Centre Number	Candidate Number	Candidate Name

NAMIBIA SENIOR SECONDARY CERTIFICATE

MATHEMATICS HIGHER LEVEL 8323/2

PAPER 2 3 hours

Marks 120 **2020**

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 π, either use your calculator value, or use 3.142.

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Marker	
Checker	

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Republic of Namibia

MINISTRY OF EDUCATION, ARTS AND CULTURE

For Examiner's Use

1 It is given that $f(x) = 4x^3 - 13x + 6$.

(a) Show that $(2x - 1)$ is a factor of $f(x)$.

Answer **(a)**

[2]

(b) Given that $f(x)$ can be written in the form $(2x - 1)(ax^2 + bx + c)$, 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]

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2 **(a)** Differentiate $\dfrac{3}{\sqrt[5]{x^2}} + 5$.

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

(b) Differentiate $\dfrac{3x^2 - 5x}{x^3}$.

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

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3 A curve has equation $y = \dfrac{1}{x} + c$ and a line has equation $y = cx - 3$, where c is a constant.

Find the set of values of x for which the line and the curve do not intersect.

Answer .... [5]

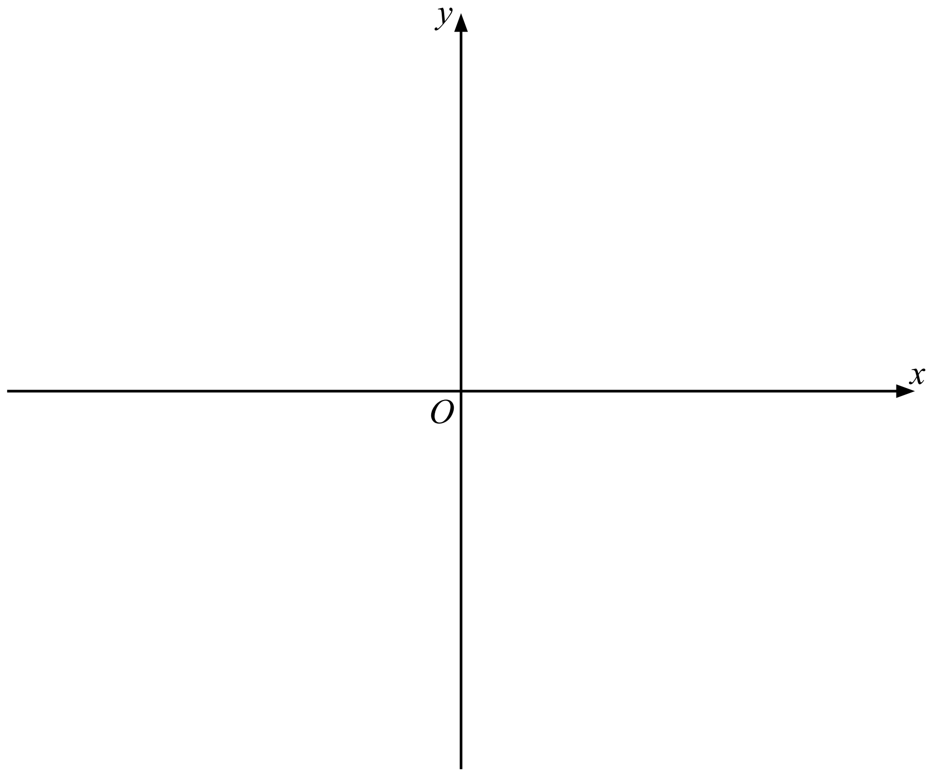
For Examiner's Use

4 It is given that $f(x) = x^3 - 2x^2 - 4x + 8$ and that $f(-2) = 0$.

(a) Calculate the co-ordinates of the turning points of the graph of $f(x)$.

Answer **(a)** .... [4]

(b) Sketch the graph of $y = f(x)$. Indicate the coordinates of the intercepts with the axes on the sketch.



[3]

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(c) Find the x−coordinates of the point of inflection of $f(x)$.

