



**higher education
& training**

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

MATHEMATICS N3

8 April 2021

This marking guideline consists of 9 pages.

QUESTION 1

$$\begin{aligned}
 1.1 \quad & 2(p-1)^2 + 7(p-1) - 15 \\
 &= [2(p-1) - 3][(p-1) + 5] \quad \checkmark \checkmark \\
 &= (2p - 2 - 3)(p - 1 + 5) \quad \checkmark \\
 &= (2p - 5)(p + 4) \quad \checkmark
 \end{aligned}$$

(4)

$$\begin{aligned}
 1.2 \quad 1.2.1 \quad & \frac{2ab}{a^2 - b^2} + \frac{a}{b - a} + \frac{a}{a + b} + 1 \\
 &= \frac{2ab}{(a - b)(a + b)} - \frac{a}{(a - b)} + \frac{a}{a + b} + 1 \\
 &= \frac{2ab - a(a + b) + a(a - b) + (a - b)(a + b)}{(a - b)(a + b)} \quad \checkmark \\
 &= \frac{2ab - a^2 - ab + a^2 - ab + (a - b)(a + b)}{(a - b)(a + b)} \quad \checkmark \\
 &= \frac{(a - b)(a + b)}{(a - b)(a + b)} \quad \checkmark \\
 &= 1 \quad \checkmark
 \end{aligned}$$

(6)

$$\begin{aligned}
 1.2.2 \quad & \frac{4^{\frac{x}{2}} + 4^{\frac{x}{2}-1}}{2^{x+2} + 2^x} \\
 &= \frac{2^{2(\frac{x}{2})} + 2^{2(\frac{x}{2})-1} \bullet 2^{-1}}{2^x \bullet 2^2 + 2^x} \quad \checkmark \\
 &= \frac{2^x (1 + \frac{1}{4})}{2^x (4 + 1)} \quad \checkmark \\
 &= \frac{5}{4} \times \frac{1}{5} \quad \checkmark \\
 &= \frac{1}{4} \quad \checkmark
 \end{aligned}$$

(5)

$$\begin{aligned}
 1.3 \quad & \text{Let } x = 2 \\
 & \therefore 2m(2)^3 + (2)^2 - 2 + 2 = 5 \quad \checkmark \\
 & 16m + 4 = 5 \quad \checkmark \\
 & 16m = 1 \\
 & m = \frac{1}{16} \quad \checkmark
 \end{aligned}$$

(3)

[18]

QUESTION 2

$$\begin{aligned}
 2.1 \quad & \frac{B^{n+1} + B^n}{B^{3n} - 9B^n} (B^n - 3) \\
 &= \frac{B^n (B + 1)}{B^n (B^{2n} - 9)} \times (B^n - 3) \\
 &= \frac{B + 1}{(B^n - 3)(B^n + 3)} \times (B^n - 3) \\
 &= \frac{B + 1}{B^n + 3}
 \end{aligned}
 \tag{4}$$

$$\begin{aligned}
 2.2 \quad 2.2.1 \quad & \frac{4^{\frac{1}{2}x} \bullet 8^{-x+1}}{16^{x+2}} = 4 \\
 & 4^{\frac{x}{2}} \bullet 8^{-x+1} = 4 \bullet 16^{x+2} \\
 & 2^{\frac{2x}{2}} \bullet 2^{-3x+3} = 2^2 \bullet 2^{4x+8} \\
 & 2^{-2x+3} = 2^{4x+10} \\
 & -2x + 3 = 4x + 10 \\
 & -6x = 10 - 3 \\
 & x = -\frac{7}{6}
 \end{aligned}
 \tag{4}$$

$$\begin{aligned}
 2.2.2 \quad & 2 \log_x 4 - \log_x \frac{1}{2} = 3 - \log_x 54 \\
 & \log_x 4^2 - \log_x \frac{1}{2} = 3 - \log_x 54 \\
 & \log_x \frac{16}{\frac{1}{2}} = 3 - \log_x 54 \\
 & \log_x 32 + \log_x 54 = 3 \\
 & \log_x 32 \times 54 = 3 \\
 & x^3 = 1728 \\
 & x = \sqrt[3]{1728} \\
 & x = 12
 \end{aligned}
 \tag{4}$$

