

NATIONAL CERTIFICATE

MATHEMATICS N4

(16030164)

20 November 2024 (X-Paper)

09:00–12:00

Calculators may be used.

This question paper consists of 5 pages and a 1-page formula sheet.

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QUESTION 1

1.1 1.1.1 Sketch the graph of $\frac{x^2}{20} + \frac{y^2}{32} = \frac{1}{50}$ (3)

1.1.2 What is the domain of the graph in QUESTION 1.1.1? (2)

1.1.3 Is the graph in QUESTION 1.1.1 symmetrical about both axes? (1)

1.1.4 Does the graph in QUESTION 1.1.1 represent a function or a relation? (1)

1.2 Sketch the graph of $x = +\sqrt{27 + y^2}$. (3)

1.3 Solve for x if:

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

1.4 Simplify the following and leave answer in $a + jb$ form:



$$-4 \left[\int_0^{\pi} \cos^2 x \, dx \right]$$

QUESTION 2

2.1 Expand $\frac{1}{\sqrt{16t^2 + 4}}$ to four terms only by the use of the binomial theorem. (4)

2.2 Differentiate the following in terms of x :

$$y = \frac{5 + 6\sin x + x \cos x}{-\cos x} + e^6 - 2 \log_e x \quad (5)$$

2.3 Determine, with the aid of differentiation, the coordinates of the maximum and minimum turning points of $y = x^3 - 2x - 4$. Also distinguish between the maximum and the minimum turning points by use of the second derivative. (7)

2.4 Differentiate the following by using the quotient rule:

$$y = \frac{\ln x^3}{\ln x} \quad (4)$$

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QUESTION 3

3.1 Simplify:

$$\frac{\sin(180^\circ + x)}{\sin(180^\circ + x)} + \frac{\sin(180^\circ + x)}{\sec x \sin(90^\circ + x)} - \frac{\tan x}{\cot(90^\circ + x)} \quad (4)$$

3.2 Solve for θ if:

$$\sin 2\theta = 2 \cos^2 \theta; 0^\circ \leq x \leq 360^\circ \quad (5)$$

3.3 Simplify:

$$\sin(180^\circ + x)$$

Show ALL steps.

(3)

3.4 Prove that:



$$\frac{\sin 2x}{1 - \cos 2x} = \cot x \quad (4)$$

3.5 Determine, without the use of a calculator, the value of $\sin\left(\frac{\pi}{4} + \frac{\pi}{6}\right)$ if

$$\sin \frac{\pi}{4} = \frac{\sqrt{2}}{2} \text{ and } \sin \frac{\pi}{6} = \frac{1}{2}. \quad (4)$$

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QUESTION 4

4.1 Draw the graph of $y = \cot x$; $-180^\circ \leq x \leq 180^\circ$. (3)

4.2 4.2.1 Draw the graph of $x = 2y^2 + 5y$. (3)