higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T1020**(E)**(M29)T

NATIONAL CERTIFICATE

MATHEMATICS N4

(16030164)

29 March 2019 (X-Paper)
09:00–12:00

Scientific calculators may be used.

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

DEPARTMENT OF HIGHER EDUCATION AND TRAINING
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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 otherwise).
6. Questions may be answered in any order, but subsections of questions must be kept together.
7. Use only BLUE or BLACK ink.
8. Write neatly and legibly.

QUESTION 1

1.1 $8x-4+2y=0$
$3y=4x+4$

Solve the values of x and y by only using Cramer's rule. (6)

1.2 Given:

$$\begin{vmatrix} 2 & 4 & -2 \\ 3 & 5 & 6 \\ 1 & 3 & 1 \end{vmatrix}$$

1.2.1 Calculate the value of the minor of 5. (1)

1.2.2 Calculate the value of the co-factor of 4. (2)

1.3 Three loads are connected in series in a circuit and the voltage drops are $V_1 = 50\angle 10°V, V_2 = 105\angle 60°V$ *and* $V_3 = 90\angle -50°V$ respectively.

Determine the total voltage (V_T) if $V_T = V_1 + V_2 + V_3$. Leave answer in polar form. (6)

1.4 Simplify and leave the answer in rectangular form if:

$$z = \frac{8cis\frac{\pi}{6} \times 3cis\frac{\pi}{3}}{6cis\frac{\pi}{4}}$$

(5)
[20]

QUESTION 2

2.1 Differentiate $y = x^4(\tan 4x)$ in terms of x by using the product rule. (3)

2.2 Given:

$$y = \frac{\sin x}{2}, -\pi \le x \le \pi$$

Use differentiation to determine the co-ordinates of the maximum and minimum turning points. Also distinguish between the maximum and minimum turning points of the given function by using the second derivative. (8)

2.3 Differentiate the following in terms of x:

$$y = 7(\pi^x) - \frac{1}{3}\log_3^x + \frac{6}{x^5} + 6\tan 6x + \frac{\cot 2x}{2}$$ (5)

2.4 Differentiate $\frac{1}{x+3}$ by using first principles. (4)

[20]

QUESTION 3

3.1 Simplify:

$$\int \sec x\left(\cos x + \frac{1}{\cos x}\right)dx$$ (3)

3.2 Evaluate:

$$\int_0^{\frac{\pi}{8}} \sec^2 2x\,dx$$ (3)

3.3 3.3.1 Sketch and clearly show the area enclosed by the graph of $y = -2x^2 + 2$, $x = -1$, $x = 1$ Also clearly show the representative strip that will be used to calculate the area enclosed. (3)

3.3.2 Use integration to determine the value of the area shown in QUESTION 3.3.1 above. (4)

3.4 Integrate the following in terms of x:

$$\int\left(2\pi \sin wx + 2^x\left(2 + \frac{3}{2^x}\right) - \frac{1}{x^2} - \frac{\cos ecx}{\tan x} + ex\right)dx$$ (7)

[20]

QUESTION 4

4.1 Simplify:

$$\frac{2\sin 2A}{\sin^2 A}$$ (3)

4.2 Solve for A, $0° \le A \le 360°$

$$7\cos^2 A - 3\sin^2 A + 1 + \cos x = 0$$ (6)

4.3 Proof:

$$\frac{2\cos^2 A-1}{\frac{1}{2}\sin 2A}=\cot A-\tan A$$

(4)

4.4 Given:

$\cos A=0{,}4$

Calculate for the value of $\sin\frac{A}{2}$ without the use of a calculator. (3)

4.5 Without the use of a calculator, determine:

$\sin(-15°)$ (4)

[20]

QUESTION 5

5.1 Derive the quadratic equation if its zero points are $2\frac{1}{4}$ *and* $-3\frac{1}{2}$. (6)

5.2 5.2.1 Sketch the graph of $y=\cos ecx,-180°\le x180°$ (3)

5.2.2 Is the graph of $y=\cos ecx,-180°\le x180°$ in QUESTION 5.2.1 continuous? (1)

5.3 Sketch the graph of $y=3\log_{\frac{1}{3}}x$ (3)

5.4 Make Q the subject of the formula if:

$$b^y\left(3-\log\frac{p}{Q}\right)=x$$

(4)

5.5 Factorise fully:

$27x^6-8y^{12}$ (3)

[20]

TOTAL: 100

MATHEMATICS N4

FORMULA SHEET

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

$\ln x = \log_e x$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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