higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE (VOCATIONAL)

MATHEMATICS
NQF LEVEL 3
(Second paper)

15 November 2023

This marking guideline consists of 8 pages.

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QUESTION 1

1.1 1.1.1 B
1.1.2 C
1.1.3 A
1.1.4 C
1.1.5 B

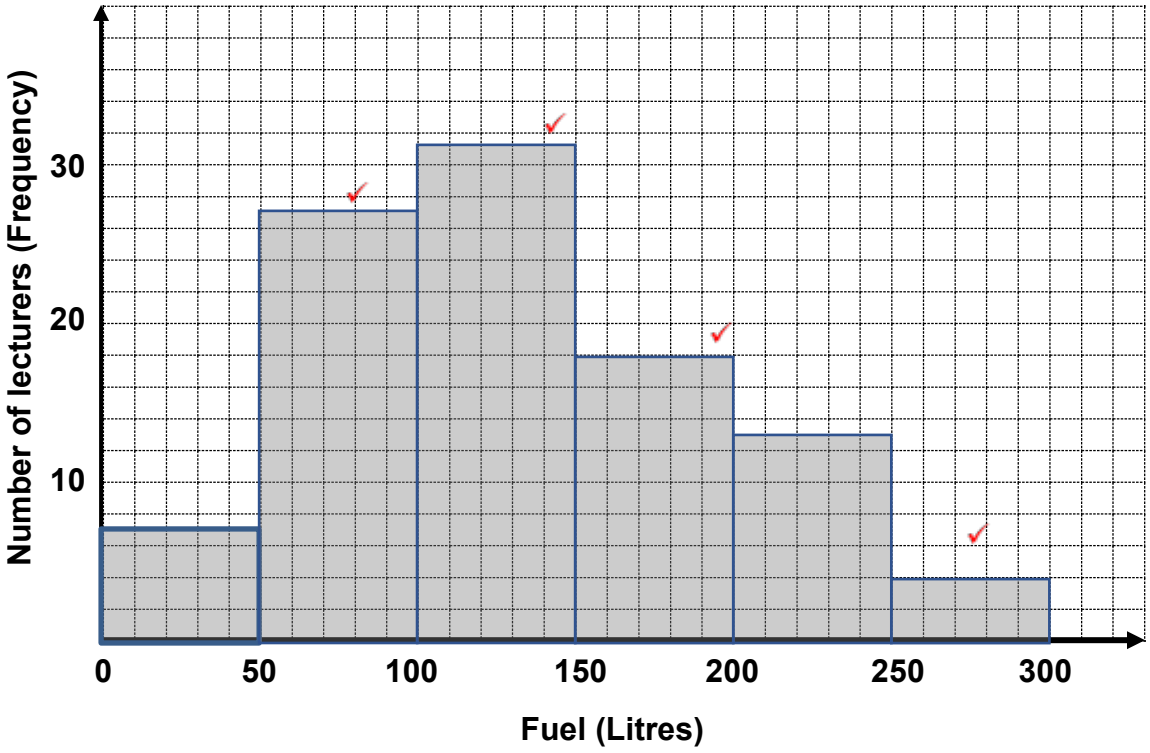
(5 × 1) (5)

1.2 1.2.1

Classes (litres)	Frequency f_i	Midpoint x_i	$f_i x_i$
$0 \leq x < 50$	7	25	175
$50 \leq x < 100$	**A. 27✓**	75	2 025
$100 \leq x < 150$	31	125	3 875
$150 \leq x < 200$	18	175	3 150
$200 \leq x < 250$	**B. 13✓**	225	**C. 2 925✓**
$250 \leq x < 300$	4	275	**D. 1 100✓**
TOTAL	$\sum f_i = 100$		$\sum f_i x_i = 13\ 250$

(4)

1.2.2



(4)

1.2.3 $$\text{Mean} = \frac{\sum f_i x_i}{\sum f_i}$$
$$= \frac{13\,250}{100} \checkmark$$
$$= 132{,}5 \checkmark$$ (2)

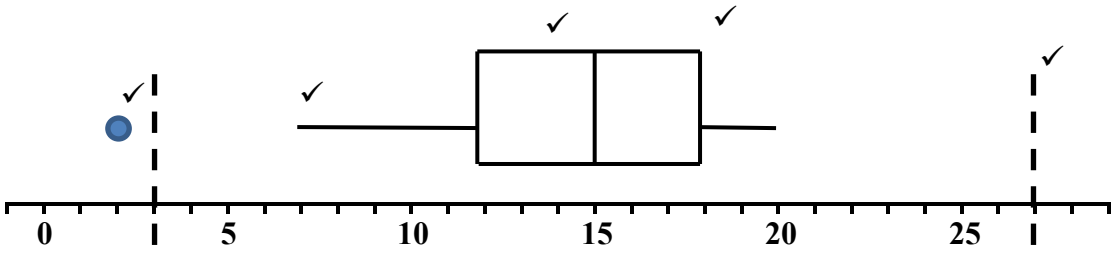
1.2.4 $$\text{Mo} = l + \frac{f_m - f_{m-1}}{2f_m - f_{m-1} - f_{m+1}} \times c$$
$$= 100 + \frac{31 - 27}{2(31) - 27 - 18} \times 50$$
$$= 111{,}765 \checkmark$$ (3)

