higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

MATHEMATICS N4

25 JULY 2018

This marking guideline consists of 9 pages.

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QUESTION 1

1.1
$$\frac{\sin(180°+30°).\tan(180°+45°).\cos(360°-45°)}{\sin(-45°).\cos(180°+60°)}$$
$$\frac{(-\sin 30°).(\tan 45°).\cos(45°)}{(-\sin 45°).(-\cos 60°)} \checkmark$$
$$\frac{\frac{-1}{2}.1.\frac{1}{\sqrt{2}}}{\frac{-1}{\sqrt{2}}.\frac{-1}{2}} \checkmark$$
$$-1 \checkmark$$
(3)

1.2
$$2(1-2\sin^2 c)+3\sin c-1=0 \checkmark$$
$$4\sin^2 c-3\sin c-1=0$$
$$(4\sin c+1)(\sin c-1)=0 \checkmark$$
$$\sin c=\frac{-1}{4} \; or/of \; \sin c-1$$
$$c_1=90° \checkmark$$
$$c_2=180°+\arcsin 0{,}25$$
$$c_2=194{,}478° \checkmark$$
$$c_3=360°-\arcsin 0{,}25$$
$$c_3=345{,}522° \checkmark$$
(5)

1.3 1.3.1
$$\sin^2\frac{x}{2}=\frac{1-\cos x}{2} \checkmark$$
$$\sin\frac{x}{2}=\pm\sqrt{\frac{1-\cos x}{2}} \checkmark$$
(2)

1.3.2
$$\sin 15°=\sin\frac{30°}{2}=\pm\sqrt{\frac{1-\cos 30°}{2}} \checkmark$$
$$=\pm\sqrt{\frac{1-\frac{\sqrt{3}}{2}}{2}}$$
$$=\pm\sqrt{\frac{\sqrt{3}-1}{4}} \checkmark$$
$$\sin 15°=\pm\frac{\sqrt{\sqrt{3}-1}}{2} \checkmark$$
(3)

1.4 $2-\sec^2 y=\cos 2y\left(\tan^2 y+1\right)$

$RHS=\left(2\cos^2-1\right)\sec^2 y$ ✓

$=2\cos^2 y\sec^2 y-\sec^2 y$ ✓

$RHS=2-\sec^2 y$ ✓

$LHS=RHS$ ✓

(4)

1.5 $\left(\cos 15°\right)^2=\left[\cos(60°-45°)\right]^2$

$=\left(\cos 60°\cos 45°+\sin 60°\sin 45°\right)^2$

$=\left(\frac{1}{2}.\frac{1}{\sqrt{2}}+\frac{\sqrt{3}}{2}.\frac{1}{\sqrt{2}}\right)^2$ ✓

$=\left(\frac{1+\sqrt{3}}{2\sqrt{2}}\right)$ ✓

$=\frac{2+\sqrt{3}}{4}$ ✓

(3)

[20]

QUESTION 2

2.1 2.1.1 $Aox=\int_0^{\pi/2}3\sin x\,dx$ ✓

$=\left[-3\cos x\right]_0^{\pi/2}$ ✓

$=-3\cos\pi/2-\left(-\cos 0\right)$ ✓

$=0+3$

$=3u^2$ ✓

(4)

2.1.2 $\frac{dy}{dx}=3\cos x$ ✓

$0=3\cos x$ ✓

$x_1=90°;x_2=360°-90°=270°$ ✓

$y_1=3\sin 90°;y_2=3\sin 270°$ ✓

$=3 \qquad =-3$ ✓

$TP_s:(90°,3);(270°,3)$ ✓

(6)

2.1.3 $\frac{d^2y}{dx^2} = -3\sin x$ ✓

$for \quad x = 90°: \frac{d^2y}{dx^2} = -3\sin 90° = -3, < 0 Max = (90°, 3)$ ✓

$for \quad x = 270°: \frac{d^2y}{dx^2} = -3\sin 270° = 3 > 0 Min = (270°, -3)$ ✓ (3)

2.2 $\frac{-4}{3}e^{3x} - 2\cos x + \sec x - \frac{2\sqrt{5}}{3}\sqrt{x^3} + 5x + \frac{2^{-3x}}{In3} + c$ ✓ ✓ ✓ ✓ ✓ ✓ ✓ (7)
[20]

