higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

NOVEMBER EXAMINATION

MATHEMATICS N2

24 NOVEMBER 2016

This marking guideline consists of 11 pages.

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INSTRUCTIONS AND INFORMATION

1. ✓ equals 1 mark.

2. Half marks are not allocated, unless indicated otherwise (√).

3. When a formula is required and the wrong formula used, it is a principle error and NO marks are allocated.

4. Students should show ALL formulae and intermediate steps and simplify where possible.

5. ALL final answers must be rounded off to THREE decimals (unless indicated otherwise).

6. Questions may be answered in any order but subsections of questions must be kept together. If subsections are separated the student can be penalised by ONE mark.

7. Where a student copied wrongly from the question paper and the standard of the question is still the same, the student will be penalised by ONE mark. If the copying error simplifies the question and makes it easier, the student forfeits the marks.

8. Questions must be answered in blue or black ink. Answers in pencil are NOT marked as it is regarded as rough work.

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QUESTION 1

1.1 $x^2-4=(x-2)(x+2)$ ✓

$8x^2-14x-4=2(4x+1)(x-2)$ ✓ ✓

$x^3+2x^2-4x-8=x^2(x+2)-4(x+2)$

$=(x+2)(x^2-4)$

$=(x+2)(x+2)(x-2)$

$=(x+2)^2(x-2)$ ✓ ✓

$HCF=(x-2)$ ✓

$LCM=2(4x+1)(x-2)(x+2)^2$ ✓ ✓

(8)

1.2 1.2.1

$\frac{1}{4x-4}+\frac{6}{8(x-1)}-\frac{1}{(x^2-1)}$ ✓

$\frac{1}{4(x-1)}+\frac{6}{8(x-1)}-\frac{1}{(x-1)(x+1)}$ ✓

$=\frac{2(x+1)+6(x+1)-8}{8(x-1)(x+1)}$

$=\frac{x}{(x-1)(x+1)}$ ✓

$\frac{1}{4x-4}+\frac{6}{8(x-1)}-\frac{1}{(x^2-1)}$

$=\frac{1}{4(x-1)}+\frac{3}{4(x-1)}-\frac{1}{(x-1)(x+1)}$ ✓

$=\frac{4}{4(x-1)}-\frac{1}{(x-1)(x+1)}$

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

$=\frac{(x+1)-1}{(x-1)(x+1)}$

$=\frac{x+1-1}{(x-1)(x+1)}$ ✓

$=\frac{x}{(x-1)(x+1)}$ ✓

(4)

1.2 1.2.2

$\frac{x^2-9}{4x^2-9}\div\frac{8x+12}{4x^2-9}\times\frac{8x+12}{4x-12}$

✓ ✓

$=\frac{(x-3)(x+3)}{4x^2-9}\times\frac{4x^2-9}{8x+12}\times\frac{8x+12}{4(x-3)}$ ✓

$=\frac{x+3}{4}$ ✓

(4)

[16]

QUESTION 2

2.1 $x(5x-6)=2(3+x)$

$5x^2-6x=6+2x$

$5x^2-8x-6=0$ ✓

$a=5 \quad b=-8 \quad c=-6$

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

$x=\dfrac{-(-8)\pm\sqrt{(-8)^2-4(5)(-6)}}{2(5)}=\dfrac{8\pm\sqrt{184}}{10}$ ✓

$x=\dfrac{8+\sqrt{184}}{10} \quad or \quad x=\dfrac{8-\sqrt{184}}{10}$

$x=2{,}156$ ✓ $\quad x=-0{,}556$ ✓ (4)

2.2 $y=x-1$ ….eq(1)

$y=-\dfrac{x}{4}+4$ …..eq(2) ✓

From eq(1) and eq(2)

$x-1=-\dfrac{x}{4}+4$ ✓

$\therefore 4x-4=-x+16$

$\therefore 5x=20$

$\therefore x=4$ ✓

$From\ eq(1): \quad y=4-1$

$\therefore \ y=3$ ✓ (4)

2.3 $\dfrac{3}{x}=A-\dfrac{5}{y}$

$\therefore \dfrac{5}{y}=A-\dfrac{3}{x}$

$\therefore \ \dfrac{5}{y}=\dfrac{Ax-3}{x}$ ✓

$\therefore \ \dfrac{y}{5}=\dfrac{x}{Ax-3}$ ✓

$y=\dfrac{5x}{Ax-3}$ ✓ (3)

2.4 Let the number be 10x+y

$\therefore x = y + 2$ ....(1) ✓

$10y + x + 10x + y = 88$ .....(2)

$\therefore 11x + 11y = 88$

$\therefore x + y = 8$ .....(3)