1.3 1.3.1 Median position = 8
Median = 15✓
Lower quartile position = 4
Lower quartile $Q_1 = 12$ ✓
Upper quartile position = 12
Upper quartile $Q_3 = 18$ ✓ (3)

1.3.2 $$\text{Lower fence} = Q_1 - 1{,}5(Q_3 - Q_1)$$
$$= 12 - 1{,}5(18 - 12)\checkmark$$
$$= 3\checkmark$$

$$\text{Upper fence} = Q_3 + 1{,}5(Q_3 - Q_1)$$
$$= 18 + 1{,}5(18 - 12)\checkmark$$
$$= 27\checkmark$$ (4)

1.3.3



ONE mark outlier
ONE mark fences
ONE mark new minimum at 7
ONE mark Q_1 and Q_2
ONE mark Q_3 and maximum. (5)
[30]

QUESTION 2

2.1 2.1.1

$$l = \sqrt{h^2 + r^2}$$
$$1 = \sqrt{h^2 + 0{,}8^2}\checkmark$$
$$h_{cone} = \sqrt{1^2 - 0{,}8^2}$$
$$= 0{,}6 \text{ cm}\checkmark$$ (2)

2.1.2

$$h_{cylinder} = 2{,}5 - 0{,}6\checkmark$$
$$= 1{,}9 \text{ m}\checkmark$$ (2)

2.1.3

$$V_{cylinder} = \pi r^2 h$$ C.F H from QUESTION 2.1.1
$$= \pi \times 0{,}8^2 \times 1{,}9\checkmark$$
$$= 3{,}820 \text{m}^3\checkmark$$ (2)

2.1.4

$$V_{cone} = \frac{1}{3}\pi r^2 h$$
$$= \frac{1}{3}\pi(0{,}8)^2 \times 0{,}6\ \checkmark$$
$$= 0{,}402 \text{ m}^3\ \checkmark$$ C.F height from QUESTION 2.1.1 (2)

2.1.5

$$V_{total} = V_{cylinder} + V_{cone}$$
$$= 3{,}820 + 0{,}402\ \checkmark$$
$$= 4{,}222 \text{ m}^3\ \checkmark$$ C.F from QUESTION 2.1.3 and 2.1.4 (2)

2.1.6

$$A = \pi rl + \pi r^2 + 2\pi rh$$
$$= \pi \times 0{,}8 \times 1 + \pi \times 0{,}8^2 + 2\pi \times 0{,}8 \times 1{,}9$$ CF
$$= 14{,}074 \text{ m}^2\checkmark$$ (4)

2.2.1

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$
$$= \frac{4\frac{1}{2} - 0}{9 - 3}\ \checkmark$$
$$= \frac{3}{4}\ \checkmark$$ (2)

2.2.2

$$\theta = \tan^{-1}\left(\frac{3}{4}\right)\ \checkmark$$
$$= 36{,}870\ \checkmark$$ (2)

2.2.3 $m_{AD} \times m_{CD} = -1$ C.F gradient from QUESTION 2.2.1

$\frac{3}{4} \times m_{AD} = -1$

$m_{AD} = -\frac{4}{3}$

$y = -\frac{4}{3}x + c$ ✓

$0 = -\frac{4}{3}(3) + c$

$c = 4$

$y = -\frac{4}{3}x + 4$

Alternative solution

$y - y_1 = m(x - x_1)$

$y - 0 = -\frac{4}{3}(x - 3)$ ✓

$y = -\frac{4}{3}x + 4$ ✓

(3)

2.2.4 $m_{AD} = m_{CD}$ ✓

$-\frac{4}{3} = \frac{k - 4\frac{1}{2}}{6 - 9}$ ✓

$k = 8\frac{1}{2}$ ✓

(3)

[24]

QUESTION 3

3.1 $\frac{\sin(360^o - x).(\text{Sin}^2x + \text{Cos}^2x)^2}{\text{Cos}(180^o + x).\text{Tan}(180^o - x)} = \frac{(-\sin x)(1)^2}{(-\cos x)(-\tan x)}$ ✓ ✓

$= -\frac{\tan x}{\tan x}$ ✓ or $-\frac{\sin x}{\cos x\left(\frac{\sin x}{\cos x}\right)} = -\frac{\sin x}{\sin x}$

$= -1$ ✓

(4)

3. 2 $\frac{\sin 210^o \times \cos 240^o}{\tan 315^o} + \frac{\sin 110^o}{\cos 20^o}$

$= \frac{\sin(180^o + 30^o).\cos(180^o + 60^o)}{\tan(360^o - 45^o)} + \frac{\sin(90^o + 20^o)}{\cos 20^o}$

$= \frac{-\sin 30^o.-\cos 60^o}{-\tan 45^o} + \frac{\cos 20^o}{\cos 20^o}$ ✓ ✓ ✓ ✓

$= \frac{(-\frac{1}{2})(-\frac{1}{2})}{(-1)} + 1$ ✓

$= -\frac{1}{4} + 1 = \frac{3}{4}$ ✓

(6)

