higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

MATHEMATICS N2

27 MARCH 2018

This marking guideline consists of 10 pages.

QUESTION 1

1.1 1.1.1

$$\frac{32^{\frac{3}{5}} \times 81^{-\frac{3}{4}}}{\left(2\frac{1}{4}\right)^{-\frac{3}{2}}}$$

$$= \frac{\left(2^5\right)^{\frac{3}{5}} \times \left(3^4\right)^{-\frac{3}{4}}}{\left(\frac{9}{4}\right)^{-\frac{3}{2}}} \quad \checkmark \quad \checkmark$$

$$= 2^3 \times 3^{-3} \times \left(\frac{3^2}{2^2}\right)^{\frac{3}{2}}$$

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

$$= 2^0 \times 3^0$$

$$= 1 \quad \checkmark \qquad (4)$$

1.1.2

$$\frac{2^{n+4} - 6.2^{n+1}}{2^{n+2} \times 5}$$

$$= \frac{2^n\left(2^4 - 6.2\right)}{2^n.2^2 \times 5} \quad \checkmark \quad \checkmark$$

$$= \frac{16 - 12}{20}$$

$$= \frac{1}{5} \quad \checkmark \qquad (3)$$

1.2 1.2.1

$2 = 10^a$

$\therefore \log 2 = a \quad \checkmark$

$9 = 10^b$

$\therefore \log 9 = b$

$\therefore \log 3^2 = b \quad \checkmark$

$\therefore 2\log 3 = b$

$\therefore \log 3 = \frac{b}{2} \quad \checkmark$

$$\log 4 = \log 2^2$$
$$= 2\log 2$$
$$= 2a \quad \checkmark \qquad (4)$$

1.2.2 $\log 6 = \log(2\times 3)$

$= \log 2 + \log 3$ ✓

$= a + \frac{b}{2}$ ✓ (2)

1.3 1.3.1 $9^x = \frac{1}{3}\sqrt{3}$

$\therefore 3^{2x} = 3^{-1}.3^{\frac{1}{2}}$

$\therefore 3^{2x} = 3^{-\frac{1}{2}}$ ✓

$\therefore 2x = -\frac{1}{2}$ ✓

$\therefore x = -\frac{1}{4}$ ✓ (3)

1.3.2 $\log_5(x+3) - \log_5(2x+1) = 1 - \log_5 9$

$\therefore \log_5(x+3) - \log_5(2x+1) + \log_5 9 = 1$

$\therefore \log_5\left[\frac{9(x+3)}{2x+1}\right] = 1$ ✓

$\therefore \frac{9(x+3)}{2x+1} = 5$ ✓

$\therefore 9x + 27 = 10x + 5$ ✓

$\therefore x = 22$ ✓ (4)

1.4 1.4.1 $b = \sqrt{\frac{3pR}{2\pi Q}}$

$b^2 = \frac{3pR}{2\pi Q}$ ✓

$2\pi Q b^2 = 3pR$

$\therefore Q = \frac{3pR}{2\pi b^2}$ ✓ (2)

1.4 1.4.2 $Q = \frac{3\times 12\times 16}{2\pi\times 11^2} = 0{,}758$ ✓✓ (2)

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QUESTION 2

2.1
$$16p^2 - 25q^2 - 4p - 5q$$
$$= (4p + 5q)(4p - 5q) - (4p + 5q) \quad ✓ \quad ✓$$
$$= (4p + 5q)(4p - 5q - 1) \quad ✓$$
(3)

2.2
$$x^3 - xy^2$$
$$= x\left(x^2 - y^2\right)$$
$$= x(x - y)(x + y) \quad ✓$$

$$2x^2 + xy - 3y^2$$
$$= (2x + 3y)(x - y) \quad ✓$$

$$2x^2 - 4xy + 2y^2$$
$$= 2(x^2 - 2xy + y^2)$$
$$= 2(x - y)^2 \quad ✓$$

$$\text{LCM} = 2x(x - y)^2(x + y)(2x + 3y) \quad ✓ \quad ✓ \quad ✓ \quad ✓$$
(7)

