



**higher education
& training**

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

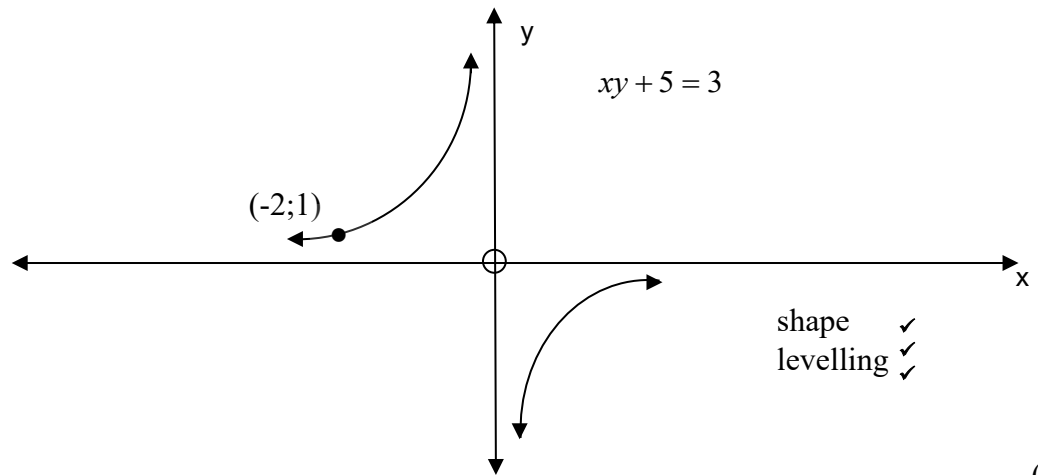
MARKING GUIDELINE

**NATIONAL CERTIFICATE
NOVEMBER EXAMINATION
MATHEMATICS N4
25 NOVEMBER 2016**

This marking guideline consists of 9 pages.

QUESTION

1.1 1.1.1



(3)

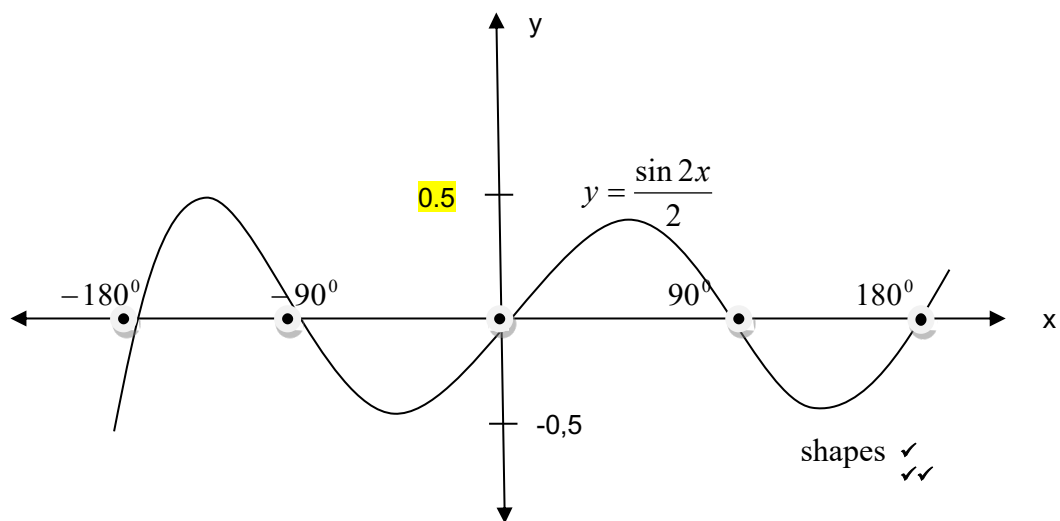
1.1.2 Yes
Function

(1)

