

Centre Number	Candidate Number	Candidate Name
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**NAMIBIA SENIOR SECONDARY CERTIFICATE**

**MATHEMATICS HIGHER LEVEL**

**8323/2**

PAPER 2

3 hours

Marks 120

**2017**

Additional Materials: Geometrical instruments  
Non programmable calculator

**INSTRUCTIONS AND INFORMATION TO CANDIDATES**

- Candidates answer on the Question Paper in the spaces provided.
- Write your Centre Number, Candidate Number and Name in the spaces at the top of this page.
- Write in dark blue or black pen.
- You may use a soft pencil for any diagrams or graphs.
- Do not use correction fluid.
- Do not write in the margin *For Examiner's Use*.
- Answer **all** questions.
- If working is needed for any question it must be shown below, or where working is indicated.
- The number of marks is given in brackets [ ] at the end of each question or part question.
- Non-programmable calculators may be used.
- If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to **three** significant figures. Give answers for angle sizes to **one** decimal place but angles in radians to **three** significant figures.
- For  $\pi$  either use your calculator value, or use 3.142.

<i>For Examiner's Use</i>	
<i>Marker</i>	
<i>Checker</i>	

This document consists of **18** printed pages and **2** blank pages.



Republic of Namibia

**MINISTRY OF EDUCATION, ARTS AND CULTURE**

1 It is given that  $f(x) = 2x^3 - 7x^2 - 24x + 45$ .

(a) Show that  $(x + 3)$  is a factor of  $f(x)$ .

Answer (a) ..... [2]

(b) Given that  $f(x)$  can also be written as  $(x + 3)(ax^2 + bx + c)$ ,  
find the values of  $a$ ,  $b$  and  $c$ .

Answer (b)  $a =$ .....  $b =$ .....  $c =$  ..... [3]

(c) Hence, solve the equation  $f(x) = 0$ .

Answer (c)  $x =$ ..... or ..... or ..... [3]

2 Differentiate

(a)  $\frac{2}{\sqrt[3]{x^4}} - 6,$

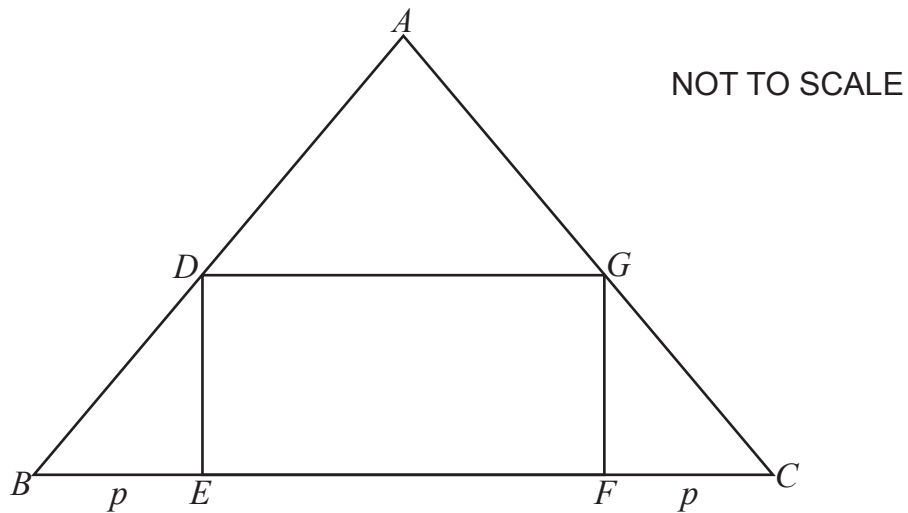
Answer (a) ..... [2]

(b)  $\frac{2x^3 + x}{x^2}.$

Answer (b) ..... [3]

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3

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In the diagram triangle  $ABC$  is an **equilateral** triangle with sides 30 cm in length, The rectangle  $DEFG$  touches the sides  $AB$ ,  $BC$  and  $AC$  as shown. and  $BE = FC = p$ .

(a) Show that  $DE = \sqrt{3p}$ .

Answer (a)

[2]

(b) Given that  $p$  can vary, find the value of  $p$  for which the area of the rectangle  $DEFG$  will be a maximum.

Answer (b)  $p = \dots\dots\dots$

[4]

- 4 (a) The expression  $2x^3 + ax^2 + bx - 30$  is divisible by  $(x + 2)$  and leaves a remainder of  $-35$  when divided by  $2x - 1$ .  
Show that  $a = 5$  and  $b = -13$ .