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

5 **(a)** The expression $ax^3 + 3x^2 + bx + 12$ is divisible by $(x + 3)$ and leaves a remainder of 18 when divided by $(x + 2)$.

Find the values of a and b, showing all your working.

Answer **(a)** a = ... b = ... [4]

(b) Using the values of a and b from **part (a)**, show that the equation $ax^3 + 3x^2 + bx + 12 = 0$ has exactly one real root.

Answer **(b)**

[3]

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6 **(a)** The function f is such that $f(x) = -2x^2 + 12x - 16$ for the domain $0 \le x \le 4$.

(i) Express $f(x)$ in the form $a(x + B)^2 + C$, where a, B and C are constants.

Answer **(a) (i)** a = ... B = ... C = ... [3]

(ii) Find the range of $f(x)$ for the domain $0 \le x \le 4$.

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

(iii) Determine, with a reason, whether $f^{-1}(x)$ is a function for the domain $0 \le x \le 4$.

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

Reason.. [2]

(b) The function g is such that $g(x) = -2x^2 + 12x - 16$ for the domain $x \le 3$.

(i) Write down the range of $g(x)$ when the domain is $x \le 3$.

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

(ii) Determine, with a reason, whether $g^{-1}(x)$ is a function for the domain $x \le 3$.

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

Reason.. [2]

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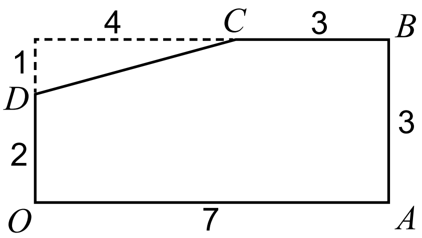

Fig. 1

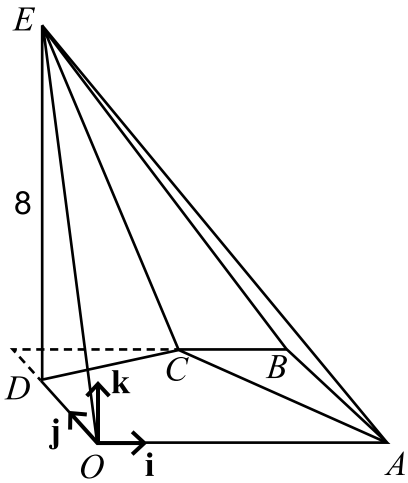

Fig. 2

Fig. 1 shows a rectangle with sides of 7 units and 3 units from which a triangular corner has been removed, leaving a 5-sided polygon $OABCD$. The sides OA, AB, BC and DO have lengths of 7 units, 3 units, 3 units and 2 units respectively. Fig. 2 shows the polygon $OABCD$ forming the horizontal base of a pyramid in which the vertex E is 8 units vertically above D. Unit vectors $\mathbf{i}$, $\mathbf{j}$ and $\mathbf{k}$ are parallel to OA, OD and DE respectively.

(a) Find $\overrightarrow{CE}$ and the length of CE.

Answer **(a)** $\overrightarrow{CE}$ = ...

length = ... [3]

(b) Use a scalar product to find angle ECA, giving your answer in the form $\cos^{-1}\left(\frac{m}{\sqrt{n}}\right)$, where m and n are integers.

Answer **(b)**... [4]

[Turn over

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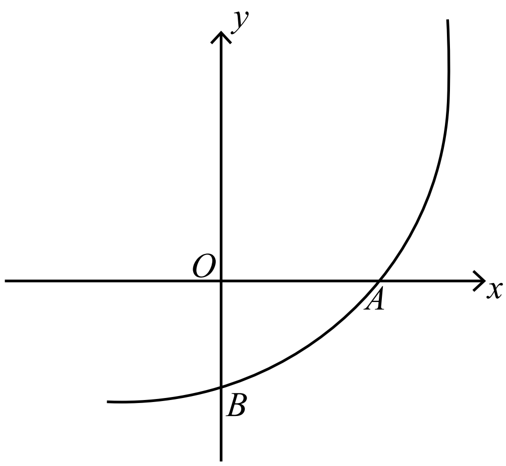

NOT TO SCALE

The diagram shows part of the graph $y = e^{3x} - 2$.

