higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

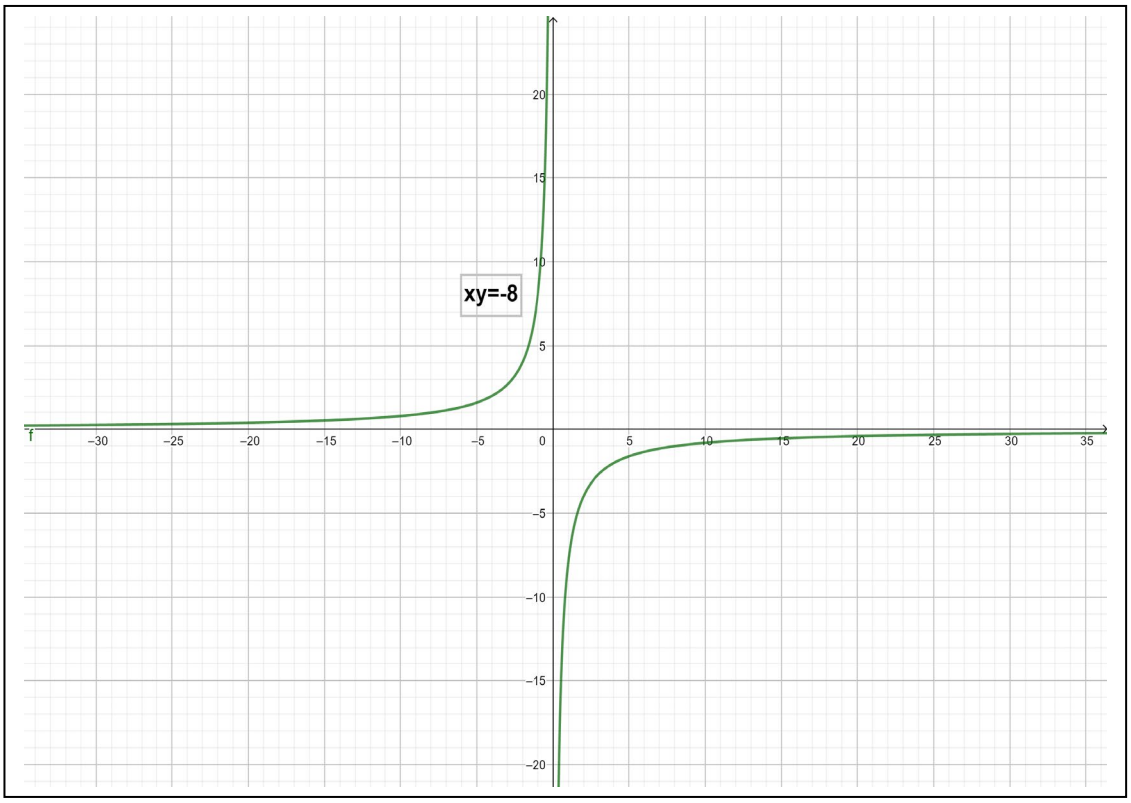
MATHEMATICS N4

6 April 2021

This marking guideline consists of 10 pages.

