-2x+4jx-2yj+4yj^2$ ✓

$-20-9j=-2x+4xj-4y$ ✓

$-2x-4y=-20.....(1)$ ✓ $\times 2$

$4x-2y=-9.....(2)\times 1$

$-40=-4x-8y.....(3)$

ADD (2) and (3) $\Leftrightarrow$ $-49=-10y$

$\therefore y=\frac{49}{10}$ ✓

$4x=-9+2y$

$x=\frac{-9+2\left(\frac{49}{10}\right)}{4}$

$\therefore x=\frac{1}{5}$ ✓ (5)

2.2 2.2. $=\frac{90^0}{45^0.30^0}$ ✓

$=90^0-75^0$ ✓

$=15^0$ ✓ (3)

2.3 $|r|=\sqrt{(7)^2+(12)^2}$

$=\sqrt{170}\,/13{,}04$ ✓

$\tan\theta=\frac{12}{7}$

$\theta=\tan^{-1}\left(\frac{12}{7}\right)$

$\theta=59{,}74^0$ ✓

$\therefore\theta=360^0-59{,}74^0$

$=300{,}26^0$ ✓

$\therefore\sqrt{170}\left(\cos 300{,}26^0+i\sin 300{,}26^0\right)$ ✓ (4)

2.4
$$\Delta_0 = 2\begin{vmatrix} -2 & 2 \\ 1 & 1 \end{vmatrix} + \begin{vmatrix} 1 & 2 \\ 3 & 1 \end{vmatrix} + \begin{vmatrix} 1 & -2 \\ 3 & 1 \end{vmatrix} \checkmark$$
$$= 2(-4) - 5 + 7 \checkmark$$
$$= 2 \checkmark$$
$$\Delta_z = 2\begin{vmatrix} -2 & 6 \\ 1 & 8 \end{vmatrix} + \begin{vmatrix} 1 & 6 \\ 3 & 8 \end{vmatrix} + 4\begin{vmatrix} 1 & -2 \\ 3 & 1 \end{vmatrix} \checkmark$$
$$= 2(-22) - 10 + 4(7) \checkmark$$
$$= -26 \checkmark$$
$$\therefore \frac{\Delta_z}{\Delta_0} = \frac{-26}{2} = 2 \checkmark\checkmark$$

(8)
[20]

QUESTION 3

3.1
$$\sin(x - 20^0) = \cos(20^0 + x) \checkmark$$
$$\sin(x - 20) = \sin[90^0 - (20^0 + x)] \checkmark$$
$$x - 20^0 = 70^0 - x \checkmark$$
$$2x = 90^0 \checkmark$$
$$x = 45^0 \checkmark$$

(5)

3.2
$$\frac{\cos x}{1 - \sin x} - \frac{\cos x}{1 + \sin x}$$
$$= \frac{\cos x(1 + \sin x) - \cos x(1 - \sin x)}{1 - \sin^2 x} \checkmark \checkmark$$
$$= \frac{2\sin x.\cos x}{\cos^2 x} \checkmark \checkmark$$
$$= 2\tan x \checkmark$$

(5)

3.3
$$LHS = \frac{\sin 2x - \sin x}{\cos 2x + \cos x}$$
$$= \frac{2\sin x.\cos x - \sin x}{\cos^2 x - \sin^2 x + \cos x} \checkmark$$
$$= \frac{\sin x(2\cos x - 1)}{2\cos^2 x + \cos x - 1} \checkmark$$
$$= \frac{\sin x(2\cos x - 1)}{(2\cos x - 1)(\cos x + 1)} \checkmark \checkmark$$
$$= \frac{\sin x}{\cos x + 1} \checkmark$$
$$= RHS$$

(5)

3.4

$$\tan 15^0 = \frac{\frac{1}{2}}{1+\frac{\sqrt{3}}{2}} \checkmark \checkmark$$

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

$$= \frac{1}{2} \times \frac{2}{2+\sqrt{3}} \checkmark$$

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

(5)
[20]

QUESTION 4

4.1

$$\lim_{x\to\infty}\left(\frac{2x^3-x^2+3x+9}{5x^3+3x^2-4}\right)$$

$$\lim_{x\to\infty} = \left(\frac{\frac{2x^3}{x^3}-\frac{x^2}{x^3}+\frac{3x}{x^3}+\frac{9}{x^3}}{\frac{5x^3}{x^3}+\frac{3x^2}{x^3}-\frac{4}{x^3}}\right) \checkmark$$

$$\lim_{x\to\infty} = \left(\frac{2-\frac{1}{x}+\frac{3}{x^2}+\frac{9}{x^3}}{5+\frac{3}{x}-\frac{4}{x^3}}\right) \checkmark$$

$$\lim_{x\to\infty} = \left(\frac{2-\frac{1}{\infty}+\frac{3}{\infty^2}+\frac{9}{\infty^3}}{5+\frac{3}{\infty}-\frac{4}{\infty^3}}\right) \checkmark$$

$$= \frac{2}{5} \checkmark\checkmark$$

(5)