QUESTION 3

3.1 $Let \quad u = x^5 - 7x \quad and/en \quad y = \tan u$

$\frac{du}{dx} = 5x^4 - 7$ ✓ $\quad \frac{dy}{du} = \sec^2 u$ ✓

$\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}$

$= \sec^2 u \times (5x^4 - 7)$ ✓

$\frac{dy}{dx} = (5x^4 - 7)\sec^2(x^5 - 7x)$ ✓ (4)

3.2 $\frac{dx}{dy} = \frac{-3}{5\sqrt[5]{y^6}} + 3\pi \sin 3\pi y + 22e^{-22y} - \frac{6}{y}$ ✓ ✓ ✓ ✓ ✓ (4)

3.3 $\lim_{x \to \infty} \left(\frac{\frac{2x^2}{x^2} - \frac{8}{x^2}}{\frac{x^2}{x^2} + \frac{2}{x^2}} \right)$ ✓

$\lim_{x \to \infty} \left(\frac{2 - \frac{8}{x^2}}{1 - \frac{2}{x^2}} \right)$ ✓

$= \frac{2 - \frac{8}{(\infty)^2}}{1 - \frac{2}{(\infty)^2}}$

$= 2$ ✓ (3)

3.4
$$f(x) = -x^3$$
$$f(x+h) = -(x+h)^3 = -\left[x^3 + 3x^2h + 3xh^2 + h^3\right] \checkmark$$
$$f(x+h) - f(x) = -x^3 - 3x^2h - 3xh^2 - h^3 - \left(-x^3\right)$$
$$= -3x^2h - 3xh^2 - h^3 \checkmark$$
$$\frac{f(x+h)-f(x)}{h} = \frac{-3x^2h - 3xh^2 - h^3}{h} = -3x^2 - 3xh - h^2 \checkmark$$
$$\lim_{h \to 0}\left[\frac{f(x+h)-f(x)}{h}\right] = -3x^2 - 3x(0) - (0)^2$$
$$= -3x^2 \checkmark \quad (4)$$

3.5
$$= \left[\frac{t^4}{4} + \frac{t^2}{2}\right]_0^4 \checkmark$$
$$= \left[\frac{4^4}{4} + \frac{4^2}{2}\right] \checkmark$$
$$= 64 + 8$$
$$= 72 \checkmark \quad (3)$$

3.6
$$\int \sec x.\tan x dx \checkmark$$
$$= \sec x + c \checkmark \quad (2)$$

[20]

QUESTION 4

4.1
$$1.8x + j3.4y = \frac{7 + j5}{2 - j} \times \frac{2 + j}{2 + j} \checkmark$$
$$= \frac{9 + j17}{5}$$
$$1.8x = \frac{9}{5} \text{.....(1)}$$
$$3.4y = \frac{17}{5} \text{.....(2)} \checkmark$$
$$x = \frac{\frac{9}{5}}{1.8} = 1 \checkmark$$
$$y = \frac{\frac{17}{5}}{3.4} = 1 \checkmark \quad (4)$$

4.2
$$\left(\sqrt{17}\left|\underline{195,596°}\right.\right)^5 \quad ✓$$
$$1191,5775\left|\underline{977,98°}\right. \quad ✓$$
$$1191,578\left(\cos 977,98° + j\sin 977,98°\right) \quad ✓$$
$$-1121,005 - j403,9847 \qquad (4)$$

4.3
$$z = \frac{10\left|\underline{-15°}\right.}{12\left|\underline{12°}\right.} \quad ✓$$
$$\gamma = \frac{10}{12} \quad ✓$$
$$\theta = -27° \quad ✓ \qquad (3)$$

4.4
$$|D| = \begin{vmatrix} 7 & -6 \\ 3 & 4 \end{vmatrix}$$
$$= 7(4) - (-6)3$$
$$|D| = 46 \quad ✓$$
$$|Da| = \begin{vmatrix} 27 & -6 \\ 5 & 4 \end{vmatrix}$$
$$|Da| = 138 \quad ✓$$
$$|Db| = \begin{vmatrix} 7 & 27 \\ 3 & 5 \end{vmatrix}$$
$$|Db| = -46 \quad ✓$$
$$a = \frac{|Da|}{|D|} = \frac{138}{46}$$
$$a = 3 \quad ✓$$
$$b = \frac{|Db|}{|D|} = \frac{-46}{46}$$
$$b = -1 \quad ✓ \qquad (5)$$