Answer (a)

- (b) Factorise  $2x^3 + 2x^2 - 13x - 30$  completely, and hence solve the equation  $2^{3y+1} + 2^{2y+1} - 13 \times 2^y - 30 = 0$ , giving your answer correct to 2 significant figures. [4]

Answer (b)  $y = \dots\dots\dots$  [5]

- 5 The line  $y = k(4x - 3)$ , where  $k$  is a constant, intersects the curve  $y = 4x^2 + 8x - 8$  at 2 distinct points.

Find the set of values of  $k$ .

Answer ..... [5]

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- 6 (a) The function  $f$  is such that  $f(x) = x^2 - 4x + 5$  for the domain  $-3 \leq x \leq 5$ .  
 (i) Express  $f(x)$  in the form  $a(x + B)^2 + C$ , where  $a$ ,  $B$  and  $C$  are constants.

Answer (a) (i)  $a = \dots\dots\dots B = \dots\dots\dots C = \dots\dots\dots$  [3]

- (ii) Find the range of  $f(x)$  when the domain is  $-3 \leq x \leq 5$ .

Answer (a) (ii) ..... [2]

- (iii) Determine, with a reason, whether  $f^{-1}(x)$  is a function, when the domain is  $-3 \leq x \leq 5$ .

Answer (a) (iii) .....

Reason.....

..... [2]

- (b) The function  $f$  is also defined for the domain  $x \geq 2$ .

- (i) Write down the range of  $f(x)$  when the domain is  $x \geq 2$ .

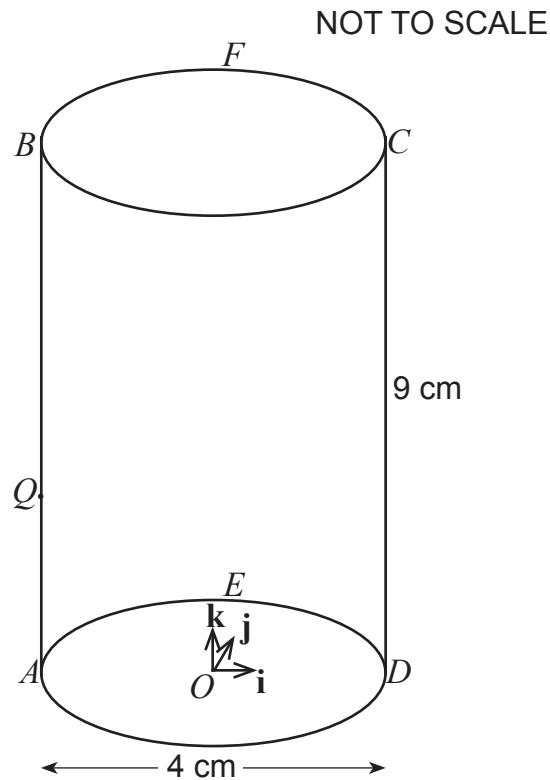
Answer (b) (i) ..... [1]

- (ii) Determine, with a reason, whether  $f^{-1}(x)$  is a function when the domain is  $x \geq 2$ .

Answer (b) (ii) .....

Reason.....

..... [2]



The diagram shows a cylinder with a diameter of 4 cm and a height of 9 cm.

$O$  is the centre of the circular base and  $AD$  is a diameter.

The horizontal circular base has centre  $O$  and  $AD$  is a diameter.

The point  $E$  lie on the circumference of the base and  $\angle DOE$  is  $90^\circ$ .

Points  $B$ ,  $C$  and  $F$  are vertically above  $A$ ,  $D$  and  $E$  respectively.

Unit vectors  $\mathbf{i}$ ,  $\mathbf{j}$  and  $\mathbf{k}$  are parallel to  $OD$ ,  $OE$  and  $DC$  respectively.

$Q$  is a point on  $AB$  such that  $AQ = \frac{2}{3}AB$ .

(a) Express vectors  $\vec{QO}$  and  $\vec{QF}$  in terms of some or all of  $\mathbf{i}$ ,  $\mathbf{j}$  and  $\mathbf{k}$ .