2.3 2.3.1
$$\frac{a^2c - b^2c}{a^2 - 2ab + b^2} \div \frac{ac + bc}{a - b}$$
$$= \frac{c(a - b)(a + b)}{(a - b)(a - b)} \times \frac{a - b}{c(a + b)} \quad ✓ \quad ✓ \quad ✓ \quad ✓ \quad ✓$$
$$= 1 \quad ✓$$
(5)

2.3.2 $\dfrac{4}{x+4}+\dfrac{x}{x-4}-\dfrac{8x}{x^2-16}$

$=\dfrac{4}{x+4}+\dfrac{x}{x-4}-\dfrac{8x}{(x-4)(x+4)}$ ✓

$=\dfrac{4(x-4)+x(x+4)-8x}{(x-4)(x+4)}$ ✓ ✓

$=\dfrac{4x-16+x^2+4x-8x}{(x-4)(x+4)}$ ✓ ✓

$=\dfrac{x^2-16}{(x+4)(x-4)}$ ✓

$=\dfrac{(x+4)(x-4)}{(x+4)(x-4)}$ ✓

$=1$ ✓ (7)

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QUESTION 3

3.1 Green balls $= g$ and white balls $= w$

$g + w = 60$✓

$2g - w = 9$✓

$\therefore 3g = 69$

$g = 23$ ✓ and $w = 37$✓ (4)

3.2 $5x^2 - 3x - 3 = 0$

$a = 5 \quad b = -3 \quad c = -3$

$x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$= \dfrac{3 \pm \sqrt{9 - 4(5)(-3)}}{2(5)}$ ✓

$= \dfrac{3 \pm \sqrt{69}}{10}$ ✓

$\therefore x = \dfrac{3+\sqrt{69}}{10}$ *or* $x = \dfrac{3-\sqrt{69}}{10}$

$\therefore x = 1{,}131$ ✓ $x = -0{,}531$ ✓

(4)

3.3 3.3.1 $\omega = 2\pi n$
$= 2\pi(10,54)$ ✓
$= 66,225$ rad/s ✓ (2)

3.3.2 $V = \pi Dn$
$= \pi(0,75)(10,54)$ ✓ ✓
$= 24,834$ m/s ✓ (3)

3.4 $\theta = 68^\circ = 1,187$ rad ✓

$A = \frac{1}{2}r^2\theta$

$\therefore 184 = \frac{1}{2}r^2(1,187)$ ✓

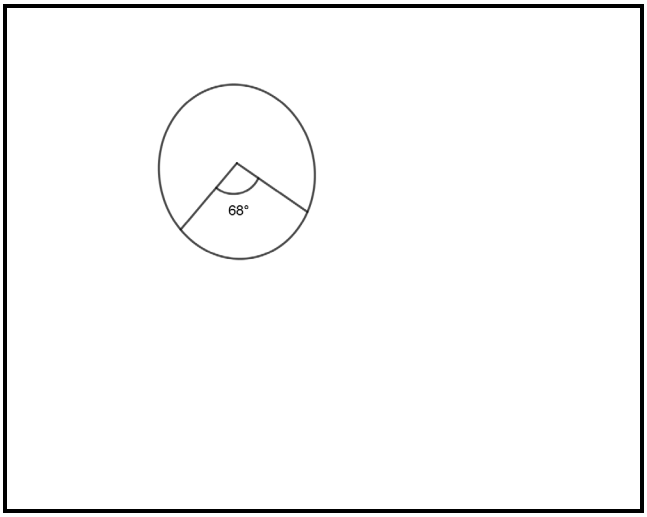
$\therefore \frac{2\times184}{1,187} = r^2$ ✓