From (1) and (3): $y + 2 + y = 8$

$\therefore 2y = 6$

$\therefore y = 3$ ✓

From (1): $x = 3 + 2$

$\therefore x = 5$ ✓

$\therefore$ Number is 10(5)+3=53 ✓

(4)
[15]

QUESTION 3

3.1 3.1.1

$$\frac{3^{x-1} \times 9^{x+2}}{27^{x+1}}$$

$$= \frac{3^{x-1} \times 3^{2x+4}}{3^{3x+3}}$$ ✓

$$= \frac{3^{3x+3}}{3^{3x+3}}$$ ✓

$= 1$ ✓

$$\frac{3^{x-1} \times 9^{x+2}}{27^{x+1}}$$

$$= \frac{3^{x-1} \times \left(3^2\right)^{x+2}}{\left(3^3\right)^{x+1}}$$

$$= \frac{3^{x-1} \times 3^{2x+4}}{3^{3x+3}}$$ ✓

$= 3^{x-1+2x+4-3x-3}$ ✓

$= 3^0$

$= 1$ ✓

(3)

3.1.2

$$\sqrt{\sqrt[3]{64x^8x^4}}$$

$= \sqrt[6]{2^6 x^{12}}$ ✓ ✓

$= 2x^2$ ✓

$$\sqrt{\sqrt[3]{64x^8x^4}}$$

$\sqrt{\sqrt[3]{2^6 x^{12}}}$ ✓

$= \sqrt{2^2 x^4}$ ✓

$= 2x^2$ ✓

(3)

3.2 3.2.1

$16^{x+1} - 4^3 = 0$

$\therefore 16^{x+1} = 4^3$

$\therefore 4^{2x+2} = 4^3$ ✓

$\therefore 2x + 2 = 3$ ✓

$\therefore 2x = 1$

$\therefore x = \frac{1}{2}$ ✓

(3)

3.2.2 $3^{4x^2-1}=1$

$\therefore 3^{4x^2-1}=3^0$ ✓

$\therefore 4x^2-1=0$ ✓

$\therefore 4x^2=1$

$\therefore x^2=\frac{1}{4}$ ✓

$\therefore x=\frac{1}{2}$ or $x=-\frac{1}{2}$

✓ ✓

(5)

3.3 $\log_2(x^2-2x)=3$

✓

$x^2-2x=2^3$

✓

$x^2-2x-8=0$

✓

$(x-4)(x+2)=0$

$x=4$ or $x=-2(n/a)$

✓ ✓

$x=-2$ can only be awarded with a mark if the root is excluded.

(5)

[19]

QUESTION 4

4.1 4.1.1 $\frac{2106}{60}=35,1r/s$ ✓

(1)

4.1.2 $V=\pi Dn$

$V=\pi(0,28)(35,1)$ ✓ ✓

$V=30,876m/s$

✓

diameter in meters

(3)

4.2 $D=\frac{x^2}{4h}+h$

$x=\sqrt{4Dh-4x^2}$

$=\sqrt{4(42)(10)-4(10)^2}$ ✓ ✓

$=\sqrt{1680-400}$

$=\sqrt{1280}$ ✓

$x=35,777mm$ ✓

Radius =21 mm
Diameter=42 mm

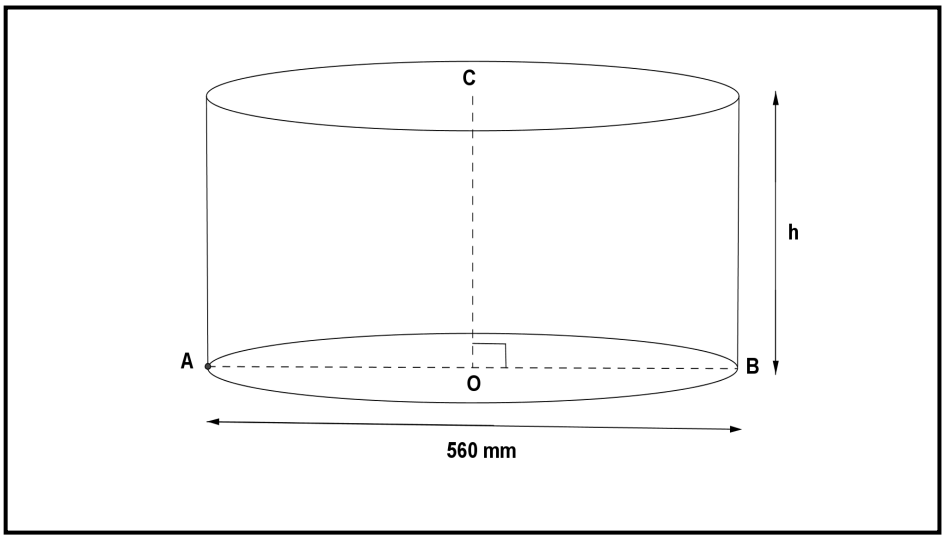
(4)