3.3
$$\sqrt{1-\frac{\tan^2\theta}{1+\tan^2\theta}}=\sqrt{\frac{1+\tan^2\theta-\tan^2\theta}{1+\tan^2\theta}}$$ ✓

$$=\sqrt{\frac{1}{1+\tan^2\theta}}$$

$$=\sqrt{\frac{1}{1+\frac{\sin^2\theta}{\cos^2\theta}}}$$ ✓

$$=\sqrt{\frac{1}{\frac{\cos^2\theta+\sin^2\theta}{\cos^2\theta}}}$$

$$=\sqrt{\frac{1}{\frac{1}{\cos^2\theta}}}$$ ✓

$$=\sqrt{\cos^2\theta}$$ ✓

$$=\cos\theta$$

$$\cos\theta = 0{,}60181$$

$$\theta = \cos^{-1}0{,}60181$$ ✓

$\theta = 53^o$ ✓ Or $\theta = 360^o - 53^o$

$= 307^o$ ✓ (7)

3.4 3.4.1
$$PR^2 = RS^2 + PS^2 - 2.RS.PS\cos\hat{S}$$ ✓

$$PR = \sqrt{120^2 + 110^2 - 2\times 120\times 110\cos 61^o}$$ ✓

$$= 117{,}051 \text{ m}$$ ✓ (3)

3.4.2
$$PR^2 = QR^2 + PQ^2 - 2.PQ.QR.\cos\hat{Q}$$

$$(117{,}051)^2 = 50^2 + 90^2 - 2(90)(50)\cos\hat{Q}$$ ✓

$$\cos\hat{Q} = \frac{(117{,}051)^2 - 50^2 - 90^2}{-2(90)(50)}$$

$$\hat{Q} = \cos^{-1}(-0{,}34454\ldots.)$$ ✓

$$= 110^o$$ ✓ (3)

3.4.3 $\text{Area} = \text{Area}_{PQR} + \text{Area}_{PSR}$ CF from 3.4.1 and 3.4.2

$$= \frac{1}{2}\times 90\times 50\sin 110^0 + \frac{1}{2}\times 110\times 120\sin 61^0$$ ✓ ✓

$$= 7\,886{,}798 m^2$$ ✓ (3)

[26]

QUESTION 4

4.1 4.1.1

$A = -200$
B = 0
C = 500
D = 12 000
E = 27 200
F = 740 (6)

4.1.2

- Increase joining fees, membership fees
- Get better interest rates
- Do not plan to get donations (Any applicable answer) (1)

4.2 4.2.1

A = $3x$. ✓ (1)

4.2.2

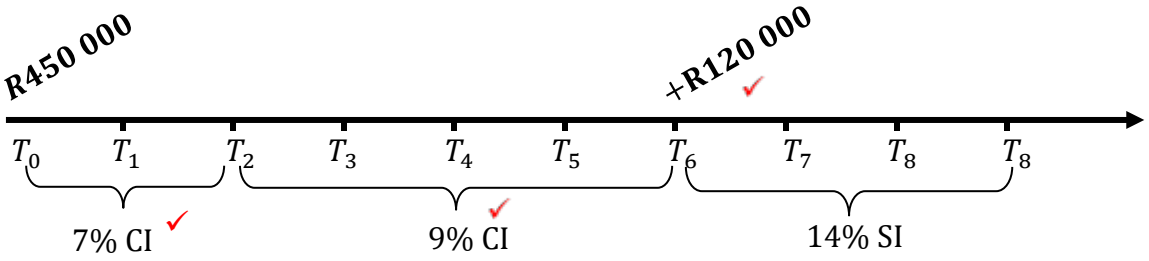
$$3x = x\left(1 + \frac{r}{12 \times 100}\right)^{8 \times 12} \checkmark$$

$$3 = \left(1 + \frac{r}{1200}\right)^{96} \checkmark$$

$$r = 1\,200\left(\sqrt[96]{3} - 1\right)$$

Rate = 13,812 % per annum ✓ (3)

4.3.1



ONE mark principal amount and interest rate for first 2 years.
ONE mark interest rate from year 2 to year 4.
ONE mark deposit at year 6 and interest rate from year 6 to year 9. (3)

4.3.2 $A_2 = 450\,000\left(1+\frac{7}{100}\right)^2$ ✓ Carry forward mistakes

$= 515\,205$ ✓

$A_6 = 515\,205\left(1+\frac{9}{100}\right)^4$ ✓

$= 727\,253{,}90$ ✓

$A_9 = (727\,253{,}90 + 120\ \ 000)\left(1+\frac{14}{100}\times 3\right)$ ✓

$= 1\,203\,100{,}54$ ✓

Alternative solution

$A = 450\,000\left(1+\frac{7}{100}\right)^2\left(1+\frac{9}{100}\right)^4\left(1+\frac{14}{100}\times 3\right) + 120\,000\left(1+\frac{14}{100}\times 3\right)$ ✓ ✓ ✓ ✓ ✓

$= 1\,203\,100{,}54$ ✓

(6)
[20]

TOTAL: 100

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