



**higher education
& training**

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE (VOCATIONAL)

MATHEMATICS

(Second paper)

NQF LEVEL 3

XX February 2020

This marking guideline consists of 10 pages.

$\checkmark = 1$ Mark $\surd = \frac{1}{2}$ Mark

Accept all mathematically valid solutions.

QUESTION 1

- 1.1 1.1.1 $A = 4\pi r^2$
 $= 4\pi(10)^2 \checkmark$
 $= 1\,256,64$ or $1\,256,637 \checkmark$ (2)
- 1.1.2 $l = \sqrt{h^2 + r^2}$
 $l = \sqrt{h^2 + r^2}$
 $= \sqrt{50^2 + 10^2} \checkmark$
 $= 51\text{ cm} \checkmark$ (2)
- 1.1.3 Area of curved surface of a cone $= \pi r l$
 $= \pi \times 10 \times 51 \checkmark$
 $= 1\,602,212 \checkmark$ (2)
- 1.1.4 $V_{\text{cone}} = \frac{1}{3} \pi r^2 \times_{\perp} h$
 $= \frac{1}{3} \pi \times 10^2 \times 50 \checkmark$
 $= 5235,988\text{ cm}^3 \checkmark$ (2)

$$1.2 \quad 1.2.1 \quad m_{AB} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{4 - (-8)}{-8 - (-4)} \checkmark$$

$$= \frac{12}{-4}$$

$$= -3 \checkmark$$

$$m_{AC} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-2 - (-8)}{14 - (-4)} \checkmark$$

$$= \frac{6}{18}$$

$$= \frac{1}{3} \checkmark$$

$$m_{AB} \times m_{AC} = -3 \times \frac{1}{3} = -1 \checkmark$$

$$\therefore AB \perp AC \checkmark$$

$\therefore \Delta ABC$ is a right angled triangle (5)

1.2.2

$$AB = \sqrt{[-8 - (-4)]^2 + [4 - (-8)]^2} = \sqrt{16 + 144} = \sqrt{160} \quad \checkmark$$

$$AC = \sqrt{[14 - (-4)]^2 + [-2 - (-8)]^2} = \sqrt{324 + 36} = \sqrt{360} \quad \checkmark$$

$$\text{Area of } \Delta ABC = \frac{1}{2} AB \times AC$$

$$= \frac{1}{2} \times \sqrt{160} \times \sqrt{360} \quad \checkmark$$

$$= 120u^2 \quad \checkmark$$

(4)

$$1.2.3 \quad M_{BC} : \left(\frac{14 - 8}{2}, \frac{-2 + 4}{2} \right)$$

$$= (3; 1) \quad \checkmark \quad \checkmark$$

(1)

$$1.2.4 \quad m_{AC} = \frac{1}{3}$$

$$\therefore m_{MN} = \frac{1}{3} \checkmark$$

$$y - 1 = \frac{1}{3}(x - 3) \checkmark$$

$$y - 1 = \frac{1}{3}x - 1$$

$$y = \frac{1}{3}x \checkmark$$

(3)

$$1.2.5 \quad m_{AB} = \left(\frac{-8 - 4}{2}, \frac{4 - 8}{2} \right)$$

$$= (-6; -2) \checkmark$$

$$y = \frac{1}{3}x$$

$$\text{LHS: } y = -2 \checkmark$$

$$\text{RHS: } y = \frac{1}{3}x$$

$$= \frac{1}{3}(-6)$$

$$= -2 \checkmark$$

$$\therefore \text{LHS} = \text{RHS}$$

Therefore the midpoint of AB lies on line MN. \checkmark

(4)
[25]

QUESTION 2

$$\begin{aligned}
2.1 \quad & \frac{\sin 120^\circ \cdot \tan 150^\circ}{\cos^2 315^\circ} \\
&= \frac{\sin(180^\circ - 120^\circ) \cdot \tan(180^\circ - 30^\circ)}{\cos^2(360^\circ - 45^\circ)} \\
&= \frac{\overset{\checkmark}{\sin 60^\circ} \cdot \overset{\checkmark}{(-\tan 30^\circ)}}{\cos^2 45^\circ} \\
&= \frac{\overset{\checkmark}{\frac{\sqrt{3}}{2}} \times \overset{\checkmark}{-\frac{1}{\sqrt{3}}}}{\left(\frac{1}{\sqrt{2}}\right)^2} \\
&= -1 \quad \checkmark
\end{aligned} \tag{5}$$

$$\begin{aligned}
2.2 \quad 2.2.1 \quad & \frac{(\sin x + \cos x)^2}{\cos x} = \frac{1}{\cos x} + 2 \sin x \\
& \text{LHS:} \\
&= \frac{\sin^2 x + 2 \sin x \cos x + \cos^2 x}{\cos x} \quad \checkmark \\
&= \frac{\overset{\checkmark}{1} + 2 \sin x \cos x}{\cos x} \\
&= \frac{1}{\cos x} + \frac{2 \sin x \cos x}{\cos x} \\
&= \frac{1}{\cos x} + 2 \sin x \quad \checkmark \\
&= \text{RHS}
\end{aligned} \tag{3}$$