[12]

QUESTION 3

3.1

$$F = \frac{9c}{5} + 32$$

$$F - 32 = \frac{9}{5}c \quad \checkmark$$

$$5F - 160 = 9c \quad \checkmark$$

$$c = \frac{5F - 160}{9} \quad \checkmark$$

OR

$$c = \frac{5(F - 32)}{9} \quad \checkmark$$

(3)

3.2

$$b = bx B^{-ya}$$

$$\frac{b}{bx} = B^{-ya} \quad \checkmark$$

$$\ln \frac{b}{bx} = \ln B^{-ya} \quad \checkmark$$

$$\ln \frac{b}{bx} = -ya \ln B \quad \checkmark$$

$$y = \frac{\ln \frac{b}{bx}}{-a \ln B} \quad \checkmark$$

OR

$$y = \frac{\ln b - \ln bx}{-a \ln B} \quad \checkmark$$

(4)

3.3

$$\therefore x + 5y = 35520 \dots\dots\dots(1)$$

$$3x + 9y = 72000 \dots\dots\dots(2)$$

$$\therefore \text{from}(1) \Rightarrow x = 35520 - 5y \dots\dots\dots(3) \quad \checkmark$$

Substitute(3)in(2)

$$3(35520 - 5y) + 9y = 72000 \quad \checkmark$$

$$106560 - 15y + 9y = 72000$$

$$-6y = 72000 - 106560$$

$$-6y = -34560$$

$$y = 5760$$

$$\therefore x + 5(5760) = 35520 \quad \checkmark$$

$$x = 35520 - 28800$$

$$x = 6720$$

Technician = R6 760 per month ✓

Artisan = R5 760 per month ✓

(5)

$$\begin{aligned}
 3.4 \quad x^2 &= -kx + y \\
 x^2 + kx &= y \\
 x^2 + kx + \left(\frac{k}{2}\right)^2 &= y + \left(\frac{k}{2}\right)^2 \quad \checkmark \\
 \left(x + \frac{k}{2}\right)^2 &= y + \frac{k^2}{4} \quad \checkmark \\
 x + \frac{k}{2} &= \pm \sqrt{y + \frac{k^2}{4}} \quad \checkmark \\
 x &= -\frac{k}{2} \pm \sqrt{y + \frac{k^2}{4}} \quad \checkmark
 \end{aligned}$$

(4)
[16]**QUESTION 4**

$$\begin{aligned}
 4.1 \quad M_{OD} &= \frac{y_2 - y_1}{x_2 - x_1} \\
 &= \frac{-6 - 0}{4 - 0} \quad \checkmark \\
 &= \frac{-3}{2} \quad \checkmark
 \end{aligned}$$

(2)

$$\begin{aligned}
 4.2 \quad \text{Midpoint } E &= \left(\frac{x_1 + x_2}{2}; \frac{y_2 + y_1}{2}\right) \\
 &= \left(\frac{0 + 4}{2}; \frac{0 - 6}{2}\right) \quad \checkmark \\
 &= (2; -3) \quad \checkmark
 \end{aligned}$$

(2)

$$\begin{aligned}
 4.3 \quad y - y_1 &= m(x - x_1) \\
 y + 6 &= \frac{2}{3}(x - 4) \quad \checkmark \\
 y + 6 &= \frac{2}{3}x - \frac{8}{3} \quad \checkmark \\
 y &= \frac{2}{3}x - \frac{26}{3} \quad \checkmark
 \end{aligned}$$

(3)

$$\begin{aligned}
 4.4 \quad y &= \frac{2}{3}x - \frac{26}{3} \\
 \therefore \frac{2}{3}x - \frac{26}{3} &= 0 \quad \checkmark \\
 \frac{2}{3}x &= \frac{26}{3} \\
 2x &= 26 \\
 x &= 13 \quad \checkmark \\
 \therefore B(0; 13) &\quad \checkmark
 \end{aligned}$$