Answer (a)  $\vec{QO} = \dots\dots\dots$   $\vec{QF} = \dots\dots\dots$  [3]

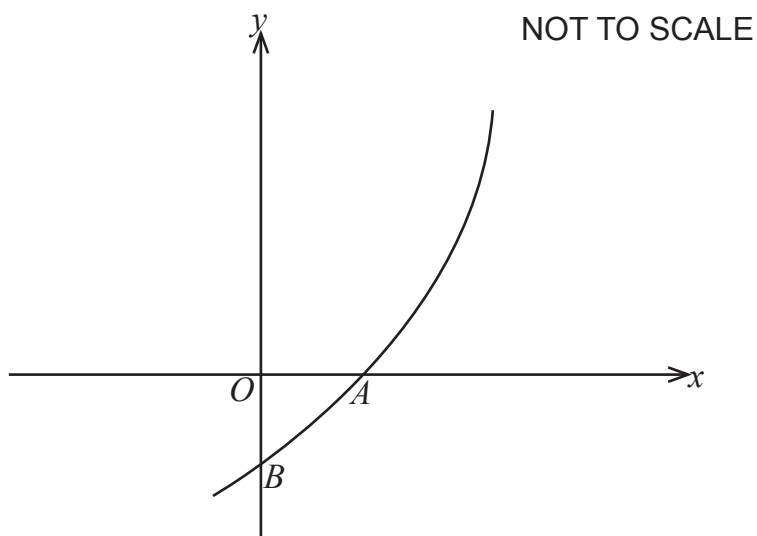


(b) Find angle  $OQF$ .

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Answer (b) Angle  $OQF = \dots\dots\dots^\circ$  [4]

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The diagram shows part of the graph  $y = e^{2x} - 2$ .  
The graph cuts the  $x$ -axis at  $A$  and the  $y$ -axis at  $B$ .

- (a) Calculate the coordinates of  $A$  and  $B$ .

Answer (a)  $A$  .....  $B$  ..... [2]

- (b) Calculate the equation of the tangent to the curve at  $B$ .

Answer (b) ..... [3]

- (c) Find the volume generated when the region bounded by the curve, the  $x$ -axis and the line  $x = 1$  and  $x = 2$  is rotated through  $360^\circ$  about the  $x$ -axis.

Answer (c) ..... [4]

- 9 When a dam is full, a sluice is opened. The depth of water,  $D$  m, at a given point  $P$  is given by

$$D = 32 - \frac{1}{16}t - \frac{1}{8}t^3,$$

where  $t$  is the time in hours after the sluice has been opened.

- (a) Find the depth of water at  $P$  after 4 hours.

Answer (a) ..... m [2]

- (b) Find the rate of decrease of the depth of water at  $P$  when  $t = 2$ .

Answer (b) ..... m/h [3]

- (c) Find the time it takes for the rate of decrease of the depth of water at  $P$  to reach  $\frac{55}{16}$  metres per hour.

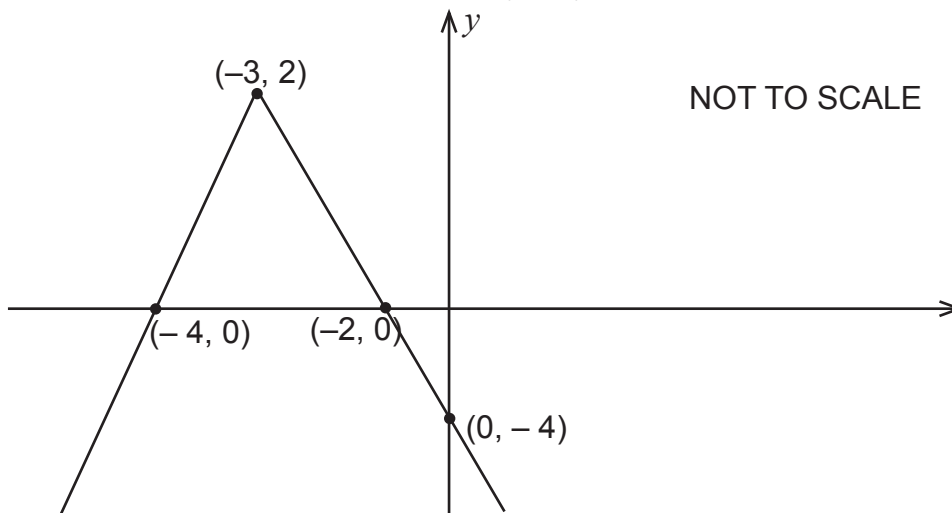
Answer (c) ..... h [3]

10 (a) Solve the equation  $3^{|1-x|} = 9^x$ .

Answer (a) .....

[3]

(b) The diagram shows the graph of  $y = a|x+b|+c$ .



The salient point (vertex) of the graph is  $(-3, 2)$ , the  $x$ -intercepts are  $(-4, 0)$  and  $(-2, 0)$  and the  $y$ -intercept is  $(0, -4)$ .