1.1.3 Discontinuous

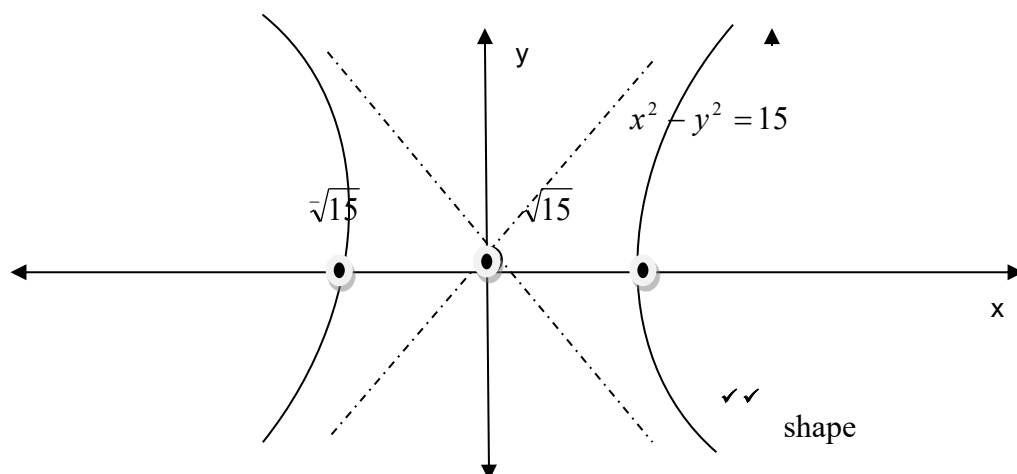
(1)

1.2



(3)

1.3



(2)

1.4

$$|D| = \begin{vmatrix} 1 & \frac{1}{2} & 1 \\ \frac{1}{3} & -\frac{1}{4} & -\frac{1}{2} \\ \frac{1}{2} & \frac{1}{5} & -\frac{1}{2} \end{vmatrix} \checkmark$$

$$|Dy| = 1 \begin{vmatrix} -\frac{1}{4} & -\frac{1}{2} \\ \frac{1}{5} & -\frac{1}{2} \end{vmatrix} - \frac{1}{2} \begin{vmatrix} \frac{1}{3} & -\frac{1}{2} \\ \frac{1}{2} & -\frac{1}{2} \end{vmatrix} + 1 \begin{vmatrix} \frac{1}{3} & -\frac{1}{4} \\ \frac{1}{2} & \frac{1}{5} \end{vmatrix} \checkmark$$

$$= 1 \left(\frac{18}{80} \right) - \frac{1}{2} \left(\frac{1}{12} \right) + 1 \left(\frac{23}{120} \right) \checkmark$$

$$= \frac{18}{80} - \frac{10}{24} + \frac{23}{120}$$

$$= 0,375 \checkmark$$

$$|Dy| = \begin{vmatrix} 1 & \frac{1}{2} & 1 \\ \frac{1}{3} & 1 & -\frac{1}{2} \\ \frac{1}{2} & \frac{1}{3} & -\frac{1}{2} \end{vmatrix} \checkmark$$

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

$$= 1 \left(-\frac{1}{3} \right) - \frac{1}{2} \left(\frac{1}{12} \right) + 1 \left(-\frac{7}{18} \right) \checkmark$$

$$= \frac{-72 - 9 - 84}{216}$$

$$= -0,076388 \checkmark$$

$$y = |Dy| = \frac{-0,076388}{0,375} \checkmark$$

$$|D| = -2,037 \checkmark$$

(10)
[20]

QUESTION 2

2.1

$$x = \frac{+18 \pm \sqrt{-144}}{6} \quad \checkmark$$

$$x = \frac{18 \pm j\sqrt{144}}{6} \quad \checkmark$$

$$x_1 = \frac{18 + j12}{6} \text{ and/or } x_2 = \frac{18 - j12}{6} \quad \checkmark$$

