higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

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AUGUST EXAMINATION

NATIONAL CERTIFICATE

MATHEMATICS N4

(16030164)

24 July 2014 (Y-Paper)
13:00–16:00

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 the question paper.
4. Show ALL the calculations and intermediary steps. Simplify where possible.
5. 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.
6. ALL final answers must be accurately approximated to THREE decimal places.
7. Questions may be answered in any order but subsections of questions must NOT be separated.
8. A formula sheet is attached to this question paper. You are NOT compelled to use the formulae and the list is NOT necessarily complete.
9. Write neatly and legibly.

QUESTION 1

1.1 Solve for x if:

$$5^{2x-1} = 7^{3x+4}$$

(3)

1.2 Make D the subject of the formula if:

$$P = A\log\left(\frac{D-R}{R}\right)$$

(3)

1.3 Given:

$$m - n + r + 3 = 0.$$
$$2n + 4 - m = r$$
$$\frac{m}{2} - 1 = \frac{r}{3}$$

1.3.1 Solve for m by the use of Cramer's Rule. (8)

1.3.2 Determine the value of the minor of -3. (2)

1.4 A steel wire of $28\,m$ is bent to form a rectangle with an area of $46\ m^2$.

Calculate the breadth and the length of the rectangle. (4)

[20]

QUESTION 2

2.1 Solve for a if:

$$2a^2 + 2a + 1 = 0$$

(5)

2.2 Simplify and leave answer in $a + jb$ form

$$\frac{(4-2j)(5+j)}{3-2j}$$

(5)

2.3 Sketch the graph of the inverse of

$$y = x - 6$$

(3)

2.4 Sketch the graph of $y = \cos ecx; \quad -180^0 \le x \le 180^0$

(3)

2.5 2.5.1 Sketch the graph of $y = 13^x$. (3)

2.5.2 Is the graph of $y = 13^x$ in QUESTION 2.5.1 a function or a relation? (1)
[20]

QUESTION 3

3.1 Calculate the value of $\tan 75^0$ without the use of a calculator. (4)

3.2 Simplify:

$$\frac{\sin^2\theta}{1+\cos\theta} - 1$$ (4)

3.3 Prove that:

$$2\tan y = \frac{\sin 2y}{1+\tan^2 y}$$ (4)

3.4 Solve for A if:

$$\cos(A + 10^0) = \sin(3A + 20^0); \quad 0^0 \leq A \leq 90^0$$ (4)

3.5 If $\sin x = \frac{3}{5}$ and $\cos y = \frac{9}{41}$, with both x and y acute angles, calculate without the use of a calculator, the value of $\sin(x - y)$. (4)
[20]

QUESTION 4

4.1 Given: $(2x^2 - 3)^5$

Expand to FOUR terms only by the use of the Binomial Theorem. (4)

4.2 Differentiate the following:

$$y = \frac{1}{3}\ell nx - 3x^{-1} + \frac{5\sin 2x + 7}{5\sin x}$$ (4)

4.3 Differentiate by the use of a Quotient Rule if:

$$y = \frac{\sec x}{\ell ogx}$$ (4)

4.4 Given: $y = -2x^3 + 3x^2 + 12x - 7$

Determine, using differentiation, the maximum and the minimum turning points. (8)
[20]

QUESTION 5

5.1 Simplify:

$$\int \frac{\tan x}{\sec x} dx$$ (3)

5.2 Determine:

$$\int_0^{\pi/3} (4\cos 4x) dx$$ (3)

5.3 5.3.1 Sketch and indicate the area enclosed by the graph of $y = -x^2 + 2x$ and the X-axis. Also indicate the representative strip used to calculate the area enclosed. (3)

5.3.2 Calculate, using Integration, the value of the enclosed area. (4)

5.4 Integrate the following:

$$\int \left(\frac{1}{3}\sec x \tan x - \frac{1}{3}e^{-2x} + \sqrt{x} + 4x^{-5} - 2.4^{3x} + p \right) dx$$ (7)
[20]

TOTAL: 100

FORMULA SHEET

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

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

$(r\,|\,\underline{\theta}\,)^n = r^n\,|\,\underline{n\theta}$ $\quad a + bj = c + dj \Leftrightarrow a = c$ 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	$ka^x \ell na$
$k\ell nx$	$\frac{k}{x}$
$\sin x$	$\cos x$
$\cos x$	$-\sin x$
$\tan x$	$\sec^2 x$
$\cot x$	$-\operatorname{cosec}^2 x$
$\sec x$	$\sec x \tan x$
$\operatorname{cosec} x$	$-\operatorname{cosec} x \cot x$

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

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

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

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

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

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

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

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

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

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

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

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

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