higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

MATHEMATICS N4

(16030164)

22 November 2023 (X-paper)
09:00–12:00

Scientific calculators may be used.

This question paper consists of 4 pages and 1 formula sheet.

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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 decimals (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 a blue pen
8. Write neatly and legibly.

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QUESTION 1

1.1 1.1.1 Draw the graph of: $\frac{4x^2}{100}+\frac{25y^2}{100}=1$

1.1.2 Draw the graph of: $\frac{4x^2}{36}-\frac{9y^2}{36}=1$

(2 × 3) (6)

1.2 A rectangular piece of sheet metal is 10 m long and 5 m wide. If the area doubles when the length and the width is increased by the same unit of length, what are the new measurements? (4)

1.3 Make "x" the subject of the given formula: $T=\frac{e^{2x}+1}{e^{2x}-1}$ (5)

1.4 Solve for x if: $12^{x+1}=36$ (5)

[20]

QUESTION 2

2.1 Solve for x and y using complex numbers if given:

$$\begin{vmatrix} xj & yj \\ -3 & -2 \end{vmatrix} = \begin{vmatrix} x-y & j \\ -4 & 2 \end{vmatrix}$$ (5)

2.2 Given: $z_1=4\angle 30^0$ and $z_2=2\angle 60^0$,determine:

2.2.1 $z_1.z_2$

2.2.2 $\frac{z_1}{z_2}$, and leave the answer in polar form.

(2 × 3) (6)

2.3 Simplify: $2j^{16}-9j^3$

$\frac{1}{x}+\frac{2}{y}+\frac{1}{z}=\frac{1}{2}$ (2)

2.4 $\frac{4}{x}+\frac{2}{y}-\frac{3}{z}=\frac{2}{3}$

$\frac{3}{x}-\frac{4}{y}+\frac{4}{z}=\frac{1}{3}$ (7)

[20]

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QUESTION 3

3.1 Simplify: $\dfrac{\sec^2\theta - \tan^2\theta}{1-\cos^2(360^0-\theta)}$ (4)

3.2 If $2\cos B - 1 = 0$ and $\sin B < 0$, calculate: $\dfrac{\cot B + \operatorname{cosec} B}{\tan B + \cot B}$ (5)

3.3 Prove the following identity: $\sec 2A + \tan 2A = \dfrac{\sin A + \cos A}{\cos A - \sin A}$ (5)

3.4 Solve for x in the following trig-equation:

$$2\sin^2 x - \sin x - 1 = 0,\ [-360^0; 360^0]$$ (6)

[20]

QUESTION 4

4.1 Determine the following limit: $\lim\limits_{x\to 0}\left(\dfrac{\sin^2 x}{1-\cos x}\right)$ (3)

4.2 Expand : $\dfrac{1}{(x+h)^5}$ (4)

4.3 Use first principles to differentiate: $y = x^4 - 3x + 6$ (5)

4.4 Differentiate: $y = \dfrac{3}{2^{-x}} + \dfrac{\pi}{e^{3x}} - \dfrac{1}{\operatorname{cosec} 3x} + \dfrac{1}{\cot x} - \dfrac{1}{\sec x} + \dfrac{\sin 2x}{\cos x} + \dfrac{3}{2}\ln x - \dfrac{1}{3p}$ (8)

[20]

QUESTION 5

5.1 Sketch and calculate the magnitude of the area enclosed by the curve $y = \sin x$ for $0^0 \le x \le 180^0$. (7)

5.2 Evaluate: $\int_0^{-1} 3^{-2x}\,dx$ (4)

5.3 Integrate the following: $\int\left(e^{3x} + 3a^{3x} - 10^{2x} + \dfrac{1}{\sqrt[3]{x}}\right)dx$ (5)

5.4 Simplify: $\int(\cos^2 x - \sin^2 x)dx$ (4)

[20]

TOTAL: 100

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MATHEMATICS N4

FORMULA SHEET

NEW SYLLABUS

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

$\ln x = \log_e x$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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