$$x_1 = 3 + j2 \text{ and/or } x_2 = 3 - j2 \quad (4)$$

2.2 2.2.1 $\bar{z} = \frac{3}{10} + j\frac{30}{6} \quad \checkmark \quad (1)$

2.2.2

$$r = \sqrt{\left(\frac{3}{10}\right)^2 + \left(\frac{30}{6}\right)^2}$$

$$r = \sqrt{25,09}$$

$$r = 5,009 \quad \checkmark$$

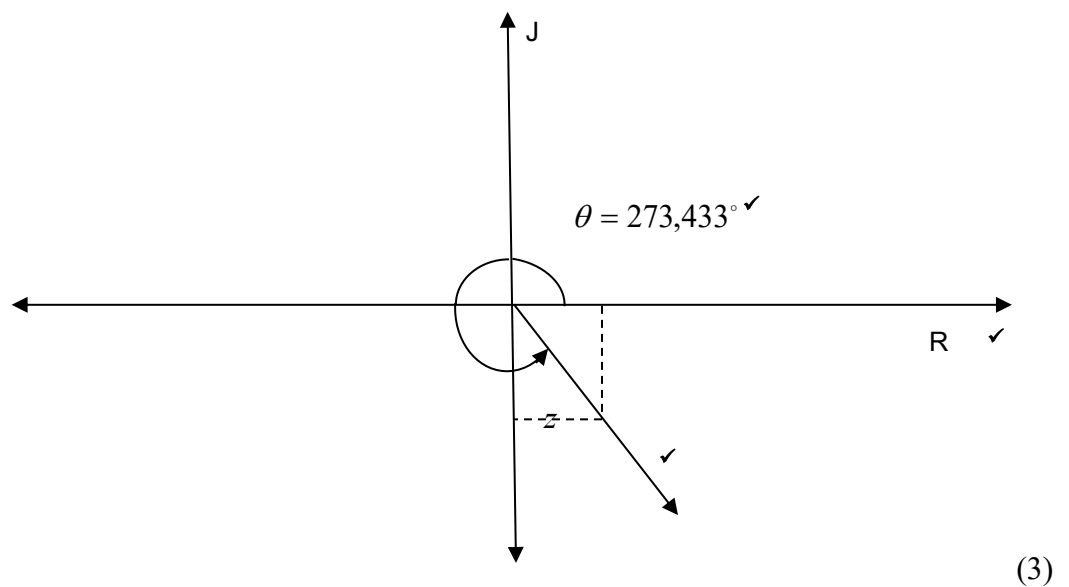
$$\alpha = \tan^{-1} \frac{y}{x}$$

$$\alpha = 86,556^\circ$$

$$\theta = 360^\circ - 86,566^\circ$$

$$\theta = 273,433^\circ \quad \checkmark \quad (2)$$

2.2.3



2.3

$$\left[(2x + 5y) - (x - 3y) \right] \left[(2x + 5y)^2 + (2x^2 - 11xy + 15y^2) + (x - 3y)^2 \right] \quad \checkmark \quad \checkmark \quad \checkmark \quad (3)$$

$$\begin{aligned}
 2.4 \quad te^{at} &= \frac{P + \cos x}{\sin x} \quad \checkmark \\
 e^{at} &= \frac{P + \cos x}{t \sin x} \quad \checkmark \\
 at &= \ln\left(\frac{P + \cos x}{t \sin x}\right) \quad \checkmark \\
 a &= \frac{\ln\left(\frac{P + \cos x}{t \sin x}\right)}{t} \quad \checkmark
 \end{aligned}
 \tag{4}$$

$$\begin{aligned}
 2.5 \quad (2y + 2)\ln 5 &= (5y - 1)\ln 3 \quad \checkmark \\
 3,219y + 3,219 &= 5,493y - 1,099 \quad \checkmark \\
 2,274y &= 4,318 \\
 y &= 1,899 \quad \checkmark
 \end{aligned}
 \tag{3}$$

[20]

QUESTION 3

$$\begin{aligned}
 3.1 \quad \tan(x + y) &= \frac{\tan x + \tan y}{1 - \tan x \cdot \tan y} \\
 &= \frac{-\frac{1}{2} + -\frac{1}{3}}{1 - \left(-\frac{1}{2}\right)\left(-\frac{1}{3}\right)} \quad \checkmark \\
 &= \frac{-\frac{5}{6}}{1 - \frac{1}{6}} \quad \checkmark \\
 &= -\frac{5}{6} \times \frac{6}{5} \\
 &= -1 \quad \checkmark
 \end{aligned}
 \tag{3}$$