(3)

$$\begin{aligned}
 4.5 \quad M_{AC} &= \frac{2}{3} \\
 \therefore \theta &= \tan^{-1} \frac{2}{3} \quad \checkmark \\
 \theta &= 33,69^\circ \quad \checkmark
 \end{aligned}
 \tag{2}$$

$$\begin{aligned}
 4.6 \quad y - y_1 &= m(x - x_1) \\
 y + 3 &= \frac{2}{3}(x - 2) \quad \checkmark \\
 y + 3 &= \frac{2}{3}x - \frac{4}{3} \quad \checkmark \\
 y &= \frac{2}{3}x - \frac{13}{3} \quad \checkmark
 \end{aligned}
 \tag{3}$$

$$\begin{aligned}
 4.7 \quad AD &= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \\
 &= \sqrt{(4 - 0)^2 + \left(-6 + \frac{26}{3}\right)^2} \quad \checkmark \\
 &= \sqrt{16 + \frac{64}{9}} \quad \checkmark \\
 &= \sqrt{23,1} \quad \checkmark
 \end{aligned}
 \tag{3}$$

[18]

QUESTION 5

$$\begin{aligned}
 5.1 \quad 5.1.1 \quad f(x) &= 2x^2 + 8x - 10 \\
 \therefore x^2 + 4x - 5 &= 0 \quad \checkmark \\
 (x - 1)(x + 5) &= 0 \\
 x = 1 \quad \checkmark \text{ OR } x = -5 \quad \checkmark
 \end{aligned}
 \tag{3}$$

$$\begin{aligned}
 5.1.2 \quad x &= -\frac{b}{2a} = -\frac{4}{2(1)} = -2 \quad \checkmark \\
 \therefore y &= (-2)^2 + 4(-2) - 5 \\
 &= -9 \quad \checkmark \\
 \therefore \text{The coordinates of B are } B(-2; -9) \quad \checkmark \checkmark
 \end{aligned}
 \tag{4}$$

5.2

✓

✓

(2)

5.3

$$f(x) = 3x^2 - 6$$

$$\lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$$

$$= \lim_{h \rightarrow 0} \frac{3x^2 + 6xh + 3h^2 - 6 - 3x^2 + 6}{h} \quad \checkmark$$

$$= \lim_{h \rightarrow 0} \frac{6xh + 3h^2}{h} \quad \checkmark$$

$$= \lim_{h \rightarrow 0} \frac{h(6x + 3h)}{h} \quad \checkmark$$

$$= \lim_{h \rightarrow 0} 6x + 3h$$

$$= 6x \quad \checkmark$$

(4)

5.4

$$f(x) = \sqrt{x} \left(x^4 - \frac{1}{3x^2} \right)$$

$$f(x) = x^{\frac{1}{2}} \left(x^4 - \frac{x^{-2}}{3} \right)$$

$$= x^2 - \frac{x^{-1}}{3} \quad \checkmark$$

$$\frac{dy}{dx} = 2x^{2-1} - \frac{x^{-1-1}}{3} \quad \checkmark$$

$$= 2x - \frac{x^{-2}}{3}$$

$$= 2x - \frac{1}{3x^2} \quad \checkmark$$

(3)

[16]