$\therefore r = 17,608$ cm

arc = radius × θ

$=17,608\times1,187$ ✓

$=20,900$ cm ✓



(5)
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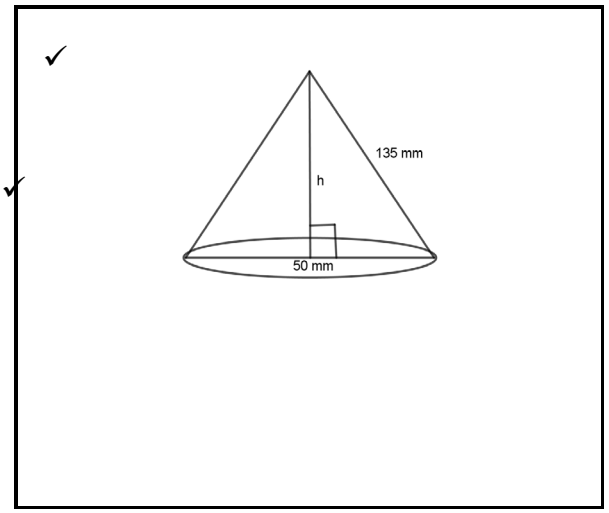
QUESTION 4

4.1 4.1.1 Surface area $= \pi rl + \pi r^2$
$=\pi(25)(135) + \pi(25)^2$
$=4000\pi$
$=12\ 566,371$ mm^2 ✓



(2)

4.1.2 $V = \frac{1}{3}\pi r^2 h$

$= \frac{1}{3}\pi(25)^2 h$

But $h^2 = 135^2 - 25^2$ (Pythagoras) ✓

$\therefore h^2 = 17600$

$\therefore h = 132,665$ mm ✓

$\therefore V = \frac{1}{3}\pi(25)^2(132,665)$ ✓

$\therefore V = 86829,039 mm^3$ ✓ (4)

4.2 $\left[\frac{(\text{First Ordinate} + \text{Last Ordinate})}{2} + \text{Sum of all other ordinates}\right] \times \text{The distance between the ordinates} = A$

$\left[\frac{120+118}{2} + 127 + 139 + 143 + 147 + 163 + 157 + 148 + 153 + 148 + 136\right] \times D = 18960$ ✓✓

$D = \frac{18960}{1669} = 11,160$ cm✓

(3)

4.3 $A = 4\pi r^2$

$\therefore 125 = 4\pi r^2$ ✓

$\therefore r^2 = \frac{125}{4\pi}$

$\therefore r = 3,154$m ✓

$V = \frac{4}{3}\pi r^3$

$= \frac{4}{3}\pi(3,154)^3$ ✓

$= 131,424\ m^3$ ✓ (4)