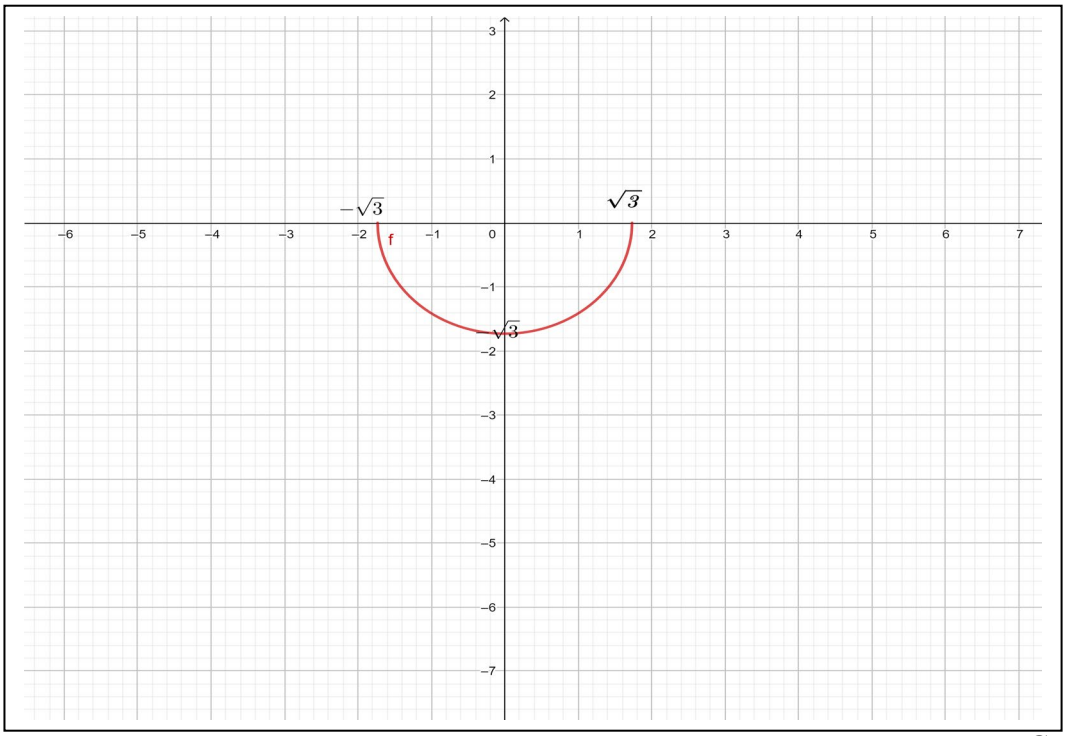
QUESTION 1

1.1



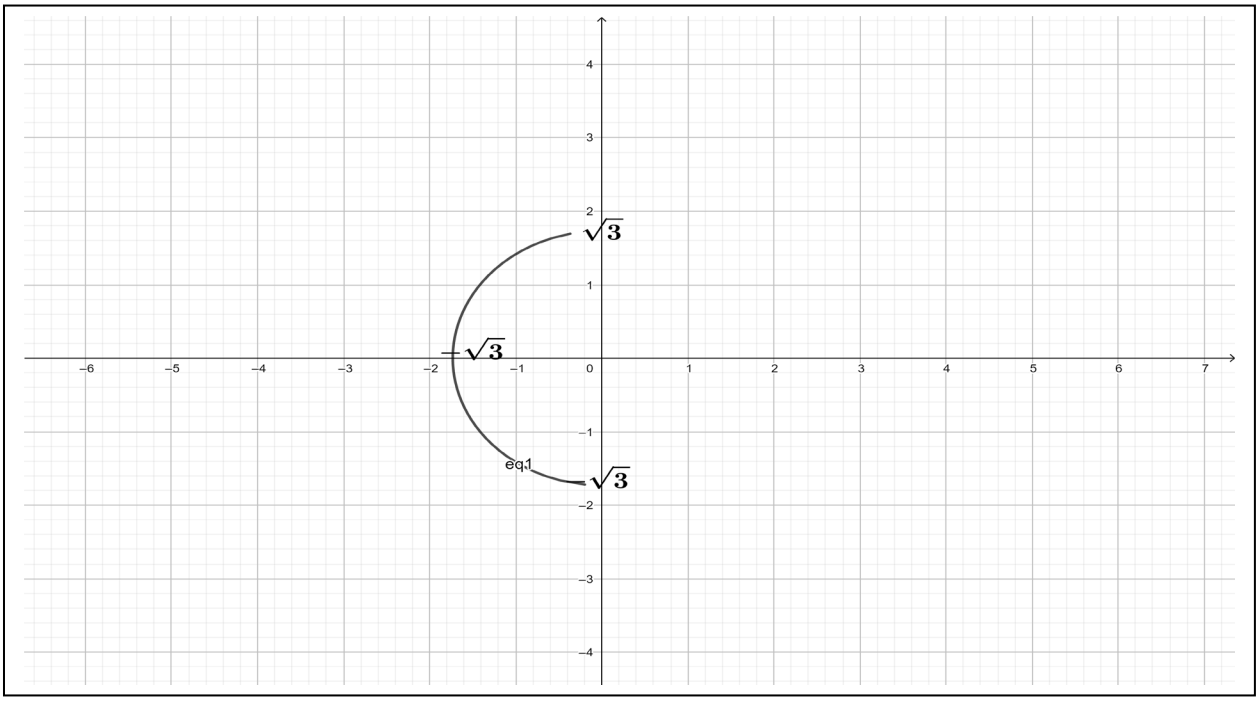
Graph√
Axis√ (2)