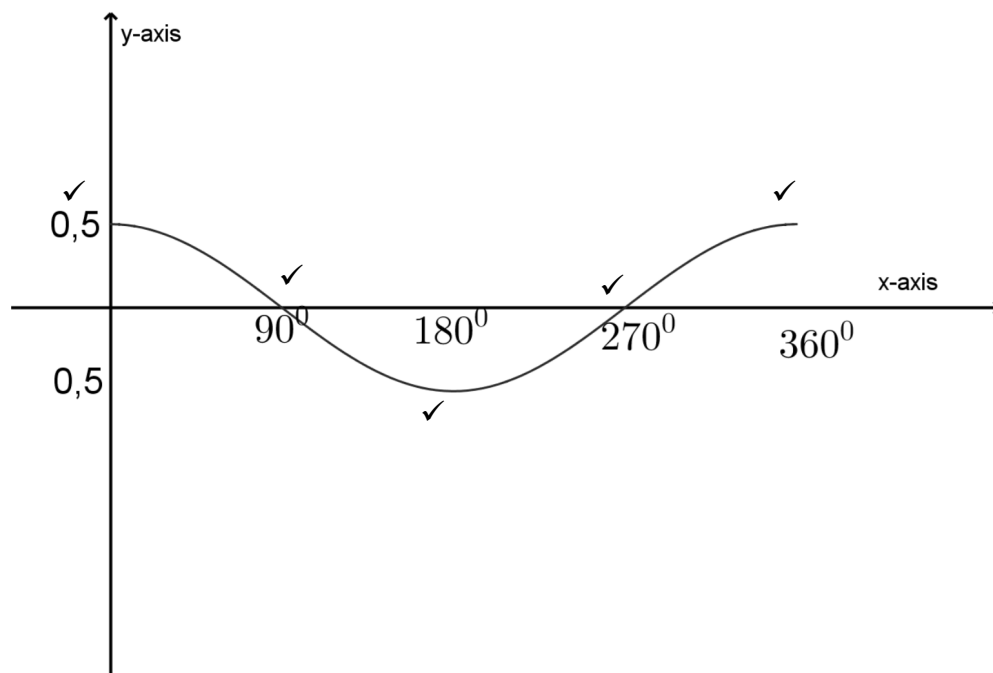
QUESTION 6

$$\begin{aligned}
 6.1 \quad & \frac{\sqrt{1+2\cos B+\cos^2 B}}{\sin^4 B+\sin^2 B\cos^2 B} = \frac{1}{1-\cos B} \\
 & LHS = \frac{\sqrt{1+2\cos B+\cos^2 B}}{\sin^4 B+\sin^2 B\cos^2 B} \\
 & = \frac{\sqrt{(1+\cos B)(1+\cos B)}}{\sin^2 B(\sin^2 B+\cos^2 B)} \checkmark \\
 & = \frac{\sqrt{(1+\cos B)^2}}{\sin^2 B(1)} \checkmark \\
 & = \frac{1+\cos B}{1-\cos^2 B} \checkmark \\
 & = \frac{1+\cos B}{(1-\cos B)(1+\cos B)} \checkmark \\
 & = \frac{1}{1-\cos B} \checkmark \\
 & = RHS \checkmark
 \end{aligned}
 \tag{5}$$

$$\begin{aligned}
 6.2 \quad & 4\cos \beta = 2\sin \beta \\
 & \frac{4\cos \beta}{2\cos \beta} = \frac{2\sin \beta}{2\cos \beta} \checkmark \\
 & 2 = \frac{\sin \beta}{\cos \beta} \checkmark \quad \beta = \tan^{-1} 2 \\
 & \tan \beta = 2 \checkmark \quad = 63,435^\circ \checkmark \\
 & \quad \quad \quad 180^\circ + 63,435^\circ = 243,435^\circ \checkmark
 \end{aligned}
 \tag{4}$$

$$\begin{aligned}
 6.3 \quad & \frac{\sin M}{KL} = \frac{\sin L}{KM} \\
 & \frac{\sin 70^\circ}{8,6} = \frac{\sin L}{7} \\
 & \sin L = \frac{7\sin 70^\circ}{8,6} \checkmark \quad \angle K = 180^\circ - (49,907^\circ + 70^\circ) \\
 & \quad \quad \quad = 60,093^\circ \checkmark \\
 & \sin L = 0,765 \checkmark \\
 & L = \sin^{-1} 0,765 \\
 & = 49,907^\circ \checkmark \\
 & Area\Delta KLM = \frac{1}{2} KL.KM \sin \angle K \\
 & \quad \quad \quad = \frac{1}{2} (8,6)(7) \sin 60,093^\circ \checkmark \\
 & \quad \quad \quad = 26,092m^2 \checkmark
 \end{aligned}
 \tag{6}$$

6.4

(5)
[20]**TOTAL: 100**