$$\begin{aligned}
 3.2 \quad \frac{2 \sin \theta \cos \theta}{2} &+ \frac{(\sin \theta + \cos \theta)(\sin^2 \theta - \sin \theta \cos \theta) + \cos^2 \theta}{\sin \theta + \cos \theta} \\
 &= \sin \theta \cos \theta + \sin^2 \theta - \sin \theta \cos \theta + \cos^2 \theta \quad \checkmark \\
 &= \sin \theta \cos \theta + 1 - \sin \theta \cos \theta \quad \checkmark \\
 &= 1 \quad \checkmark
 \end{aligned}
 \tag{5}$$

$$\begin{aligned}
 3.3 \quad \cos 22,5^\circ &= \cos \frac{45^\circ}{2} = \pm \sqrt{\frac{\cos 45^\circ + 1}{2}} \quad \checkmark \\
 &= \pm \sqrt{\frac{\frac{\sqrt{2}}{2} + 1}{2}} \quad \checkmark \\
 &= \pm \sqrt{\frac{\sqrt{2} + 2}{2}} \quad \checkmark \\
 &= \pm \frac{\sqrt{\sqrt{2} + 2}}{2} \quad \checkmark
 \end{aligned}
 \tag{4}$$

$$\begin{aligned}
 3.4 \quad &\frac{1 + 2 \sin \theta}{\cos \theta + 2 \sin \theta \cos \theta} \quad \checkmark \\
 &\frac{1 + 2 \sin \theta}{\cos \theta (1 + 2 \sin \theta)} \quad \checkmark \\
 &\frac{1}{\cos \theta} \quad \checkmark \\
 &= \sec \theta
 \end{aligned}
 \tag{3}$$

$$\begin{aligned}
 3.5 \quad &5(\sec^2 \theta - 1) + 8 \sec \theta - 1 = 0 \quad \checkmark \\
 &5 \sec^2 \theta + 8 \sec \theta - 6 = 0 \\
 &\sec \theta = \frac{-8 \pm \sqrt{64 - 4(5)(-6)}}{10} \\
 &\sec \theta = \frac{-8 \pm \sqrt{184}}{10} \quad \checkmark \\
 &\sec \theta = 0,556 \quad \text{and / or} \quad \sec \theta = -2,156 \\
 &\theta_1 = \text{invalid} \quad \checkmark \\
 &\theta_2 = 180^\circ - 2 \\
 &\quad = 180^\circ - 62,366^\circ \\
 &\quad = 117,634^\circ \quad \checkmark \\
 &\theta_3 = 180^\circ + 62,366^\circ \\
 &\quad = 242,366^\circ \quad \checkmark
 \end{aligned}
 \tag{5}$$

[20]

QUESTION 4

$$4.1 \quad \frac{dy}{dx} = 3(\pi^x) \ln \pi + \frac{1}{3} \left(\frac{1}{x \ln 3} \right) + \frac{1 \operatorname{cosec}^2 x}{3} - \frac{1}{2\sqrt{x}} - 3 \operatorname{cosec} x \cot x \quad (5)$$

$$4.2 \quad u = \sqrt{x}$$

$$u^1 = \frac{1}{2\sqrt{x}} \quad \checkmark$$

$$v = x^2 + x + 1 \quad \checkmark$$

$$v^1 = 2x + 1 \quad \checkmark$$

$$\frac{dy}{dx} = \sqrt{x}(2x+1) + \frac{1}{2\sqrt{x}}(x^2 + x + 1) \quad \checkmark \quad (4)$$

$$4.3 \quad \frac{dy}{dx} = 9x^2 + 18x \quad \checkmark$$

$$\frac{d^2y}{dx^2} = 18x + 18 \quad \checkmark$$

$$18x + 18 = 0$$

$$18x = -18 \quad \checkmark$$

$$x = -1 \quad \checkmark \quad (4)$$

$$4.4 \quad \frac{dy}{dx} = 6x^2 - 8$$

$$6x^2 - 8 = 0 \quad \checkmark$$

$$6x^2 = 8$$

$$x_1 = \frac{2}{\sqrt{3}} \text{ and } x_2 = -\frac{2}{\sqrt{3}} \quad \checkmark$$

$$y_1 = 2 \left(\frac{2}{\sqrt{3}} \right)^3 - 8 \left(\frac{2}{\sqrt{3}} \right)$$