Find the values of  $a$ ,  $b$  and  $c$ .

Answer (b)  $a = \dots\dots\dots b = \dots\dots\dots c = \dots\dots\dots$

[4]

11 (a) Differentiate  $(2x - 3)^5$ .

For  
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Use

Answer (a) ..... [2]

(b) Given that  $\int_0^8 3p \times \sqrt[3]{x} \, dx = 360$ , find the value of the constant  $p$ .

Answer (b) ..... [3]

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12 (a) The number  $0.\dot{5}$  can also be written as

$$0.\dot{5} = 0.5 + 0.05 + 0.005 + \dots$$

Show that this number can be written as the vulgar fraction  $\frac{5}{9}$ .

Answer (a)

[3]

(b) Given  $\sum_{n=1}^{24} [2(2n + 1) + 1] = 1272$  .

(i) Write down the term in  $x^r$ .

Answer (b) (i) ..... [1]

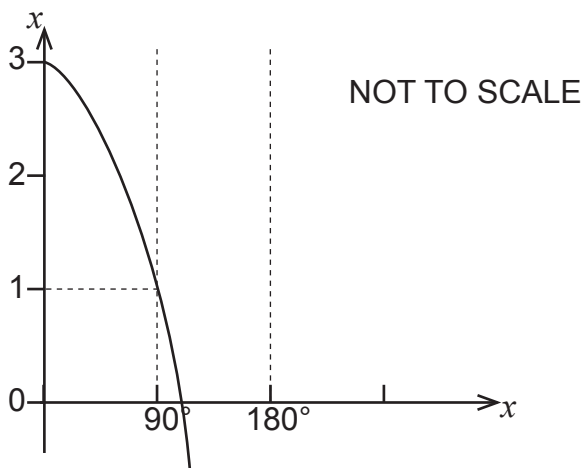
(ii) Find the value of  $r$  for which the  $r^{\text{th}}$  term is 63.

Answer (b) (ii) ..... [2]

(iii) Write down the sum of the first 24 terms.

Answer (b) (iii) ..... [1]

13 The diagram shows the graph of  $y = a \tan bx + c$  for  $0^\circ \leq x \leq 180^\circ$  with an asymptote at  $x = 180^\circ$ .



(a) Find the values of  $a$ ,  $b$  and  $c$ .

Answer (a)  $a = \dots\dots\dots b = \dots\dots\dots c = \dots\dots\dots$  [3]

(b) Write down the period of  $y = a \tan bx + c$ .

Answer (b)  $\dots\dots\dots$  [1]

(c) Determine the range of  $y = a \tan bx + c$  for  $0^\circ \leq x \leq 180^\circ$ .

Answer (c)  $\dots\dots\dots$  [1]

- 14 (a) Prove the identity  $\frac{\cot x + 1}{\cot x - 1} \equiv \frac{1 + \tan x}{1 - \tan x}$

Answer (a)

- (b) Solve the equation  $\operatorname{cosec} 2x = 3$  for  $-\pi \leq x \leq \pi$ .

[4]

Answer (b) .....

[4]

- (c) Solve for  $2 \sin^2 x + 3 \cos x = 0$  for  $0^\circ \leq x \leq 360^\circ$ .

Answer (c) .....

[5]



**15 (a)** Write down the range of values of  $x$  for which  $\log_3 x$  is defined.

*For  
Examiner's  
Use*

Answer **(a)**  $x = \dots\dots\dots$  [1]

**(b)** Solve the equation  $2 \log_3 x - 1 = 6 \log_x 3$ .

Answer **(b)**  $\dots\dots\dots$  [6]

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- 16** A bird starts from rest on a tree,  $T$ , and flies in a straight line until it comes to rest on the roof of a house,  $R$ . Its velocity,  $v$  m/s, at time  $t$  seconds after leaving  $T$ , is given by

$$v = 3t - t^2.$$

- (a)** Find, in terms of  $t$ ,

- (i)** the acceleration of the bird at time  $t$ ,

Answer **(a) (i)** ..... m/s<sup>2</sup> [1]

- (ii)** the displacement of the bird at time  $t$ .

Answer **(a) (ii)** ..... m [2]

- (b)** How long does the bird take to reach  $R$ ?

Answer **(b)** .....s [2]

- (c)** Find the distance between  $T$  and  $R$ .

Answer **(c)** ..... m [2]

- (d)** Find the greatest speed of the bird between  $T$  and  $R$ .

Answer **(d)** .....m/s [2]

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