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.

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✓= 1 Mark √ = ½ Mark

Accept all mathematically valid solutions.

QUESTION 1

1.1 1.1.1

$$A = 4\pi r^2$$
$$= 4\pi(10)^2 \checkmark$$
$$= 1\,256,64 \text{ or } 1\,256,637 \checkmark$$

(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

$$V_{cone} = \frac{1}{3}\pi r^2 \times_{\perp} h$$
$$= \frac{1}{3}\pi \times 10^2 \times 50 \checkmark$$
$$= 5235,988\,\text{cm}^3 \checkmark$$

(2)

1.2 1.2.1

$$m_{AB} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{4-(-8)}{-8-(-4)} \checkmark$$
$$= \frac{12}{-4}$$
$$= -3 \checkmark$$

$$m_{AC} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-2-(-8)}{14-(-4)} \checkmark$$
$$= \frac{6}{18}$$
$$= \frac{1}{3} \checkmark$$

$$m_{AB} \times m_{AC} = -3 \times \frac{1}{3} = -1 \ \surd$$
$$\therefore AB \perp AC \surd$$
$$\therefore \Delta ABC \text{ is a right angled triangle}$$ (5)

1.2.2

$$AB = \sqrt{[-8-(-4)]^2 + [4-(-8)]^2} = \sqrt{16+144} = \sqrt{160} \quad \checkmark$$
$$AC = \sqrt{[14-(-4)]^2 = [-2-(-8)]^2} = \sqrt{324+36} = \sqrt{360} \quad \checkmark$$
$$\text{Area of } \Delta \text{ ABC} = \frac{1}{2} AB \times AC$$
$$= \frac{1}{2} \times \sqrt{160} \times \sqrt{360} \quad \checkmark$$
$$= 120u^2 \quad \checkmark$$ (4)

1.2.3

$$M_{BC} : \left(\frac{14-8}{2} ; \frac{-2+4}{2} \right)$$
$$= (3;1) \ \surd \ \surd$$ (1)

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

$\therefore m_{MN} = \frac{1}{3}$ ✓

$y - 1 = \frac{1}{3}(x - 3)$ ✓

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

$y = \frac{1}{3}x$ ✓ (3)

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

$= (-6; -2)$ ✓

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

LHS: $y = -2$ ✓

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

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

$= -2$ ✓

$\therefore$ LHS = RHS

Therefore the midpoint of AB lies on line MN.✓ (4)

[25]

QUESTION 2

2.1 $\dfrac{\sin 120°.\tan 150°}{\cos^2 315°}$

$= \dfrac{\sin(180° - 120°).\tan(180° - 30°)}{\cos^2(360° - 45°)}$

$= \dfrac{\overset{\surd}{\sin 60°}.(-\overset{\surd}{\tan 30°})}{\cos^2 45° \surd}$

$= \dfrac{\overset{\checkmark}{\dfrac{\sqrt{3}}{2}} \times \overset{\checkmark}{\dfrac{-1}{\sqrt{3}}}}{\left(\dfrac{1}{\sqrt{2}}\right)^2 \checkmark}$

$= -1 \quad \surd$ (5)

2.2 2.2.1 $\dfrac{(\sin x + \cos x)^2}{\cos x} = \dfrac{1}{\cos x} + 2\sin x$

LHS:

$= \dfrac{\sin^2 x + 2\sin x\cos x + \cos^2 x}{\cos x} \checkmark$

$= \dfrac{\overset{\checkmark}{1} + 2\sin x\cos x}{\cos x}$

$= \dfrac{1}{\cos x} + \dfrac{2\sin x\cos x}{\cos x}$

$= \dfrac{1}{\cos x} + 2\sin x \checkmark$

$=$ RHS (3)

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

LHS:

$$\frac{1-2\sin^2 x}{1+2\sin x\cos x}$$

$$=\frac{\sin^2 x+\cos^2 x-2\sin^2 x}{\sin^2 x+\cos^2 x+2\sin x\cos x} \quad \surd \quad \surd$$

$$=\frac{\cos^2 x-\sin^2 x}{\sin^2 x+2\sin x\cos x+\cos^2 x}$$

$$=\frac{(\cos x-\sin x)(\cos x+\sin x)}{(\sin x+\cos x)^2} \quad \surd \quad \surd$$

$$=\frac{\cos x-\sin x}{\sin x+\cos x}$$

$$=\frac{(\cos x-\sin x)\times\dfrac{1}{\cos x}}{(\sin x+\cos x)\times\dfrac{1}{\cos x}} \checkmark$$

$$=\frac{1-\dfrac{\sin x}{\cos x}}{\dfrac{\sin x}{\cos x}+1} \checkmark$$

$$=\frac{1-\tan x}{1+\tan x} \checkmark$$

$=$ RHS (5)

2.3 $2\sin^2\alpha=-\sin\alpha$

$2\sin^2\alpha+\sin\alpha=0$ $\surd$

$\sin\alpha(2\sin\alpha+1)=0$ $\surd$

$\therefore \sin\alpha=0$ $\surd$ or $2\sin\alpha=-1$

$\therefore \sin\alpha=-\dfrac{1}{2}$ $\surd$

$\therefore$ ref angle $\alpha=0°$ or ref $\alpha=60°$ $\surd$

$\alpha=0°$ or $180°$ or $360°$ or $240°$ or $300°$ (5)

$\surd$ $\surd$ $\surd$ $\surd$ $\surd$

2.4 2.4.1 $In\ \Delta\ ABD:$

$AD^2 = 24^2 + 15^2 - 2(24)(15)\cos 23°$ ✓✓

$= 138,2365$ ✓

$AD = 11,757\ m$ ✓ (4)