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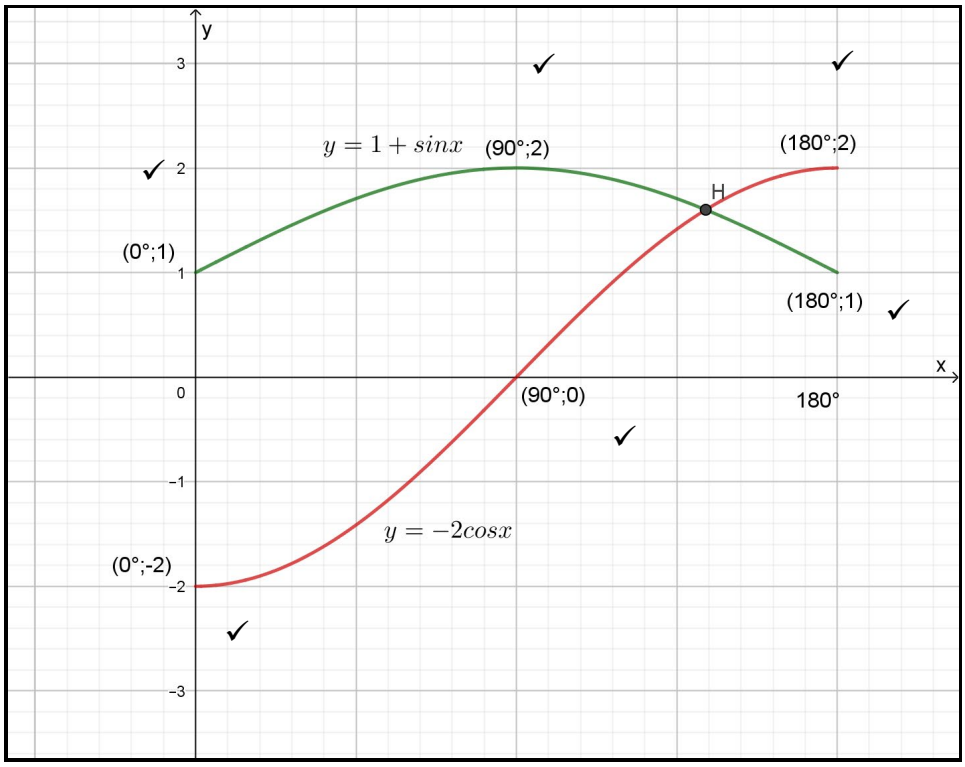
QUESTION 5

5.1 5.1.1



(6)

Mark allocation:
3 marks - $y = -2\cos^x$
$(0^\circ;-2)$ $(90^\circ;0)$ $(180^\circ;2)$ ✓✓✓
3 marks $y = 1 + \sin^x$ $(0^o;1)$ $(90^o;2)$ $(180^o;1)$ ✓✓✓

5.1.2 If $-2\cos x = 1$
then $x = 120^o$ ✓

(1)

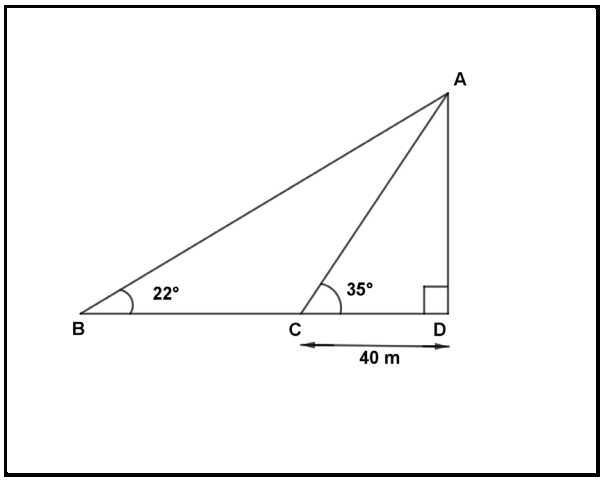
5.2 5.2.1 In ΔABC:

$\frac{AD}{CD} = \tan 35^o$ ✓

$\therefore \frac{AD}{40} = \tan 35^o$

$\therefore AD = 40\tan 35^o$ ✓

$\therefore AD = 28,008\text{m}$ ✓



(3)

5.2 5.2.2 In ΔABD:

$$\tan 22^\circ = \frac{AD}{BD} \quad \checkmark$$

$$\therefore \tan 22^\circ = \frac{28,008}{BD} \quad \checkmark$$

$$\therefore BD = \frac{28,008}{\tan 22^\circ} \quad \checkmark$$

$$\therefore BD = 69,322\text{m}$$

$$\therefore BC = BD - CD$$

$$= 69,322 - 40 \quad \checkmark$$

$$= 29,322\text{m} \quad \checkmark$$

(5)
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QUESTION 6

6.1 $Roots: let\ y = 0$

$$y = -x^2 - 4x$$

$$0 = -x^2 - 4x$$

$$-x^2 - 4x = 0$$

$$-x(x+4) = 0$$

$$\therefore -x = 0 \quad or \quad x + 4 = 0$$

$$\therefore x = 0 \quad or \quad x = -4$$

the x-intercepts are $(0;0)$ and $(-4;0)$

y-intercept; let x=0 then the coordinates of the y-intercept is at (0;0)