4.5 4.5.1

$$|D| = 0\begin{vmatrix} -1 & 0 \\ 0 & \frac{-1}{3} \end{vmatrix} + \frac{1}{2}\begin{vmatrix} \frac{1}{2} & \frac{1}{3} \\ 0 & \frac{-1}{3} \end{vmatrix} - (-3)\begin{vmatrix} \frac{1}{2} & \frac{1}{3} \\ -1 & 0 \end{vmatrix} \quad ✓$$

$$= 0 + \frac{1}{2}\left(\frac{-1}{6}\right) + 3\left(\frac{1}{3}\right) \quad ✓$$

$$= \frac{-1}{12} + 1$$

$$= 0{,}916 \quad ✓$$

(3)

4.5.2

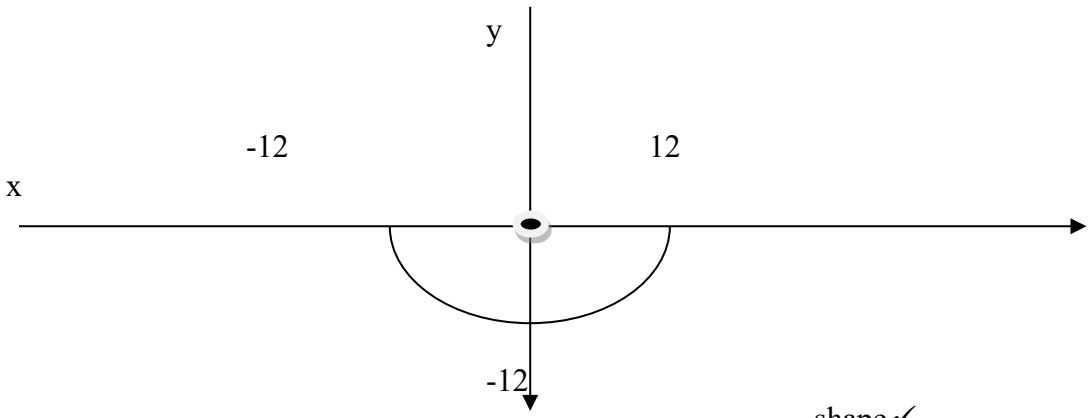
$$(-)\begin{vmatrix} 0 & \frac{1}{3} \\ -3 & \frac{-1}{3} \end{vmatrix}$$

$$= -1 \quad ✓$$

(1)
[20]

QUESTION 5

5.1 5.1.1



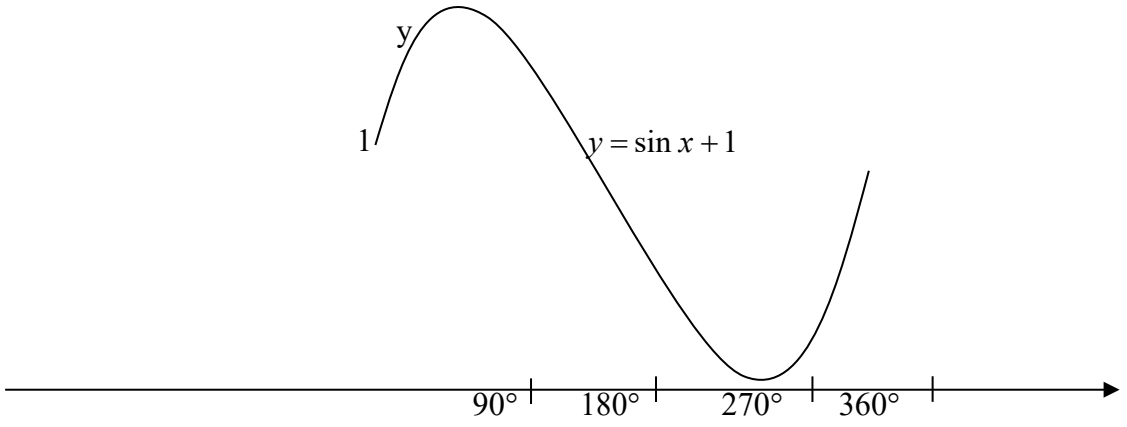
shape ✓
-12 ✓

(2)

