higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

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APRIL 2012

NATIONAL CERTIFICATE

MATHEMATICS N4

(16030164)

28 March (X-Paper)
09:00 – 12:00

Calculators may be used.

This question paper consists of 6 pages and a 1-page 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 FIVE the questions in full.
2. Show ALL the calculations and intermediary steps. Simplify where possible.
3. Read ALL the questions carefully.
4. All the graph work must be done in the ANSWER BOOK. Graph paper is NOT supplied. Values of intercepts with the system of axes and the turning point(s) MUST be shown on the graph.
5. ALL final answers must be accurately approximated to THREE decimal places.
6. Questions may be answered in any order but subsections of questions must NOT be separated.
7. A formula sheet is attached to this question paper. You are NOT compelled to use the formulae and the list is NOT necessarily complete.
8. Number the answers correctly according to the numbering system used in this question paper.
9. Write neatly and legibly.

QUESTION 1

1.1 Solve for x and y if:

$$x + jy = \frac{(3 + j5)(2 - j7)}{(1 - j3)}$$ (5)

1.2 Given:

$Z = -3 + j2$

1.2.1 Find $\overline{Z}$ (1)

1.2.2 Change $\overline{Z}$ into polar form. θ must be positive. Show ALL steps. (3)

1.2.3 Represent all the calculated values in QUESTION 1.2.2, on the Argand diagram. (3)

1.3 Sketch the graph of $y = \sec x$; $0° \leq x \leq 360°$ (3)

1.4 1.4.1 Sketch the graph of $y = 6 + 4x - 2x^2$ (2)

1.4.2 Is the graph of $y = 6 + 4x - 2x^2$ continuous or discontinuous? (1)

1.5 Sketch the graph of $y = \ell nx$ (2)
[20]

QUESTION 2

2.1 Make P_2 the subject of the formula if:

$$H = 100\ell og\frac{P_1}{P_2}$$ (3)

2.2 The hypotenuse of a right-angled triangle is 10 mm longer than the longest of the two other sides. Calculate the lengths of the sides if the shortest side is 50 mm long. (5)

2.3 Solve for x if:

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

2.4 Given:

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

2.4.1 Calculate the value of the determinant. (3)

2.4.2 What is the minor of –5? (1)

2.4.3 What is the cofactor of –2? (1)

2.5 Solve for x by using determinants if:

$$x + y = 10$$
$$x - y = 2$$

(4)
[20]

QUESTION 3

3.1 3.1.1 Derive a formula for $\cos\frac{A}{2}$ if $\cos 2A = 2\cos^2 A - 1$. (4)

3.1.2 Use the formula derived in QUESTION 3.1.1 to calculate the value of cos 15° WITHOUT using a calculator. (4)

3.2 Solve for θ if:

$\sec^2\theta + \tan\theta - 3 = 0 \quad ; 0° \leq \theta \leq 360°$ (4)

3.3 Calculate the value of sin 120° WITHOUT the use of a calculator. (4)

3.4 Prove that:

$\tan(90° - B) = \cot B$ (4)
[20]

QUESTION 4

4.1 Expand $(3x+6)^{\frac{1}{2}}$ to four terms only. (4)

4.2 Given:

$$y=\frac{\sin 3x}{4x^3}$$

Differentiate by using the quotient rule. (4)

4.3 Given:

$$y=x^3-6x^2+11x-6$$

Calculate with the aid of differentiation, the co-ordinates of the turning points and the point of inflection. (7)

4.4 Differentiate the following with respect to x:

$$y=-3e^{-2x}-\ell og_e\frac{1}{x^3}-\operatorname{cosec}3x+\pi p+7x^3$$ (5)
[20]

QUESTION 5

5.1 Integrate:

$$\int\left(-4x^3-9^{-3x}+14\sin 7x-\frac{3}{x}+\sec^2 4x-4\right)dx$$ (7)

5.2 5.2.1 Sketch and indicate the area enclosed by the graph $y=3\sin x$, the x-axis; $x=0$ and $x=\frac{\pi}{2}$. Also, show the representative strip to be used to calculate the area. (3)

5.2.2 Calculate, using integration, the magnitude of the area indicated in QUESTION 5.2.1. (4)

5.3 Simplify:

$$\int\sqrt{x^2-6x+9}\ dx$$ (3)

5.4 Determine:

$$\int_0^2 (x - 3)(x + 3)dx$$ (3)

[20]

TOTAL: 100

MATHEMATICS N4

FORMULA SHEET

NEW SYLLABUS

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

$\ell n\, x = \log_e x$

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

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

$\sin^2 x + \cos^2 x = 1$
$1 + \cot^2 x = \operatorname{cosec}^2 x$
$1 + \tan^2 x = \sec^2 x$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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