1.2



Graph√
Axis√ (2)

1.3 1.3.1



Graph√
Axis√

It is a relation.√ (3)

1.3.2 Continuous (1)

1.4
$$|r| = \sqrt{x^2 + y^2}$$
$$= \sqrt{3^2 + (-4)^2}$$
$$= \sqrt{25}$$
$$= 5 \surd$$
$$\tan\theta = \frac{y}{x}$$
$$\theta = \tan^{-1}\left(\frac{4}{3}\right)$$
$$\theta = 53^0 \surd$$
$$\theta = 360^0 - 53^0$$
$$\theta = 307^0 \surd$$
$$\therefore \left(5\angle 307^0\right)^3 \surd$$
$$= 125Cis921^0 \quad \text{OR} \quad 125\left(\cos 921^0 - i\sin 921^0\right) \quad \text{OR} \quad 125\angle 921^0 \surd\surd$$ (6)

1.5 $$x - jy = \frac{7 - j^9}{1 - j}$$

$$(x - jy)(1 - j) = 7 - j^9$$

$$x - jy - jx + j^2 y = 7 - j \;\surd$$

$$x - y = 7 \ldots\ldots\ldots\ldots (1) \;\surd$$

$$-x - y = -1 \ldots\ldots\ldots\ldots (2) \;\surd$$

ADD (1) AND (2)

$$-2y = 6$$

$$y = -3 \;\surd$$

Substitute y in (1)

$$x - (-x) = 7$$

$$x = 4 \;\surd$$

(5)

1.6 $$j^9 - j^2$$

$$= j + 1 \;\surd$$

(1)
[20]

QUESTION 2

2.1 $$\cos^2\theta + \tan\theta.\cos\theta$$

$$= \left(\frac{\sqrt{39}}{8}\right)^2 + \left(\frac{-5}{-\sqrt{13}}\right)\left(\frac{-\sqrt{39}}{8}\right) \;\surd$$

$$= \frac{39}{64} - \frac{5}{8} \;\surd$$

$$= \frac{39 - 40}{64} \;\surd$$

$$= -\frac{1}{64} \;\surd$$

(4)

2.2 $$\cot(90^0 + \theta) = -\tan\theta$$

PROVE: $\cot(90^0 + \theta)$

$$= \frac{\cos(90^0 + \theta)}{\sin(90^0 + \theta)} \;\surd$$

$$= \frac{\cos 90^0.\cos\theta - \sin 90^0.\sin\theta}{\sin 90^0.\cos\theta + \cos 90^0.\sin\theta} \;\surd$$

$$= \frac{0.\cos\theta - 1.\sin\theta}{1.\cos\theta + 0.\sin\theta} \;\surd$$

$$= \frac{-\sin\theta}{\cos\theta}$$

$$= -\tan\theta \;\surd$$

(4)

