higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

MATHEMATICS N4

(16030164)

1 April 2020 (X-paper)
09:00–12:00

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

048Q1A2001

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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 Simplify:

$$\frac{\sin(90^0 - x).\sec(360^0 - x)}{\cot(90^0 - x).\sin(180^0 - x).\cos ec(180^0 + x)}$$ (3)

1.2 Solve for β if:

$$2\cos^2 2\beta + \cos 2\beta - 1 = 0; -180° \le \beta \le 180°$$ (5)

1.3 1.3.1 Derive the identity for $\cos\frac{x}{2}$ if:

$$1 - \sin x = 2\cos^2\frac{x}{2}$$ (2)

1.3.2 Determine the value of $\cos 15°$ without the use of a calculator if:

$$1 - \sin x = 2\cos^2\frac{x}{2}$$ (3)

1.4 Prove that:

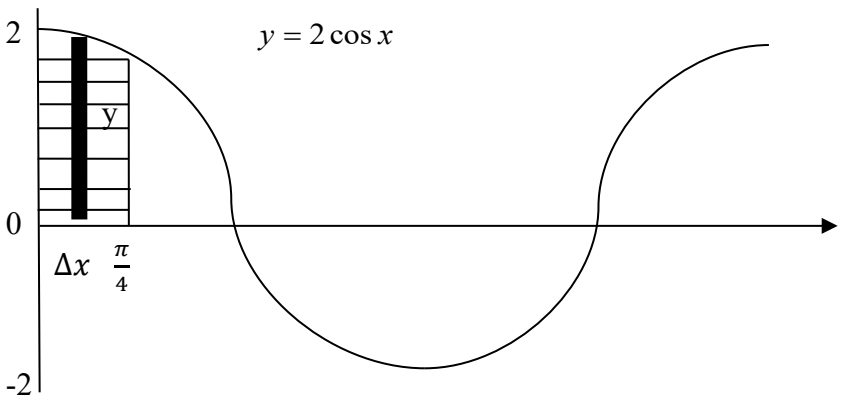
$$\frac{\sin x + \sin 2x}{1 + \cos x + \cos 2x} = \tan x$$ (4)

1.5 Determine $(\cos 75°)$ without the use of a calculator. Simplify as far as possible. (3)

[20]

QUESTION 2

2.1



2.1.1 Determine, using integration, the value of the shaded area indicated in the graph. (4)

2.1.2 Calculate, using differentiation, the minimum and the maximum turning points of the graph. (6)

2.1.3 Distinguish, using the second derivative, between the minimum and the maximum turning points of the graph. (3)

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2.2 Integrate the following in terms of x:

$$\int\left(\frac{1}{x^3}+\frac{3}{2}\sin 3x+3\sqrt{x}-10.10^x+\frac{1}{\sec 2x}-2x^0\right)dx$$

(7)
[20]

QUESTION 3

3.1 Use the function (chain rule) to differentiate the following:

$$y=\sqrt{\tan x}$$

(4)

3.2 Differentiate the following in terms of y:

$$y=2^x+\frac{1}{2}\ln x+\frac{1}{2}e^x+6t$$

(4)

3.3 Determine the following limit:

$$\lim_{x\to 2}\left(\frac{x^2-4}{x-2}\right)$$

(3)

3.4 Differentiate the following by the use of first principles:

$$y=-x^3+5x$$

(4)

3.5 The displacement of an object is represented by:

$$S=\int_1^4\left(\sqrt{t}-5\right)^2dt$$

Determine the value of S. (3)

3.6 Simplify:

$$\int\left(\frac{4\sec^4\theta-9}{2\sec^2\theta+3}\right)d\theta$$

(2)
[20]

QUESTION 4

4.1 Solve for x and y if:

$$(3-4j)^2=\frac{-x-yj}{j^2}$$

(4)

4.2 Simplify:

$$\left(\sqrt{3}-j\right)^5$$

Leave the answer in rectangular form. (4)

4.3 Determine the argument and the modulus of:

$$\underline{2}\quad -6b-27=-7a$$
$$3a+4b-5=0$$

(3)

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4.4 Solve for a and b using only Cramer's rule:

$$-6b-27=-7a$$

$$3a+4b-5=0$$ (5)

4.5 4.5.1 Determine the value of the following determinant by only expanding on column 2:

$$\begin{vmatrix} \frac{2}{3} & -1 & \frac{-1}{2} \\ \frac{-1}{4} & 2 & 0 \\ 5 & -8 & \frac{-2}{3} \end{vmatrix}$$ (3)

4.5.2 Determine the value of the co-factor of -1 in QUESTION 4.5.1 above. (1)

[20]

QUESTION 5

5.1 5.1.1 Sketch the graph of $y=e^x$. (2)

5.1.2 State the range of the graph mentioned in QUESTION 5.1.1. (1)

5.1.3 Write down the equation of the inverse of the graph mentioned in QUESTION 5.1.1. (1)

5.2 Sketch the graph of $y=\cos x-1;-360\le x\le 360°$ (3)

5.3 Sketch the graph of $y=\cot\theta$ for $\frac{-3\pi}{2}\le\theta\le\frac{3\pi}{2}$ (3)

5.4 Given:

$$\ln\sqrt{x-1}+\ln\sqrt{x+1}=a$$

Make x the subject of the formula. (4)

5.5 Factorise:

$$27(k-1)^3-8(k+1)^3$$

Do not simplify. (3)

5.6 Solve for the unknown:

$$3^{2x-1}=\ln 5$$ (3)

[20]

TOTAL: 100

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MATHEMATICS N4

FORMULA SHEET

NEW SYLLABUS

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

$\ln x = \log_e x$

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

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

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

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

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

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

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

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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