2.4.2 $\frac{AC}{\sin 23°} = \frac{24}{\sin 35°}$ ✓

$AC = \frac{24 \times \sin 23°}{\sin 35°}$ ✓

$AC = 16,349\ m$ ✓ (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

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

$= 10,5$ ✓

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

$= 69$ ✓

or $\frac{69+69}{2} = 69$ ✓ ✓ (2)

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

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

$= 5,25$ ✓

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

$= 63,25$ ✓

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

$= 15,75$ ✓

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

$= 84,25$ ✓ (4)

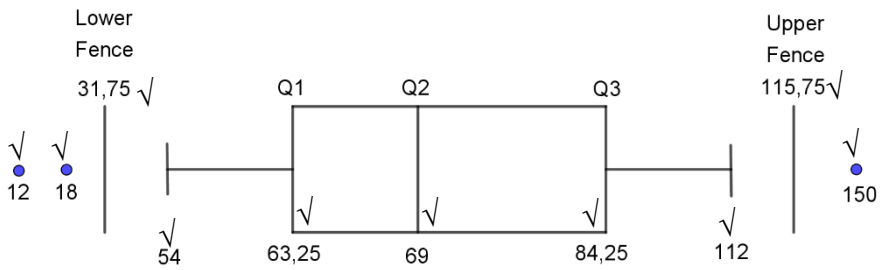
3.1.3 Upper fence $= 84,25 + 1,5(21)$ ✓
$= 115,75$ ✓

Use values from 3.1.2 to get IQR. CA marks awarded

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

(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
$0 \le x < 10$	27	5	135	27
$10 \le x < 20$	6	15	90	33
$20 \le x < 30$	30	25	750	**63** ✓
$30 \le x < 40$	5	35	175	**68** ✓
$40 \le x < 50$	12	45	540	**80** ✓
$50 \le x < 60$	20	55	1 100	**100** ✓
Total	100		$\sum f_i x_i = 2\ 790$ ✓	

(5)

3.2.2 $\dfrac{\sum f_i x_i}{n} = \dfrac{2790}{100}$ ✓
$= 27,9$ ✓

(2)

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

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

$= 20 + \dfrac{\left(\dfrac{100}{2} - 33\right)}{30} \times 10$ ✓ ✓ ✓
$= 25,67$ ✓
Or 25,667

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

(4)

3.2.4 $Mo = l + \dfrac{f_m - f_{m-1}}{2f_m - f_{m-1} - f_{m+1}} \times c$

$= 20 + \dfrac{30-6}{2(30)-6-5} \times 10$ ✓ ✓ ✓

$= 20 + \dfrac{24}{49} \times 10$

$= 24,898$ ✓

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

(4)

[30]

QUESTION 4

4.1 $A = P(1+in)$

$= 12\,000(1+0,098\times 6)$ ✓

$= \text{R } 19\,056$ ✓ (2)

4.2 $A = P(1+i)^n$

$2\,700 = 1\,200(1+i)^3$ √

$\dfrac{2\,700}{1\,200} = (1+i)^3$ √

$2,25 = (1+i)^3$ √

$1+i = \sqrt[3]{2,25}$ √

$1+i = 1,31$ √

$i = 0,31$

$\therefore r = 31\%$ √ (3)

4.3 $A = P(1+i)^n$

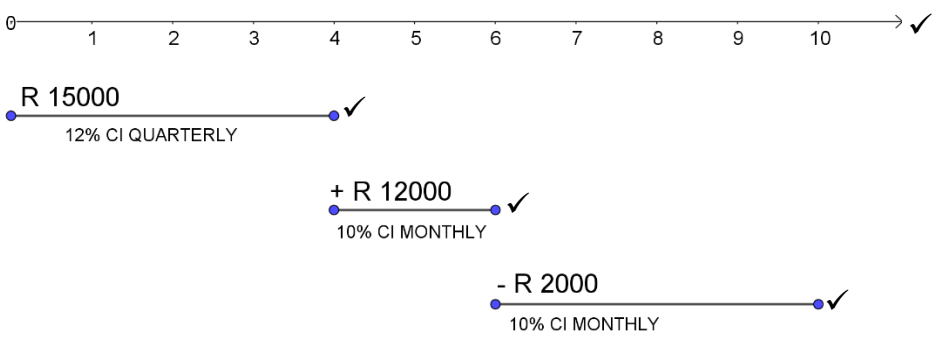
$150\,000 = P\left(1+\dfrac{0,12}{12}\right)^{12\times 7}$ ✓✓

$150\,000 = P(1=0,01)^{84}$ ✓

$150\,000 = P \times 2,3067$ ✓

$P = 65\,027,96$ or $65\,027,32$ if calculator was not switched off ✓ (5)

4.4 4.4.1



(4)

4.4.2 $A = P(1+i)^n$

$= 15\,000\left(1+\frac{0,12}{4}\right)^{4\times4}$ ✓

$= \text{R}24\,070,60$ ✓

$A = \text{R}24\,070{,}60 + \text{R}12\,000 = \text{R}36\,070{,}60$ √

$A = P(1+i)^n$

$= 36\,070,60\left(1+\frac{0,10}{12}\right)^{2\times12}$ ✓

$= \text{R}44\,020{,}23$ √

$A = \text{R}44\,020{,}23 - \text{R}2\,000 = \text{R}42\,020{,}23$ √

$A = P(1+i)^n$

$= 42\,020,23\left(1+\frac{0,10}{12}\right)^{4\times12}$ ✓

$= \text{R}62\,583$ √

(6)
[20]

TOTAL: 100

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