$$2.2.2 \quad \frac{1-2\sin^2 x}{1+2\sin x \cos x} = \frac{1-\tan x}{1+\tan x}$$

LHS:

$$\begin{aligned} & \frac{1-2\sin^2 x}{1+2\sin x \cos x} \\ &= \frac{\sin^2 x + \cos^2 x - 2\sin^2 x}{\sin^2 x + \cos^2 x + 2\sin x \cos x} \checkmark \\ &= \frac{\cos^2 x - \sin^2 x}{\sin^2 x + 2\sin x \cos x + \cos^2 x} \\ &= \frac{(\cos x - \sin x)(\cos x + \sin x)}{(\sin x + \cos x)^2} \checkmark \\ &= \frac{\cos x - \sin x}{\sin x + \cos x} \\ &= \frac{(\cos x - \sin x) \times \frac{1}{\cos x}}{(\sin x + \cos x) \times \frac{1}{\cos x}} \checkmark \\ &= \frac{1 - \frac{\sin x}{\cos x}}{\frac{\sin x}{\cos x} + 1} \checkmark \\ &= \frac{1 - \tan x}{1 + \tan x} \checkmark \\ &= \text{RHS} \end{aligned}$$

(5)

$$\begin{aligned} 2.3 \quad & 2\sin^2 \alpha = -\sin \alpha \\ & 2\sin^2 \alpha + \sin \alpha = 0 \checkmark \\ & \sin \alpha(2\sin \alpha + 1) = 0 \checkmark \\ & \therefore \sin \alpha = 0 \text{ or } 2\sin \alpha = -1 \\ & \quad \quad \quad \checkmark \quad \quad \quad \therefore \sin \alpha = -\frac{1}{2} \checkmark \\ & \therefore \text{ref angle } \alpha = 0^\circ \text{ or ref } \alpha = 60^\circ \\ & \alpha = 0^\circ \text{ or } 180^\circ \text{ or } 360^\circ \text{ or } 240^\circ \text{ or } 300^\circ \end{aligned}$$

(5)

2.4 2.4.1 *In* $\triangle ABD$:

$$AD^2 = 24^2 + 15^2 - 2(24)(15) \cos 23^\circ \checkmark \checkmark$$

$$= 138,2365 \checkmark$$

$$AD = 11,757 \text{ m} \checkmark \quad (4)$$

2.4.2

$$\frac{AC}{\sin 23^\circ} = \frac{24}{\sin 35^\circ} \checkmark$$

$$AC = \frac{24 \times \sin 23^\circ}{\sin 35^\circ} \checkmark$$

$$AC = 16,349 \text{ m} \checkmark \quad (3)$$

[25]

QUESTION 3

3.1 3.1.1 12, 18, 54, 62, 63, 64, 65, 68, 69, 69, 69, 70, 79, 80, 82, 85, 86, 98, 112, 150

$$Q_{2_{pos}} = \frac{2}{4}(20+1)$$

$$= 10,5 \checkmark$$

$$Q_2 = 69 + 0,5(69 - 69)$$

$$= 69 \checkmark$$

$$\text{or } \frac{69+69}{2} = 69 \checkmark \quad (2)$$

3.1.2 12, 18, 54, 62, 63, 64, 65, 68, 69, 69, 69, 70, 79, 80, 82, 85, 86, 98, 112, 150

$$Q_{1_{pos}} = \frac{1}{4}(20+1)$$

$$= 5,25 \checkmark$$

$$Q_1 = 63 + 0,25(64 - 63)$$

$$= 63,25 \checkmark$$

$$Q_{3_{pos}} = \frac{3}{4}(20+1)$$

$$= 15,75 \checkmark$$

$$Q_3 = 82 + 0,75(85 - 82)$$

$$= 84,25 \checkmark \quad (4)$$

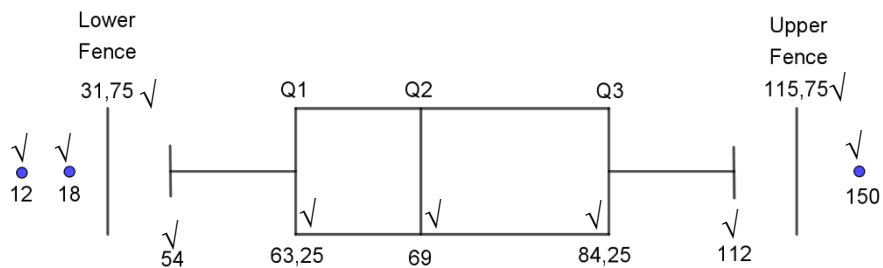
3.1.3 Upper fence = $84,25 + 1,5(21) \checkmark$
 = $115,75 \checkmark$

Use values from 3.1.2 to get IQR. CA marks awarded

Lower fence = $63,25 - 1,5(21) \checkmark$
 = $31,75 \checkmark$

(4)

3.1.4



(½ mark for each correct value shown on a box plot)

(5)