$$= -6,155 \quad \checkmark$$

$$y_2 = 2 \left(-\frac{2}{\sqrt{3}} \right)^3 - 8 \left(-\frac{2}{\sqrt{3}} \right)$$

$$= 6,155 \quad \checkmark$$

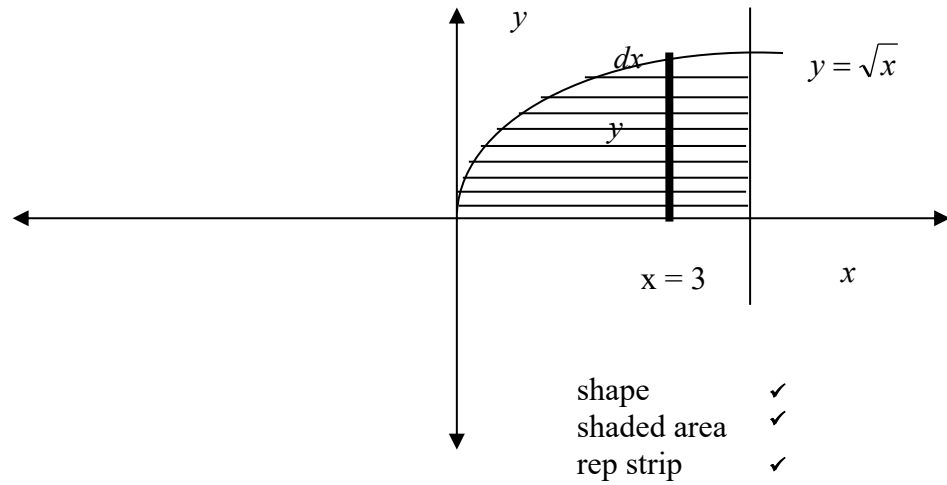
$$\text{at } x = \frac{2}{\sqrt{3}} \quad \frac{d^2y}{dx^2} > 0 \quad \text{and} \quad \text{at } x = -\frac{2}{\sqrt{3}} \quad \frac{d^2y}{dx^2} < 0$$

$$m \left(\frac{2}{\sqrt{3}}; -6,155 \right) \quad \checkmark \quad M \left(-\frac{2}{\sqrt{3}}; 6,155 \right) \quad \checkmark$$

(7)
[20]

QUESTION 5

5.1 5.1.1



(3)

5.1.2

$$\begin{aligned}
 A_{ox} &= \int_0^3 \sqrt{x} dx \quad \checkmark \\
 &= \left[\frac{x^{\frac{3}{2}}}{\frac{3}{2}} \right]_0^3 \quad \checkmark \\
 &= \left[\frac{3^{\frac{3}{2}}}{\frac{3}{2}} - 0 \right] \quad \checkmark \\
 &= 3,464u^2 \quad \checkmark
 \end{aligned}$$

(4)

5.2

$$\begin{aligned}
 &\left[2x - \frac{x^{\frac{3}{2}}}{\frac{3}{2}} \right]_0^2 \quad \checkmark \\
 &= \left[2(2) - \frac{2^{\frac{3}{2}}}{\frac{3}{2}} \right] - 0 \quad \checkmark \\
 &= 2,114 \quad \checkmark
 \end{aligned}$$

(3)

5.3

$$3x^3 + \frac{6}{\sqrt{x}} + \frac{3 \cdot 7^{-3x}}{-3 \cdot \ln 7} - \frac{4 \ln \sec \frac{4}{x}}{4} - 3 \sec x + c \quad \checkmark$$

$$\begin{array}{ccccccccccc} 3x^3 & + & \frac{6}{\sqrt{x}} & + & \frac{7^{-3x}}{\ln 7} & - & \ln \sec \frac{4}{x} & - & 3 \sec x & + & c \\ \checkmark & & \checkmark & & \checkmark & & \checkmark & & \checkmark & & \checkmark \end{array} \quad (7)$$

5.4

$$\frac{\sin 2y}{2} - \frac{\cos 2y}{2} + c \quad \checkmark$$

(3)
[20]

TOTAL: 100