4.3 $e^{-0,5}\cos\left(\ln\frac{\pi}{4}\right)+\sin 270^o-\tan\pi$

= -0,411 ✓

(1)

4.4



4.4.1 $A = 2\pi r^2 + 2\pi rh$

$2\pi(28)^2 + 2\pi(28)h = 7891$ ✓

$\therefore 4926{,}017 + 175{,}929h = 7891$

$\therefore 175{,}929h = 2964{,}983$ ✓

$\therefore h = \dfrac{2964{,}983}{175{,}929}$ ✓

$h = 16{,}853cm$ ✓ (4)

4.4.2 $V = \pi r^2 h$

$V = \pi(28)^2(16{,}853)$ ✓ ✓

$V = 41509{,}08462cm^3$ ✓

$= 41{,}509l$ ✓

Follow up on wrong height of QUESTION 4.3.1

(4)

4.5

Volume of sphere$= \dfrac{4}{3}\pi r^3$

$= \dfrac{4}{3}\pi(60)^3$ ✓

$= 904778{,}684mm^3$ ✓

Volume of small cubes$= l^3$

$= 20^3 = 8000mm^3$ ✓

number of smaller cubes $= \dfrac{904778{,}684}{8000}$

$= 113$ small cubes ✓

Volume of sphere$= \dfrac{4}{3}\pi r^3$

$= \dfrac{4}{3}\pi(6)^3$ ✓

$= 904{,}779cm^3$ ✓

Volume of small cubes$= l^3$

$= 2^3 = 8cm^3$ ✓

number of smaller cubes $= \dfrac{904{,}779}{8}$

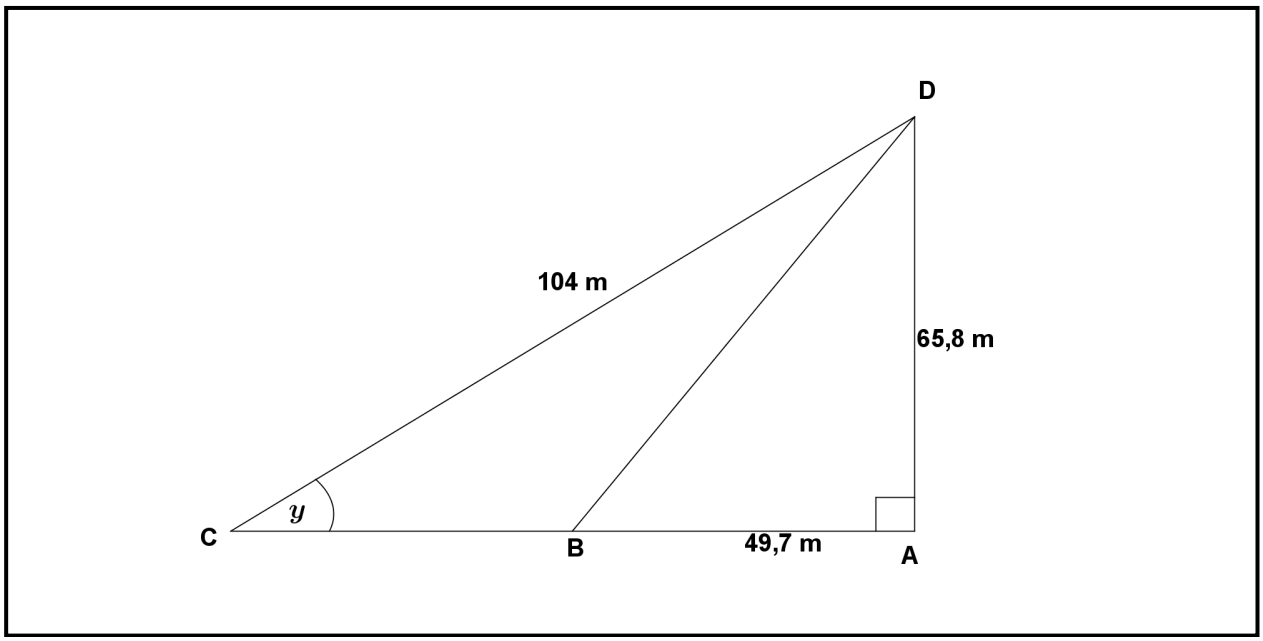
$= 113$ small cubes ✓

(4)

