

DEPARTMENT OF EDUCATION
REPUBLIC OF SOUTH AFRICA

252

NATIONAL CERTIFICATE

MATHEMATICS N4

TIME: 3 HOURS

MARKS: 100

Aug 09

INSTRUCTIONS AND INFORMATION

1. Answer ALL the questions.
 2. Read ALL the questions carefully.
 3. Number the answers correctly according to the numbering system used in this question paper.
 4. Answer ALL FIVE questions IN FULL. 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.
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QUESTION 1

1.1 A number increased by 5 is 24 times the reciprocal of the number. Determine the number algebraically. (4)

1.2 Solve for x if:

$$6^{2x} = 3^{x-2} \quad (3)$$

1.3 Given:

$$V = B - \frac{q}{k} \ln(r-1)$$

Make r the subject of the formula. (5)

1.4 Given:

$$3x + 2y + 5z = 2$$

$$5x + 3y - 2z = 4$$

$$2x - 5y - 3z = 14$$

1.4.1 Write down and evaluate the determinant of coefficients by using the FIRST ROW only. (4)

1.4.2 Write down and evaluate the minor of -2. (2)

1.4.3 Write down and evaluate the co-factor of -5. (2)

[20]

QUESTION 2

2.1 Sketch the graph of $y = \sqrt{9 - x^2}$. (3)

2.2 What is the domain of the graph of $y = \sqrt{9 - x^2}$? (1)

2.3 Sketch the graph of:

$$y = \frac{1}{2} e^{2x} \quad (3)$$

2.4 Sketch the graph of $2x^2 + 4y^2 = 16$ (3)

2.5 Solve for x and y if:

$$(x + y) + j(x - y) = (2 + j5)^2 + (2 - j3) \quad (4)$$

2.6 Given:

$$z = -2 - j\sqrt{6}$$

Convert z into polar form. Show ALL steps. θ may ONLY be positive. (3)

2.7 Given:

$$z = 15,9 \angle 49,7^\circ$$

Express z in $a + jb$ form. Show ALL steps. (3)
[20]

QUESTION 3

3.1 Prove that:

$$\frac{1 - \sin 2x}{\sin x - \cos x} = \sin x - \cos x \quad (4)$$

3.2 Solve for x if:

$$\cot x - \operatorname{cosec}^2 x + 6 = 0; \quad 0^\circ \leq x \leq 180^\circ \quad (6)$$

3.3 Show that: $\sin \frac{x}{2} = \pm \sqrt{\frac{1 - \cos x}{2}}$

$$\text{If } \cos 2x = 1 - 2\sin^2 x \quad (4)$$

3.4 Derive a formula for $\cos 2A$, in terms of $\cos A$ only. (3)

3.5 Prove that:

$$\sec(90^\circ - \theta) = \operatorname{cosec} \theta \quad (3)$$

[20]

QUESTION 4

4.1 Differentiate with respect to x from first principles if:

$$y = 4x^2 - x.$$

(5)

4.2 Differentiate, with respect to x , by using of the quotient rule if:

$$y = \frac{\sin 2x}{2x}$$

(4)

4.3 Determine $\frac{dy}{dx}$

$$y = \frac{2}{\operatorname{cosec} x} - e^{-x} + 9^x - \sqrt{x}$$

(4)

4.4 Given:

$$y = x^3 - 6x^2 + 9x + 6$$

Calculate, with the aid of DIFFERENTIATION, the coordinates of the minimum and maximum turning points. Distinguish between the maximum and the minimum turning points by using the second derivative.

(7)

[20]

QUESTION 5

5.1 Simplify:

$$\int \left(3^{5x} + \frac{5}{\sec 2x} - e^{\pi x} + \frac{x^2}{3} - \frac{2}{x} \right) dx$$

(6)

5.2 Evaluate:

$$\int_1^2 2^{x^2} dx$$

(4)

5.3 Simplify:

$$\int (\operatorname{cosec} x)$$

(3)

- 5.4 5.4.1 Sketch the area enclosed by the graph of $y = \cos 2x$ for $0 \leq x \leq \frac{\pi}{4}$.
Also, INDICATE the representative strip to be used to calculate the area. (3)
- 5.4.2 Calculate, using INTEGRATION, the area indicated in QUESTION 5.4.1. (4)
[20]

TOTAL: 100