Axis of symmetry:

$$x = -\frac{b}{2a} = -\frac{(-4)}{2(-1)} = -2$$

Turning point

$$y = -(-2)^2 - 4(-2) = 4$$

The coordinates of the turning point : $(-2;4)$

$$y - 2x - 8 = 0$$

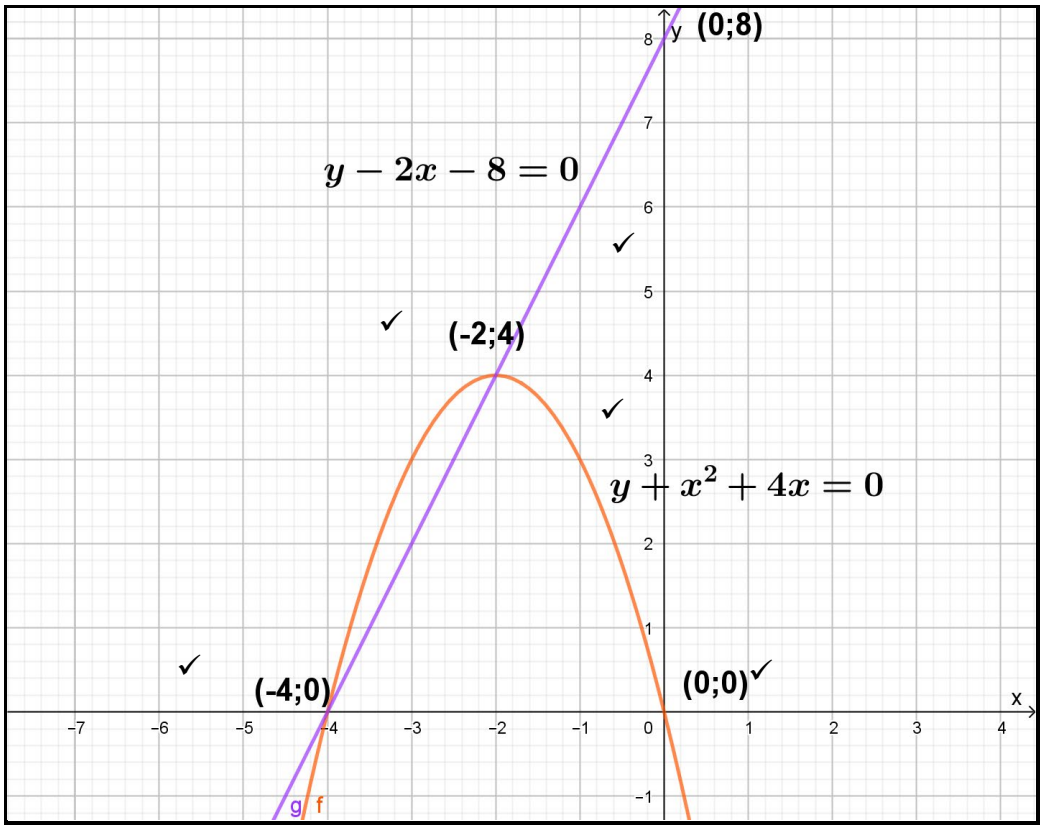
$$\therefore x - \text{intercept} : x = -4$$

$$x - \text{intercept} : (-4;0)$$

$$y - \text{intercept} : y - 8 = 0$$

$$y = 8$$

$$y - \text{intercept} : (0;8)$$



Mark allocation:
Parabola $(-4;0)$ ✓ $(-2;4)$ ✓✓ $(0;0)$ ✓
straight line $(-4;0)$ ✓ $(0;8)$ ✓ (6)

6.2 $(-4;0)$ and $(-2;4)$ ✓✓ (2)
[8]

TOTAL: 100