



higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T1020(E)(J29)T

NATIONAL CERTIFICATE

MATHEMATICS N4

(16030164)

29 July 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
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 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. Graph paper is not supplied.
 9. Write neatly and legibly.
-

QUESTION 1

1.1 Differentiate from first principles if $f(x) = \frac{2}{x^4}$ (4)

1.2 Differentiate $y = \sqrt{5x+1}$ by using the chain rule (function of function). (4)

1.3 Differentiate in terms of y if $x = \ln(-y) - 4a^3 - 2\pi \cos y - \frac{\ln y^3}{4} + \frac{1}{\sqrt{4y}}$ (5)

1.4 Prove that the co-ordinates of the turning points of $y = x^3 - 2x - 4$ are $(+0,816; -5,089)$ and $(-0,816; -2,911)$ respectively. Also determine the points of inflection using the second derivative of $y = x^3 - 2x - 4$. (7)
[20]

QUESTION 2

2.1 Given $y = x^3 - 2x - 4$

2.1.1 Sketch and clearly indicate the area enclosed by the curve of $y = x^3 - 2x - 4$, the X-axis, $x = 1$ and $x = 2$. Also, clearly show the representative strip which will be used to calculate the enclosed area. (3)

2.1.2 Calculate the enclosed area in QUESTION 2.1.1 by using integration (4)

2.2 Integrate the following:

2.2.1 $\int \left(\frac{\cos^3 t - 1}{\cos^2 t} - \sqrt{2t} + 2e^{-2t} + \frac{2}{t} - 4^{\sqrt{16t^2}} + 4t^0 \right) dt$ (7)

2.2.2 $\int_2^4 \left(\ln 3 - \frac{1}{x} \right) dx$ (3)

2.3 Simplify:

$\int \left(\frac{y^2 - 2y + 1}{y - 1} \right) dy$ (3)
[20]

QUESTION 3

3.1 The circumference of a right-angled triangle is 24 cm and its hypotenuse is 10 cm.

Determine the lengths of the other two sides of the right-angled triangle. (4)

3.2 Solve for x if $\left(\frac{8}{10}\right)^{2x-5} = \left(\frac{5}{2}\right)^x$ (3)

3.3 Make P the subject of the formula $\frac{2xyz}{B^{2P}} = \frac{QS}{R}$ (3)

3.4 Sketch the graph of $y = 4 \cos 2x$; $0^\circ \leq x \leq 360^\circ$ (3)

3.5 3.5.1 Sketch the graph of $y = x^3 - 6x^2 + 9x$ (3)

3.5.2 What is the domain of the graph of $y = x^3 - 6x^2 + 9x$ in QUESTION 3.5.1? (1)

3.5.3 Is the graph of $y = x^3 - 6x^2 + 9x$ in QUESTION 3.5.1 continuous or discontinuous? (1)

3.6 Sketch the graph of $xy = -4$ (2)

[20]

QUESTION 4

4.1 Solve for x and y if $x - jy = (j - 4) + \frac{2+j}{2-j}$ (4)

4.2 Simplify $\frac{Z_2}{Z_1} = \frac{3-j}{\sqrt{8+j2}}$ (5)

Leave answer in polar form.

4.3 Simplify $(j^2)^2$ (1)

4.4 Given:

$$2a + b - 3c = 4$$

$$a - 2b + 5c = 7$$

$$3a + 4b - c = 8$$

4.4.1 Solve for c by only using Cramer's rule. (6)

4.4.2 Calculate the minor of -2. (2)

4.4.3 Calculate the co-factor of 3. (2)

[20]

QUESTION 5

5.1 Solve for y if $3\sec^2 y - 4\tan y - 2 = 0$; $0^\circ \leq y \leq 360^\circ$ (6)

5.2 Prove that $\frac{\sin(-x)\cos(180^\circ + x) + \sin(90^\circ + x)}{(\sin 180^\circ - \tan 135^\circ)\cos(-x)} = 1 + \sin x$. (4)

5.3 Simplify $\frac{1 - \cos 2\theta}{\tan \theta}$ (3)

5.4 Determine $\cos 22,5^\circ$ by using half-angle identities. Calculators may not be used. (4)

5.5 Given: $\sin x = \frac{3}{5}$ and $\cos y = \frac{8}{9}$; with both x and y being acute angles

Determine, without the use of a calculator, the value of $\sin(x - y)$. (3)

[20]

TOTAL: 100

MATHEMATICS N4**FORMULA SHEET**

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

$$\ln x = \log_e x$$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$\int ka^x dx = \frac{ka^x}{\ln a} + c$$

$$\int \tan x dx = \ln \sec x + c$$

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

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