2.3 $\dfrac{\sin x+\tan x}{\cos ecx+\cot x}$

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

$$=\frac{\dfrac{\sin x.\cos x+\sin x}{\cos x}}{\dfrac{1+\cos x}{\sin x}}\surd$$

$$=\frac{\sin x(\cos x+1)}{\cos x}.\frac{\sin x}{(1+\cos x)}\surd$$

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

$$=\frac{\sin x}{\cos x}.\frac{\sin x}{1}$$

$$=\tan x.\sin x\surd$$

(4)

2.4 $\dfrac{\sec\theta+\tan\theta}{\cos\theta}=\dfrac{1}{1-\sin\theta}$

$$\text{LHS}=\frac{\dfrac{1}{\cos\theta}+\dfrac{\sin\theta}{\cos\theta}}{\cos\theta}\surd$$

$$=\frac{1+\sin\theta}{\cos\theta}.\frac{1}{\cos\theta}$$

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

$$=\frac{1+\sin\theta}{1-\sin^2\theta}\surd$$

$$=\frac{(1+\sin\theta)}{(1+\sin\theta)(1-\sin\theta)}\surd$$

$$=\frac{1}{1-\sin\theta}\surd$$

$$=\text{RHS}$$

(4)

2.5 $\sec\left(\frac{\alpha}{2}+5^0\right)=-\cos ec\left(20^0-\alpha\right)$

$\sec\left(\frac{\alpha}{2}+5^0\right)=\sec\left[90^0-\left(-20^0+\alpha\right)\right]\surd$

$\frac{\alpha}{2}+5^0=90^0+20^0-\alpha\surd$

$\frac{3}{2}\alpha=105^0$

$3\alpha=210^0\surd$

$\alpha=70^0\surd$

ALTERNATIVE METHOD

$\cos ec\left[90^0-\frac{\alpha}{2}-5^0\right]=\cos ec\left(-20^0+\alpha\right)\surd$

$90^0-\frac{\alpha}{2}-5^0=-20^0+\alpha\surd$

$-\frac{3}{2}\alpha=-105^0\surd$

$-3\alpha=-210^0$

$\alpha=70^0\surd$ (4)

[20]

QUESTION 3

3.1 $y=\sqrt{\sec x}$ $u=sex$

$y=\sqrt{u}$ $\frac{du}{dx}=\sec x.\tan x\surd$

$\frac{dy}{du}=\frac{1}{2}u^{-\frac{1}{2}}$

$=\frac{1}{2\sqrt{u}}\surd$

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

$=\frac{1}{2\sqrt{u}}.\sec x.\tan x\surd$

$=\frac{\sec x.\tan x}{2\sqrt{\sec x}}\surd$ (4)

3.2 $\frac{dy}{dx}=2\cos x+\sec x.\tan x+\frac{1}{2}e^{7x}-2^x.\ln 2+\frac{3}{4}\pi^{3x}.\ln\pi-0+\frac{1}{2x}$ (7)

3.3 $y = 5x^5 - 2x$

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

$$=\frac{5(x+h)^5-2(x+h)-(5x^5-2x)}{h}\surd$$

$$=5\left[\frac{x^5+\frac{5x^{5-1}.h}{1!}+\frac{5(5-1)x^{5-2}.h^2}{2!}+\frac{5(5-1)(5-2)x^{5-3}.h^3}{3!}-2x-2h-5x^5+2x}{h}\right]\surd$$

$$=\frac{5x^5+25x^4h+50x^3h^2+50x^2h^3+50xh^4-2x-2h-5x^5+2x}{h}\surd$$

$$=\quad h\left[\frac{25x^4+50x^3h+50x^2h^2+50xh^3-2}{h}\right]\surd$$

$$=25x^4-2\surd$$ (5)