5.1.2 $Domain = \{x : -12 \le x \le 12, xER\}$
$Range = \{y : -12 \le 12, yER\}$ ✓ (1)

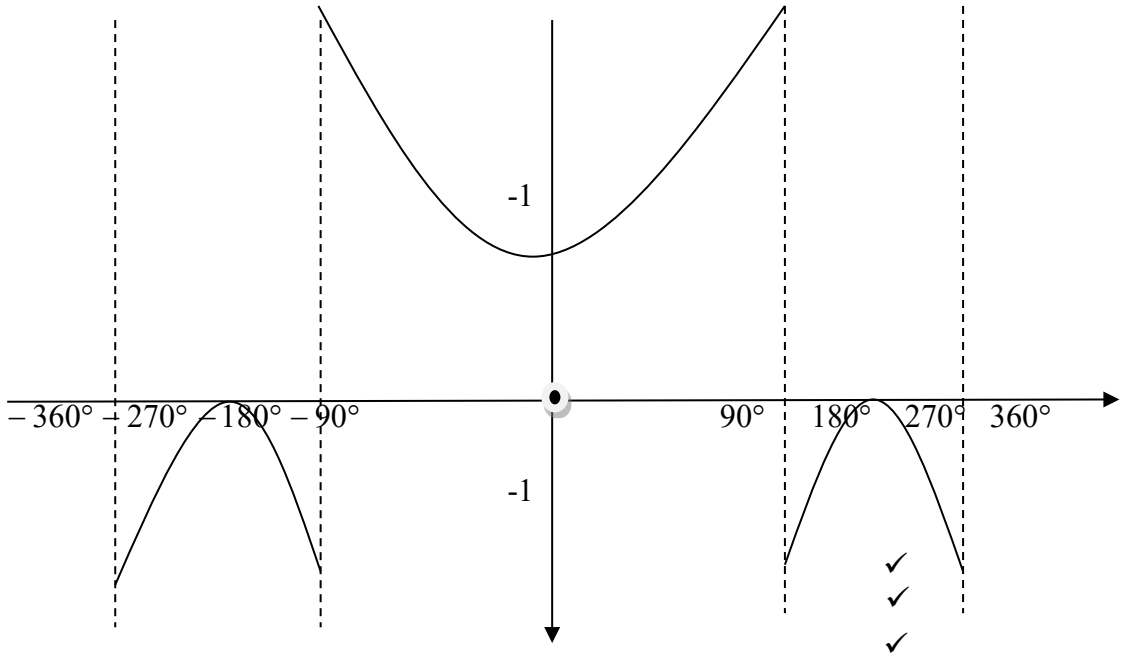
5.1.3 $x = -\sqrt{144 - y^2}$ ✓ (1)

5.2



Shape ✓
$y = 1$ ✓
$x = 270°$ ✓ (3)

5.3



✓
✓
✓
shape (3)

5.4

$$\frac{1-y}{1-y^2} = \frac{R5}{R1}$$

$$1-y^n = \frac{R1}{R5}(1-y) \checkmark$$

$$y^n = 1-\frac{R1}{R5}(1-y) \checkmark$$

$$n\ln y = \ln\left[1-\frac{R1}{R5}(1-y)\right] \checkmark$$

$$n = \frac{\ln\left[1-\frac{R1}{R5}(1-y)\right]}{\ln y} \checkmark$$

(4)

5.5 $[8(a-1)-(a+1)][64(a-1)^2+8(a-1)(a+1)+(a+1)^2]$ ✓ ✓ ✓ (3)

5.6 $(3y+2)\ln 15=(8+y)\ln 2$ ✓

$8{,}124y+5{,}416=5{,}5452+0{,}69314y$ ✓

$7{,}43ly=0{,}1292$

$y=0{,}0174$ ✓ (3)

[20]

TOTAL: 100

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