3.2

3.2.1

| Classes (Ages) | Frequency (f_i) | Midpoint (x_i) | $f_i \times x_i$ | < Cumulative frequency |
|------------------|---------------------|--------------------|---------------------------|------------------------|
| $0 \leq x < 10$ | 27 | 5 | 135 | 27 |
| $10 \leq x < 20$ | 6 | 15 | 90 | 33 |
| $20 \leq x < 30$ | 30 | 25 | 750 | 63 ✓ |
| $30 \leq x < 40$ | 5 | 35 | 175 | 68 ✓ |
| $40 \leq x < 50$ | 12 | 45 | 540 | 80 ✓ |
| $50 \leq x < 60$ | 20 | 55 | 1 100 | 100 ✓ |
| Total | 100 | | $\sum f_i x_i = 2\ 790$ ✓ | |

(5)

3.2.2
$$\frac{\sum f_i x_i}{n} = \frac{2790}{100} \checkmark$$

 = $27,9 \checkmark$

(2)

3.2.3
$$Me_{position} = \frac{1}{2}(n+1) = 50,5$$

$$Me = l + \frac{\left(\frac{n}{2} - F\right)}{f} \times c$$

$$= 20 + \frac{\left(\frac{100}{2} - 33\right)}{30} \times 10 \checkmark$$

$$= 25,67 \checkmark$$

Or 25,667

Award 3 marks if learner has chosen the incorrect class but has substituted correctly.

(4)

$$\begin{aligned}
 3.2.4 \quad Mo &= l + \frac{f_m - f_{m-1}}{2f_m - f_{m-1} - f_{m+1}} \times c \\
 &= 20 + \frac{30 - 6}{2(30) - 6 - 5} \times 10 \\
 &= 20 + \frac{24}{49} \times 10 \\
 &= 24,898
 \end{aligned}$$

Award 3 marks if student has chosen the incorrect class but has substituted correctly.

(4)
 [30]

QUESTION 4

$$\begin{aligned}
 4.1 \quad A &= P(1 + in) \\
 &= 12\,000(1 + 0,098 \times 6) \\
 &= R\,19\,056
 \end{aligned}$$

(2)

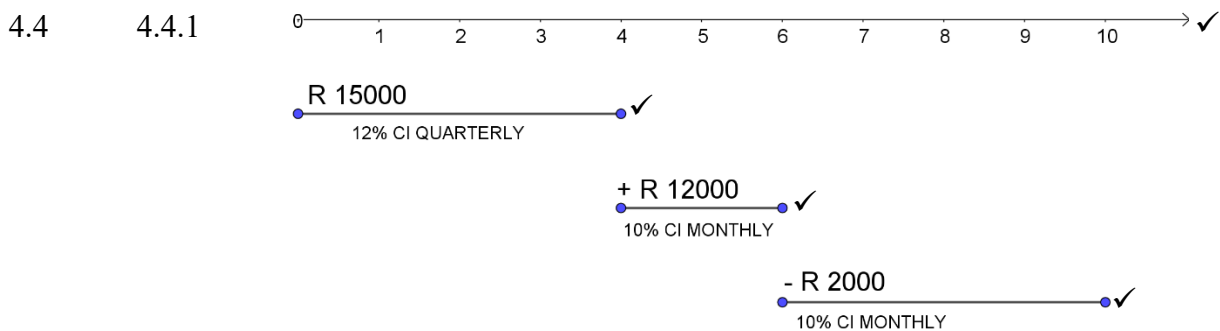
$$\begin{aligned}
 4.2 \quad A &= P(1 + i)^n \\
 2\,700 &= 1\,200(1 + i)^3 \\
 \frac{2\,700}{1\,200} &= (1 + i)^3 \\
 2,25 &= (1 + i)^3 \\
 1 + i &= \sqrt[3]{2,25} \\
 1 + i &= 1,31 \\
 i &= 0,31 \\
 \therefore r &= 31\%
 \end{aligned}$$

(3)

$$\begin{aligned}
 4.3 \quad A &= P(1 + i)^n \\
 150\,000 &= P \left(1 + \frac{0,12}{12} \right)^{12 \times 7} \\
 150\,000 &= P(1,01)^{84} \\
 150\,000 &= P \times 2,3067
 \end{aligned}$$

$$P = 65\,027,96 \text{ or } 65\,027,32 \text{ if calculator was not switched off}$$

(5)



(4)

$$\begin{aligned}4.4.2 \quad A &= P(1+i)^n \\ &= 15\,000 \left(1 + \frac{0,12}{4}\right)^{4 \times 4} \checkmark \\ &= R24\,070,60 \checkmark \\ \\ A &= R24\,070,60 + R12\,000 = R36\,070,60 \checkmark \\ A &= P(1+i)^n \\ &= 36\,070,60 \left(1 + \frac{0,10}{12}\right)^{2 \times 12} \checkmark \\ &= R44\,020,23 \checkmark \\ \\ A &= R44\,020,23 - R2\,000 = R42\,020,23 \checkmark \\ A &= P(1+i)^n \\ &= 42\,020,23 \left(1 + \frac{0,10}{12}\right)^{4 \times 12} \checkmark \\ &= R62\,583 \checkmark\end{aligned}$$

(6)
[20]**TOTAL: 100**