4.2

$$\frac{dy}{dx} = 3y^2 + 2e^{2y} - 2\sin 2y - \frac{2}{y} + 0$$

(5)

4.3 $y = \ln u$ $\qquad$ $u = kx$

$\frac{dy}{du} = \frac{1}{u}$ ✓ $\qquad$ $\frac{du}{dx} = k$ ✓

$$\therefore \frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}$$
$$= \frac{1}{u} \times k \checkmark$$
$$= \frac{1}{x} \checkmark\checkmark$$

(5)

4.4 $$\frac{dy}{dx} = \frac{e^x.\sec x - e^x.\sec x.\tan x}{\sec^2 x}$$

(5)

4.5 $\frac{dy}{dx} = 3x^2 - 4x - 8$ ✓

$\frac{d^2y}{dx^2} = 6x - 4$ ✓

$\frac{d^2y}{dx^2} = 0 \quad \therefore 6x - 4 = 0 \quad \therefore x = \frac{2}{3}$ ✓

$y = \left(\frac{2}{3}\right)^3 - 2\left(\frac{2}{3}\right)^2 - 8\left(\frac{2}{3}\right) = -5{,}93 \quad \therefore$ the points of inflection $(0{,}667; -5{,}93)$ ✓ ✓

(5)

[20]

QUESTION 5

5.1 $$= \frac{-\cos 2x}{2} - 3\cot x + e^{3x} + kx + c$$ ✓ ✓ ✓ ✓ ✓

(5)

5.2 $= \left[2 \ln \sec x\right]_0^{\frac{\pi}{4}}$ ✓

$= 2\left[\ln \sec\left(\frac{\pi}{4}\right) - \ln \sec(0)\right]$ ✓

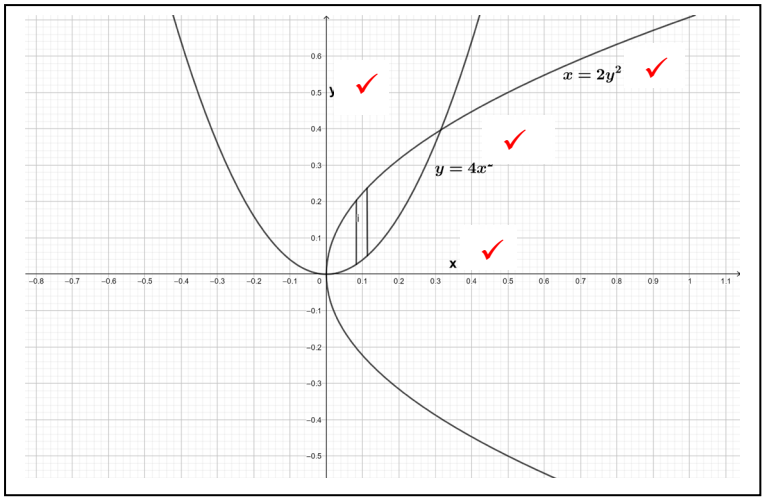
$= 2\left(\ln\left(\frac{1}{\sqrt{2}}\right) - 0\right)$ ✓

$= -0{,}693$ ✓

(4)

5.3
$$\frac{3}{2}\int\frac{(x-3)(x^2+3x+9)}{(x-3)}$$
$$=\frac{3}{2}\int(x^2+3x+9)dx \checkmark\checkmark$$
$$=\frac{3}{2}\left[\frac{x^3}{3}+\frac{3x^2}{2}+9x\right]+c \checkmark$$
$$=\frac{x^3}{2}+\frac{9x^2}{4}+\frac{27}{2}x+c \checkmark$$
(6)

5.4 5.4.1



✓ for area
✓ for strip

(6)

5.4.2
$$A=\int_{x_1}^{x_2}(y_2-y_1)dx$$
$$=\int_0^{0,3}\left(\frac{1}{\sqrt{2}}x^{\frac{1}{2}}-4x^2\right)dx \checkmark$$
$$=\left[\frac{3}{2\sqrt{2}}x^{\frac{3}{2}}-\frac{4}{3}x^3+c\right]_0^{0,3} \checkmark$$
$$=\frac{3}{2\sqrt{2}}(0.3)^{\frac{3}{2}}-\frac{4}{3}(0.3)^3-(0) \checkmark$$
$$=0,138u^2 \checkmark$$
(4)
[25]

TOTAL: 100

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