higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

MATHEMATICS N4

(16030164)

20 November 2024 (X-paper)
09:00–12:00

Scientific calculators may be used.

This question paper consists of 4 pages and a formula sheet.

044Q1E2420

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE
MATHEMATICS N4
TIME: 3 HOURS
MARKS: 100

INSTRUCTIONS AND INFORMATION

1. Answer all the questions.
2. Read all the questions carefully.
3. Number the answers according to the numbering system used in this question paper.
4. Show all intermediate steps and simplify where possible.
5. All final answers must be rounded off to THREE decimal places (unless indicated differently.)
6. Questions may be answered in any order, but subsections of questions must be kept together.
7. Use only a black or blue pen.
8. Write neatly and legibly.

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QUESTION 1

1.1 Draw a neat graph of: $y = 2e^{3x}$. (3)

1.2 1.2.1 Draw a neat graph of: $y = -\frac{2}{3}x - 2$. (3)

1.2.2 Is the graph: $y = -\frac{2}{3}x - 2$ a function or a relation? (1)

1.3 Draw a neat graph of an inverse of: $x = \frac{1}{5}\ln y$. (3)

[10]

QUESTION 2

2.1 Solve the value of x and y simultaneously using complex numbers if given:

$$(3+2j)(-6+j) = (x+yj)(-2+4j)$$ (5)

2.2 Simplify: $\sqrt{\frac{1}{2}\pi} \Big/ \sqrt{\frac{3\pi}{12} \times \frac{2\pi}{12}}$ (3)

2.3 Convert: $7 - 12j$ to polar form. (4)

2.4 Determine the value of z only using determinants if:

$2x - y + z = 4$

$x - 2y + 2z = 6$

$3x + y + z = 8$ (8)

[20]

QUESTION 3

3.1 Solve for the value of x if: $\frac{1}{\text{cosec}(x - 20^0)} = \frac{1}{\sec(20^0 + x)}; 0^0 \le x \le 90^0$ (5)

3.2 Simplify as far as possible: $\frac{\cos x}{1 - \sin x} - \frac{\cos x}{1 + \sin x}$ (5)

3.3 Prove that: $\frac{\sin 2x - \sin x}{\cos 2x + \cos x} = \frac{\sin x}{\cos x + 1}$ (5)

3.4 Simplify: $\tan 15^0 = \frac{\sin 30^0}{1 + \cos 30^0}$ (5)

[20]

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QUESTION 4

4.1 Determine the following limit: $\lim_{x\to\infty}\left(\frac{2x^3-x^2+3x+9}{5x^3+3x-4}\right)$ (5)

4.2 Differentiate the following with respect to y.

$$x = y^3 + \frac{1}{e^{-2y}} + \frac{1}{\sec 2y} - 2\ln y - 4\pi p$$ (5)

4.3 Differentiate: $y = \ln kx$ using A FUNCTION OF A FUNCTION (CHAIN RULE). (5)

4.4 Differentiate: $y = \frac{e^x}{\sec x}$ using the QUOTIENT RULE. (5)

4.5 Determine the co-ordinates of the points of inflection of $y = x^3 - 2x^2 - 8x$ with the AID of DIFFERENTIATION. (5)

[25]

QUESTION 5

5.1 Evaluate: $\int\left(2\sin x.\cos x + \frac{3}{\sin^2 x} + 3e^{3x} + \pi^3\right)dx$ (5)

5.2 Evaluate the following definite integrals: $\int_0^{\frac{\pi}{4}}(2\tan x)dx$ (4)

5.3 Simplify: $\int\left(\frac{3x^3-81}{2x-6}\right)dx$ (6)

5.4 5.4.1 Sketch the graph of: $y = 4x^2$ and $x = 2y^2$ and clearly indicate the area as well as the strip. (6)

5.4.2 Calculate the magnitude of the area included between the graphs $y = 4x^2$ and $x = 2y^2$ with the AID of INTEGRATION. (4)

[25]

TOTAL: 100

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MATHEMATICS N4

FORMULA SHEET

$a^x = b \Leftrightarrow \log a^x = \log b$

$\ln x = \log_e x$

$\left(r\left|\underline{\theta}\right.\right)^n = r^n\left|\underline{n\theta}\right.$ $\quad a + bj = c + dj \Leftrightarrow a = c and b = d$

$\sin(a \pm b) = \sin a \cos b \pm \sin b \cos a$

$\cos(a \pm b) = \cos a \cos \mp \sin a \sin b$

$\sin^2 x + \cos^2 x = 1$

$1 + \cot^2 x = \operatorname{cosec}^2 x$

$1 + \tan^2 x = \sec^2 x$

$$\tan(a \pm b) = \frac{\tan a \pm \tan b}{1 \mp \tan a \tan b}$$

y	$\frac{dy}{dx}$
an^n	nax^{n-1}
ka^x	$ka^x \ln a$
$k \ln x$	$\frac{k}{x}$
$\sin x$	$\cos x$
$\cos x$	$-\sin x$
$\tan x$	$\sec^2 x$
$\cot x$	$-\operatorname{cosec}^2 x$
$\sec x$	$\sec x \tan x$
$\operatorname{cosec} x$	$-\operatorname{cosec} x \cot x$

$$y = u(x) \cdot v(x)$$

$$\Rightarrow \frac{dy}{dx} = u(x)v^1(x) + u^1(x)v(x)$$

$$y = \frac{u(x)}{v(x)}$$

$$\Rightarrow \frac{dy}{dx} = \frac{v(x)u^1(x) - u(x)v^1(x)}{[v(x)]^2}$$

$$\frac{dy}{dx} = \frac{dy}{du} x \frac{du}{dx}$$

$$\int ax^n dx = \frac{ax^{n+1}}{n+1} + C$$

$$\int \frac{a}{x} dx = a\ell nx + c$$

$$\int ka^x dx = \frac{ka^x}{\ell na} + c$$

$$A_{ox} = \int_a^b y dx$$

$$A = \int_a^b (y_2 - y_1) dx$$

$$A = \int_c^d (x_2 - x_1) dx$$

$$\int \sin x dx = -\cos x + c$$

$$\int \cos x dx = \sin x + c$$

$$\int \tan x dx = \ell n \sec x + c$$

$$\int \sec x dx = \ell n(\sec x + \tan x) + c$$

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