[21]

QUESTION 5

5.1



5.1.1

$DB^2 = (65,8)^2 + (49,7)^2$ ✓

$DB^2 = 6799,73$ ✓

$DB = 82,460$ m ✓ (3)

5.1.2

In ΔACD

$\sin y = \frac{65,8}{104}$ ✓

$\therefore y = 39,272^{\circ} (or 39,249^{\circ})$ ✓ (2)

5.1.3

$AC^2 + 65,8^2 = 104^2$

$AC^2 = 6486,36$ ✓

$AC = 80,538$ ✓

$BC = 80,538 - 49,7$ ✓

$BC = 30,838$ ✓

OR

$\tan 39,272^o = \frac{65,8}{AC}$ ✓

$AC = \frac{65,8}{\tan 39,272^o}$ ✓

$AC = 80.472 (or 80,538)$ ✓

$BC = 30,772 (or 30,838)$ ✓

Or

let $BC = x$

$104^2 = 65,8^2 + (49,7 + x)^2$ ✓

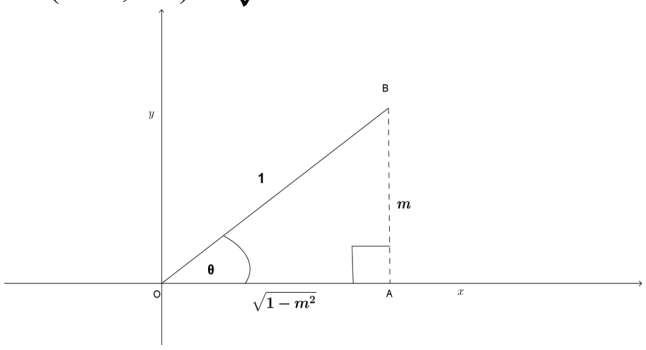
$\sqrt{104^2 - 65,8^2} = 49,7 + x$

$80,538 - 49,7 = x$ ✓

$\therefore BC = 30,84cm$ ✓

(4)

5.2



$\sin\theta = m = \frac{m}{1}$

In Δ ABC

$OA^2 = OB^2 - BA^2$

$= 1^2 - m^2$

$OA = \sqrt{1-m^2}$

5.2.1

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

(2)

5.2.2

$\sin^2\theta + \cos^2\theta$

$= m^2 + \left(\sqrt{1-m^2}\right)^2$ ✓

$= m^2 + 1 - m^2$

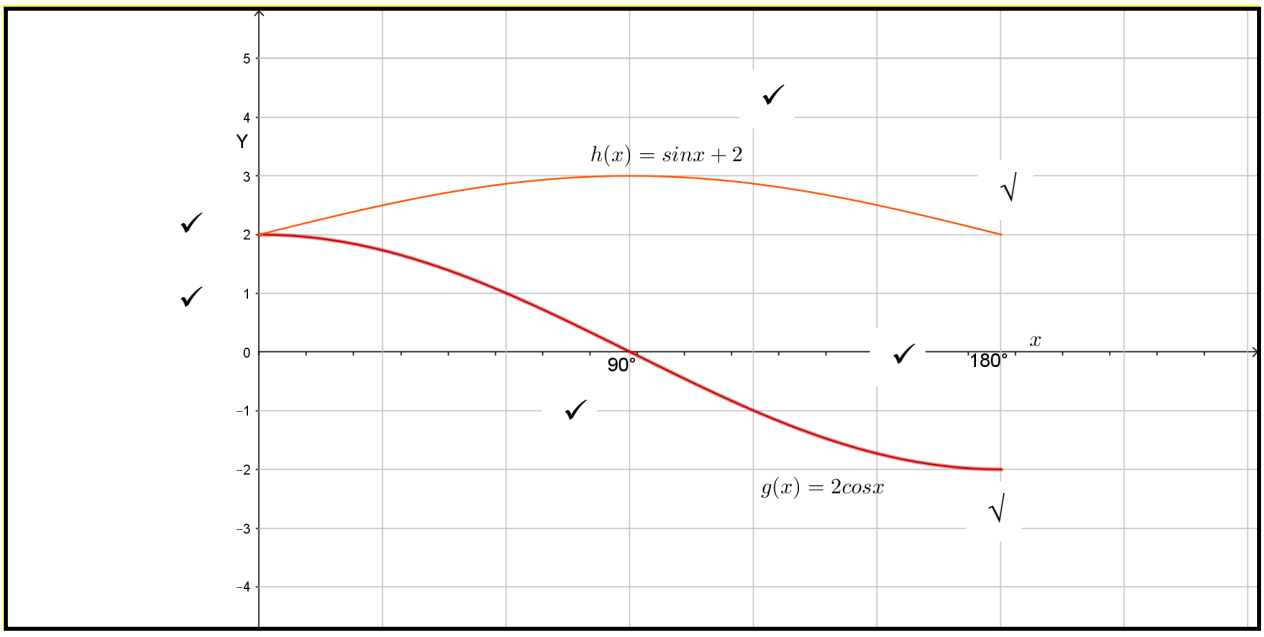
$= 1$ ✓

(2)

