higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T1020**(E)**(J25)

# NATIONAL CERTIFICATE

# MATHEMATICS N4

(16030164)

**25 July 2018 (X-Paper)**
**09:00–12:00**

**Scientific calculators may be used.**

**This question paper consists of 6 pages and 1 formula sheet.**

 

# DEPARTMENT OF HIGHER EDUCATION AND TRAINING
# REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE
MATHEMATICS N4
TIME: 3 HOURS
MARKS: 100

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**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. Work neatly.

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## QUESTION 1

1.1 Simplify:

$$\frac{\sin 210°.\tan 225°.\cos 315°}{\sin(-45°).\cos 240°}$$ (3)

1.2 Solve for c if $2\cos c + 3\sin c - 1 = 0; 0° \le c \le 360°$ (5)

1.3 1.3.1 Derive the identity for $\sin\frac{x}{2}$ if $1-\cos x = 2\sin^2\frac{x}{2}$. (2)

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

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

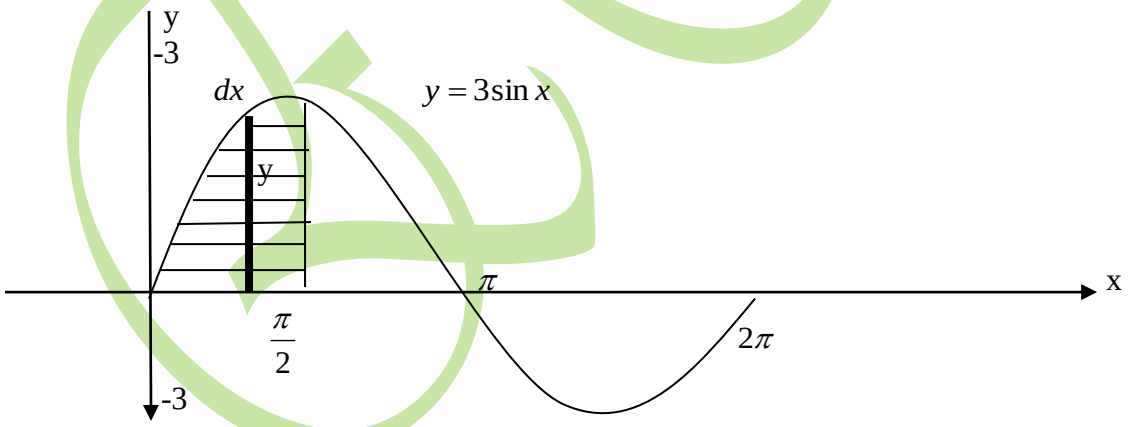
1.4 Prove that $2-\sec^2 y = \cos 2y(\tan^2 y + 1)$. (4)

1.5 Determine $(\cos 15°)^2$ without the use of a calculator. Simplify as far as possible. (3)

**[20]**

## QUESTION 2

2.1




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

2.1.2 Using differentiation and calculate the minimum and the maximum turning points of the graph. (6)

2.1.3 Use the second derivative and distinguish between the minimum and the maximum turning points of the graph. (3)

2.2 Integrate the following in terms of $x$:

$$\int\left(-4e^{3x}+\frac{\sin 2x+\tan x}{\cos x}-\sqrt{5x}+5-2^{-3x}\right)dx$$

(7)
**[20]**

**QUESTION 3**

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

$$y=\tan\left(x^5-7x\right)$$

(4)

3.2 Differentiate the following in terms of $y$:

$$x=\frac{3}{\sqrt[5]{y}}-\cos 3\pi y-e^{-22y}-\ln\left(y^6\right)$$

(4)

3.3 Determine the limit of $\lim\limits_{x\to\infty}\left(\frac{2x^2-8}{x^2+2}\right)$

(3)

3.4 Differentiate $y=-x^3$ by using first principles. (4)

3.5 The displacement of an object is represented by $S=\int_0^4\left(t^3+t\right)dt$

Determine the value of $S$. (3)

3.6 Simplify $\int\frac{1}{2}\sqrt{1+\tan^2 x}.2\tan x dx$

(2)
**[20]**

**QUESTION 4**

4.1 Solve for $x$ and $y$ if $\frac{7+j5}{-j+2} = 1{,}8x + j3{,}4y$ (4)

4.2 Simplify $(-4-j)^5$

Leave answer in rectangular form. (4)

4.3 Determine the argument and the modulus of

$$z = \frac{2cis-60^0.5cis45^0}{4cis33^0.3cis-21^0}$$ (3)

4.4 Solve for a and b only using 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:

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

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

**[20]**

**QUESTION 5**

5.1 5.1.1 Sketch the graph of $y = -\sqrt{144 - x^2}$ (2)

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

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

5.2 Sketch the graph of $y = \sin x + 1; 0° \leq x \leq 360°$ (3)

5.3 Sketch the graph of $y = \sec\theta$; for $\frac{-3\pi}{2} \leq 0 \leq \frac{3\pi}{2}$ (3)

5.4 Given:

$$R_1 = R_5\left[\frac{1-y}{1-y^n}\right]$$

Make $n$ the subject of the formula. (4)

5.5 Factorise, but do NOT simplify.

$$64(a-1)^3 - (a+1)^3$$ (3)

5.6 Solve for the unknown:

$$15^{3y+2} = 2^{8+y}$$ (3)

**[20]**

**TOTAL: 100**

**MATHEMATICS N4**

**FORMULA SHEET**

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

$\ln x = \log_e x$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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