3.4 $y = x^3 - 12x^2 + 16x - 12$

$$\frac{d^2y}{dx^2} = 6x - 24\surd$$

$$6x - 24 = 0$$

$$x = 4\surd$$

Substitute x to the corresponding y – value:

$$y = 4^3 - 12(4)^2 + 16(4) - 12$$

$$y = -76\surd$$

Points of inflection: $(4,-76)\surd$ (4)

[20]

QUESTION 4

4.1 $$3^{x+2} = \ln 19$$

$$\ln 3(x+3) = \ln(\ln 19)\surd$$

$$1{,}098x + 2{,}197 = 1{,}079\surd$$

$$1{,}098x = -1{,}118$$

$$x = -1{,}018\surd$$ (3)

4.2 $3x+4y=6$
$x-2y=-3$

$$\begin{vmatrix}3 & 4\\ 1 & -2\end{vmatrix}=-6-4=-10\ \surd$$
$$D_x=\begin{vmatrix}6 & 4\\ -3 & -2\end{vmatrix}=-12+12=0\ \surd$$
$$D_y=\begin{vmatrix}3 & 6\\ 1 & -3\end{vmatrix}=-9-6=-15\ \surd$$
$$x=\frac{D_x}{D}=\frac{0}{-10}=0\ \surd$$
$$y=\frac{D_y}{D}=\frac{-15}{-10}=1{,}5\ \surd$$

(5)

4.3
$$\begin{vmatrix}3 & 7 & 9\\ -3 & -1 & 6\\ 4 & 8 & 5\end{vmatrix}$$

4.3.1 $$\begin{vmatrix}-3 & 6\\ 4 & 5\end{vmatrix}=-15-24=-39\ \surd\surd$$

4.3.2 $$(-1)^{2+2}\begin{vmatrix}3 & 9\\ 4 & 5\end{vmatrix}=15-36=-21\ \surd\surd$$

(2 × 2) (4)

4.4 $x+y=4.....(1)\ \surd$
$4(x-y)=15.....(2)\surd$
$4x-4y=15$
$y=4-x$

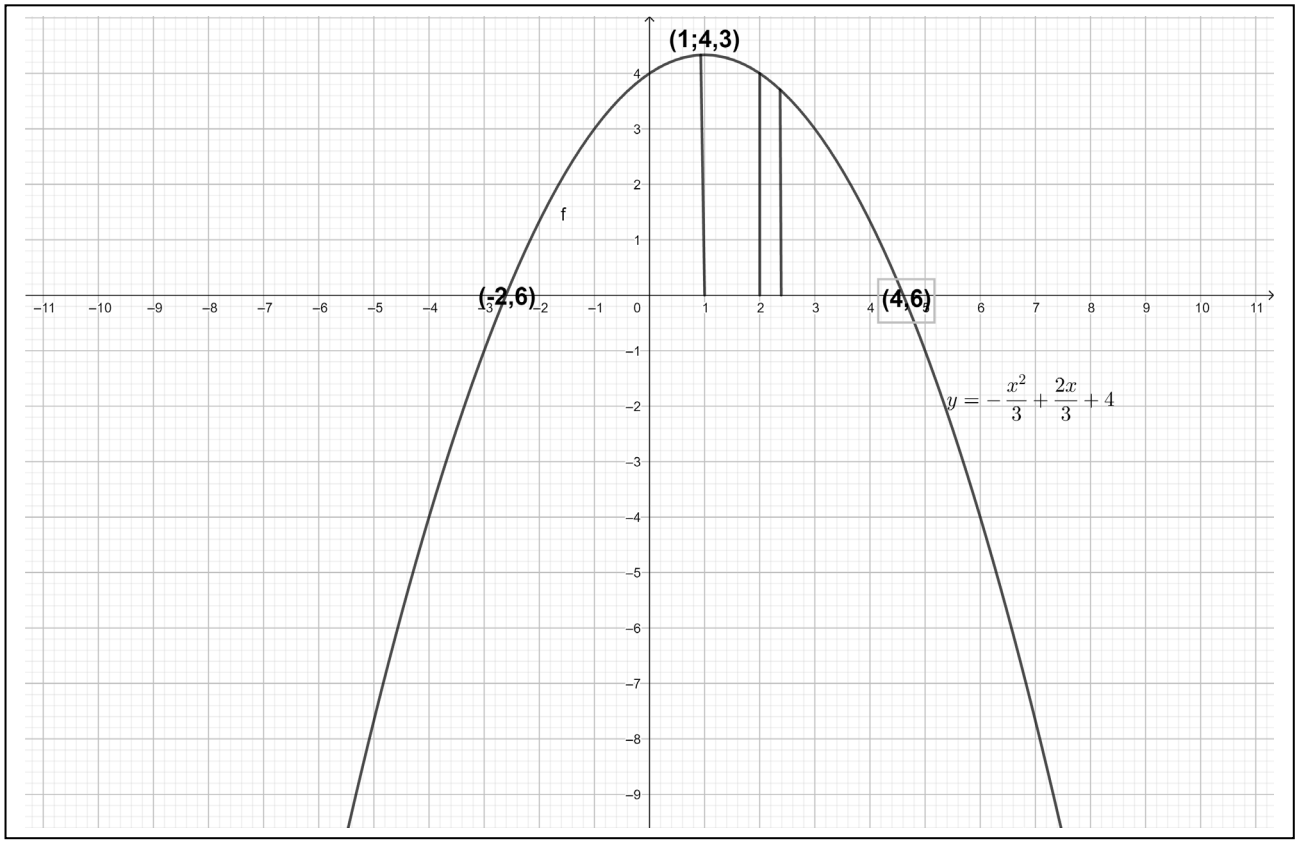
Substitute $y-in\,(2)$
$4x-4(4-x)=15\ \surd$
$4x-16+4x=-64$
$x=6\ \surd$
$y=-2\ \surd$