[13]

QUESTION 6

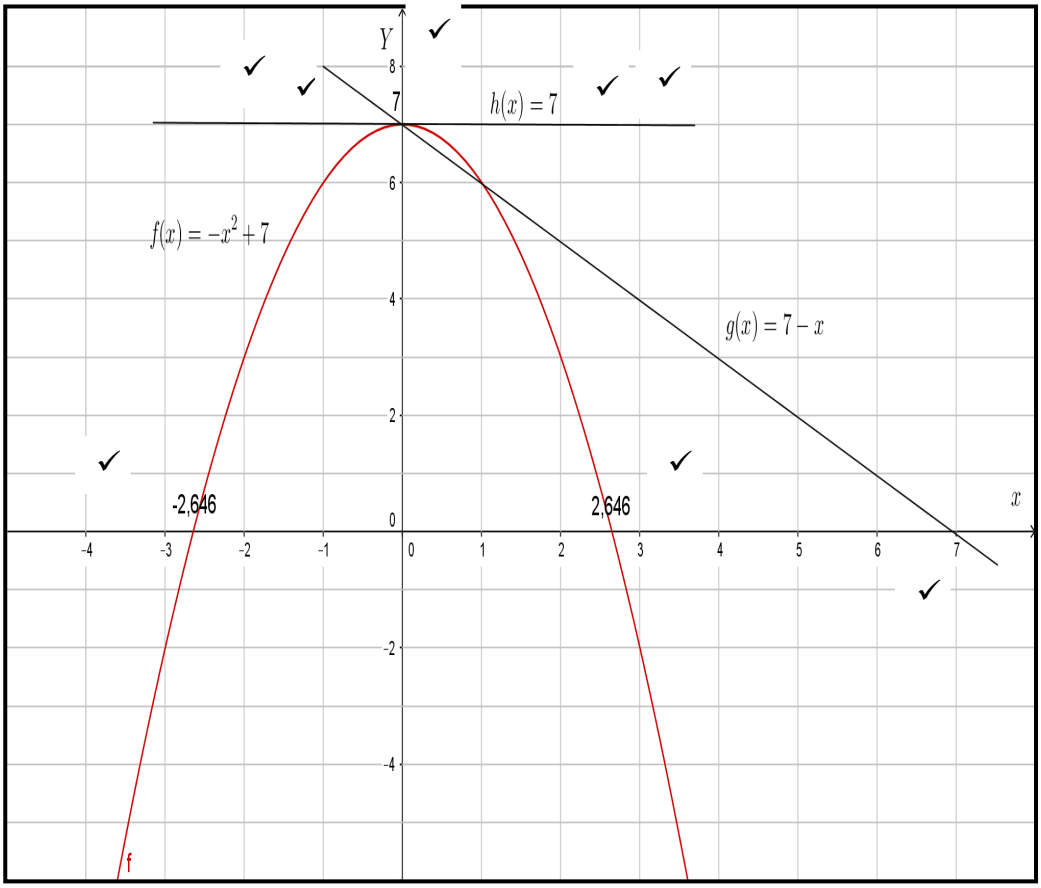
6.1 6.1.1



H	Starting point (0° ;2)	TP(maxvalue) (90° ;3)	Shape Half mark	Total =2½
G	Starting point (0° ; 2)	TP(min value)(180° ;-2)	Shape Half mark	Total =2½

6.1.2 (0° ; 2) ✓ (1)

6.2 (6.2.1 & 6.2.2)



(8)

Marking instructions-mark critical points only under the condition that the shape of the graphs are correct.

	Critical points	values	Values	Marks
Parabola				
✓✓	Roots	-2,646	2,646	2
✓	y-intercept	(0;7)		1
✓✓	TP	(0;7)		2
Total				5
$g(x) = 7 - x$ ✓	Root(x-intercept)	(7;0)		1
✓	Y-intercept	(0;7)		1
Total				2
✓H(x)=7	Y-intercept	(0;7)		1
Total				1

6.2.3 (0 ; 7) ✓ ✓ (2)

[16]

TOTAL: 100

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