The graph cuts the x-axis at A and the y-axis at B.

(a) Calculate the coordinates of A.

Answer **(a)** A .... [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 lines $x = 0$ and $x = 1$ is rotated through 360° about the x-axis.

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

For Examiner's Use

9 When a dam is full, a sluice is opened. The level of the water in the dam, h metres, at a given point P is given by the equation $h = 32 - \frac{1}{16}t - \frac{1}{8}t^3$ metres, where t is the time in hours after the sluice has been opened.

(a) What is the level of the water at P after 4 hours?

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

(b) What is the rate of decrease of the water level at P after 2 hours?

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

(c) How long will it take for the rate of decrease of the water level at P to reach $\frac{55}{16}$ m/h?

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

For Examiner's Use

10 (a) Solve the inequality $|2x - 3| < 4$.

Answer **(a)** .... [3]

(b) A graph has the equation $y = |x - 2| - 3$.

(i) Find the salient point (vertex) of the graph.

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

(ii) Find the x-coordinate of each of the intercepts of the graph with the x-axis.

Answer **(b)(ii)** x =................. or x = ... [3]

For Examiner's Use

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

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

(b) Given that $\int_3^4 \frac{2p}{x-2} dx = 18$, find the value of the constant p.

Answer **(b)** p =... [3]

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12 **(a)** On a certain day, the height of a young bamboo plant was found to be 40 cm. After **exactly** one day its height was found to be 40.3 cm. Two different models are used to predict its height exactly 70 days after it was first measured.

Model A assumes that the daily amount of growth continues to be constant at the daily amount found on the first day.

Model B assumes that the daily percentage rate of growth continues to be constant at the percentage rate of growth found for the first day.

(i) Using model A, find the predicted height in cm of the bamboo plant **exactly** 70 days after it was first measured.

Answer **(a) (i)** ....cm [2]

(ii) Using model B, find the predicted height in cm of the bamboo plant **exactly** 70 days after it was first measured.

Answer **(a)(ii)**......................................cm [3]

(b) How many terms are there in the sequence $\sum_{n=5}^{40}(2n-5)$?

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

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13 A curve has the equation $y = -2\sin 3x + 4$.

(a) Write down the amplitude of the curve.

Answer **(a)** .... [1]

(b) Determine the period of the curve.

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

(c) Describe the single transformation that maps the curve of $y = -2\sin 3x + 4$ onto the curve of $y = -2\sin 3x$.

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

14 **(a)** Prove the identity $\dfrac{\sin x}{1 - \sin x} + \dfrac{\sin x}{1 + \sin x} \equiv 2\tan x \sec x$.

Answer **(a)**

[4]

(b) Solve the equation $\sec 2x = 5$ for $-\pi \le x \le \pi$.

Answer **(b)** .... [4]

(c) Solve the equation $2\sec^2 x + 3\tan x - 4 = 0$ for $180° \le x \le 360°$.

Answer **(c)** .... [5]

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15 It is given that $\log(2x + 1) - \log(x - 1) \geq 1$.

(a) Write down the range of values for which the given inequality is defined.

Answer (a) .... [2]

(b) Solve the inequality.

Answer (b) .... [4]

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16 An insect starts from rest on a flower **F** and flies in a straight line until it comes to rest on a bush **B**. Its velocity, v m/s, at time t seconds after leaving **F**, is given by

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

(a) Find, in terms of t,

(i) the acceleration of the insect at time t,

Answer **(a) (i)** ....m/s [1]

(ii) the displacement of the insect at time t.

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

(b) How long does the insect take to reach **B**?

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

(c) Find the distance between **F** and **B**.

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

(d) Find the greatest speed of the insect between **F** and **B**.

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