(5)

4.5
$$P = \frac{DB}{C}\ln\left(\frac{N}{R}\right)$$
$$\ln\left(\frac{N}{R}\right) = \frac{PC}{DB}\surd$$
$$\frac{N}{R} = e^{\frac{PC}{DB}}\surd$$
$$N = \text{Re}^{\frac{PC}{DB}}\surd$$
(3)
[20]

QUESTION 5

5.1 5.1.1



Indicating the area√
Drawing the strip√ (2)

5.1.2 $\int_1^{4,6}\left(\frac{-1}{3}x^2+\frac{2}{3}x+4\right)dx$ √

$=\left[\frac{-x^3}{9}+\frac{1}{3}x^2+4x\right]_1^4$ √

$=\frac{-(4)^3}{9}+\frac{1}{3}(4)^2+4(4)-\left(-\frac{1^3}{9}+\frac{1}{3}.1^2+4(1)\right)$ √

$=14{,}2-4{,}2$ √

$=10\ units^2$ √ (5)

5.2 $=\frac{4.\pi^{3x}}{3\ln\pi}-5\pi\ln x+\sec x-\frac{1}{3}\cot 3x-\frac{e^{-3x}}{3\ln e}-\frac{5^{-7x}}{7\ln 5}+px+c$ (7)

5.3 $\int_0^{\frac{\pi}{2}}\sin 3x dx$

$=\left[\frac{-1}{3}\cos x+c\right]_0^{\frac{\pi}{2}}$ √

$=\frac{-1}{3}\cos\left(\frac{\pi}{2}\right)+c-\left(-\frac{1}{3}\cos 0^0+c\right)$ √

$=\frac{1}{3}/0.333$ √ (3)

5.4 $\int\left(-\cos ecx.\cot x-\left(coesc^2x\right)\right)dx$

$=-\cos ecx+\cot x$ √

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

$=\frac{\cos x-1}{\sin x}$ √ (3)

[20]

TOTAL: 100