higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

MATHEMATICS N4

(16030164)

16 November 2022 (X-paper)
09:00–12:00

Scientific calculators may be used.

This question paper consists of 5 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. Read all the questions carefully.
2. Answer all the questions.
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 otherwise)
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 Prove that $\frac{1+\sin y}{1-\sin y}-\frac{1-\sin y}{1+\sin y}=4\tan y.\sec y$. (5)

1.2 Simplify $\frac{\tan\theta}{\sec\theta-1}+\frac{\tan\theta}{\sec\theta+1}$. (4)

1.3 If $cos\ A=\frac{3}{5}$ and $0°\leq A\leq 90°$, without using a calculator, calculate the value of:

$$\frac{\cos ecA}{1+\cos A}$$ (3)

1.4 Determine $\frac{1}{sec(-15°)}$ without using a calculator. (3)

1.5 Solve the following equation: $2\,cos\,2\,\theta+cos\,2\,\theta-1=0$, $-180°\leq\theta\leq 180°$ (5)

[20]

QUESTION 2

2.1 Solve for x if : $3^{2x-1}=\ln 8$ (5)

2.2 Make m the subject of the formula if $\left[\frac{1+m}{1-x}\right]^{1/m}=a$. (4)

2.3 2.3.1 Draw the graph of $y=\text{cosec}x$, $-180°\leq x\leq 180°$. (3)

2.3.2 What are the asymptotes of the function $y=\text{cosec}x$? (3)

2.4 2.4.1 Draw the graph of $-x^2=\frac{y}{4}$. (3)

2.4.2 Is the graph $-x^2=\frac{y}{4}$ a function or a relation? (1)

2.4.3 Is the graph $-x^2=\frac{y}{4}$ continuous or discontinuous? (1)

[20]

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QUESTION 3

3.1 Integrate with respect to x: $\int \left(2x^{-2} + 3x^{-1} + 2.5^{2x} + 4\tan x + 3\sec^2 x\right)dx$. (6)

3.2 Evaluate: $\int_0^{\frac{\pi}{x}} (2\cos 2x)dx$. (4)

3.3 3.3.1 Sketch the graph of $y = x^2 + 4$, and clearly indicate the area included between $y = x^2 + 4$, the $x-axis$ and the lines $x = 0$ and $x = 2$. (4)

3.3.2 Calculate the magnitude of the indicated area with the aid of integration. (4)

3.4 Simplify: $\int \left(\frac{x^2 - x}{x}\right)dx$. (2)

[20]

QUESTION 4

4.1 Determine the following limit: $\lim_{x \to 2}\left(\frac{x^3 - 8}{x - 2}\right)$ (3)

4.2 Differentiate with respect to x: $y = \log 5x$, with the aid of the function of a function (chain rule). Show ALL intermediary steps and substitution. (4)

4.3 Differentiate with respect to x: $y = \frac{\cos x}{\ln x}$, with the aid of the quotient rule. (3)

4.4 Differentiate with respect to x:

$$y = -\frac{1}{2}\cot x - \sqrt{2}\cos x + \frac{1}{3}\log 7x + \tan 2\theta.$$ (4)

4.5 Calculate the co-ordinates of the turning points of $y = x^3 - 9x$. Distinguish between minimum and maximum turning points with the aid of the second derivative. (6)

[20]

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QUESTION 5

5.1 Use Cramer's rule to determine the value of x_1 and x_2 if:

$$2x_1 = -4x_2 + 4$$
$$3x_1 + 7x_2 = 6$$

(5)

5.2 Given the determinant: $D = \begin{vmatrix} 1 & 5 & 3 \\ 7 & -6 & 4 \\ 9 & 2 & -3 \end{vmatrix}$

5.2.1 Write down and evaluate the minor of element 7.

5.2.2 Write down and evaluate the co-factor of element 7.

(2 × 2) (4)

5.3 The impedance z of a circuit is given by: $Z = Z_1 - \dfrac{Z_2.Z_3}{Z_2 + Z_3}$,

where $z_1 = 2 + j5$, $z_2 = 2 + j2$, and $z_3 = 2 + j4$.

Determine the value of z. (4)

5.4 Convert the following expression to polar form:

$$z = \begin{vmatrix} j-1 & j^2 \\ 3-j4 & 2+j3 \end{vmatrix}$$

(6)

5.5 Simplify: j^{17} (1)

[20]

TOTAL: 100

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MATHEMATICS N4

FORMULA SHEET

NEW SYLLABUS

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

$\ln x = \log_e x$

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

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

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

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

$1 + \cot^2 x = \cos ec^2 x$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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