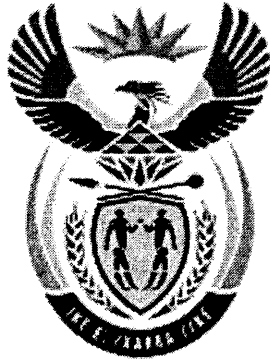


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higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T1060(E)(A5)T
APRIL 2011

NATIONAL CERTIFICATE

MATHEMATICS N3

(16030143)

5 April (X-Paper)
09:00 – 12:00

Calculators may be used.

This question paper consists of 6 pages and a 2-page formula sheet.

DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA
NATIONAL CERTIFICATE
MATHEMATICS N3
TIME: 3 HOURS
MARKS: 100

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 number.
 4. Show ALL calculations and intermediary steps. Simplify where possible.
 5. Questions may be answered in any sequence. Subsections of questions may NOT be separated.
 6. ALL the final answers must be approximated accurately to THREE decimal places.
 7. The formula sheets (attached) are not necessarily complete. Any other applicable formula may be used.
 8. NOTE: Diagrams are not drawn to scale.
 9. Graph paper is not required.
 10. Write neatly and legibly.
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QUESTION 1

1.1 Indicate whether the following statements are TRUE or FALSE. Write only 'true' or 'false' next to the question number (1.1.1 – 1.1.3) in the ANSWER BOOK.

1.1.1 $\log(x - y) = \log x - \log y$ (1)

1.1.2 $(x - y)^2 = x^2 - y^2$ (1)

1.1.3 $\cos^{-1} x = \sec x$ (1)

1.2 Simplify without using the calculator:

1.2.1
$$\frac{(\sqrt{3} - \sqrt{2})(\sqrt{3} + \sqrt{2})}{\sqrt{2}(\sqrt{2} - 2\sqrt{50})}$$
 (3)

1.2.2
$$\frac{2^3 \times \sqrt[3]{64} \times 6^0}{4^{\frac{3}{2}} \times 9^{-\frac{1}{2}} \times 16^{\frac{1}{2}}}$$
 (3)

1.2.3 $\log \frac{a}{b} + \log \left(\frac{a}{b}\right)^{-1}$ (2)

1.3 Determine the square root of the following polynomial:

$9x^2 + 42x + 49$ (2)

1.4 Given that $(x - 2)$ is a factor of $f(x)$. Calculate the factors of the function:

$f(x) = x^3 + 2x^2 - 5x - 6$ (3)

1.5 Simplify the following fractions:

1.5.1
$$\frac{2m}{m^2 - n^2} + \frac{1}{n - m}$$
 (4)

1.5.2
$$\frac{x^2 - x - 6}{x^2 + x - 20} \times \frac{x^2 - 25}{2x - 6} \div \frac{x^2 - 3x - 10}{x - 4}$$
 (4)

[24]

QUESTION 22.1 Solve for x :

2.1.1 $\sqrt{8x} - 2x - 1 = 0$ (3)

2.1.2 $2 \log_3 x - 3 \log_2 4 = \log_b 1$ (3)

2.1.3 $\frac{3^{x+2} \times 3^{2x}}{3^{-x^2}} = 9$ (3)

2.2 Make ' n ' the subject of the formula:

$s = 1 - ar^n$ (3)

2.3 Calculate the value of ' g ' given that $t = 2,3$ and $l = 4,2$:

$t = 2\pi \sqrt{\frac{l}{g}}$ (3)

2.4 Make ' t ' the subject of the formula by completing the square:

$s = ut + \frac{1}{2}at^2$ (4)

2.5 The price of Mathematics book is R60,00 less than that of a Science book. Four Mathematics books cost R260,00 more than two Science books. Calculate the prices of the books. (4)

[23]**QUESTION 3**

3.1 Sketch the graphs of the following equations in the ANSWER BOOK:

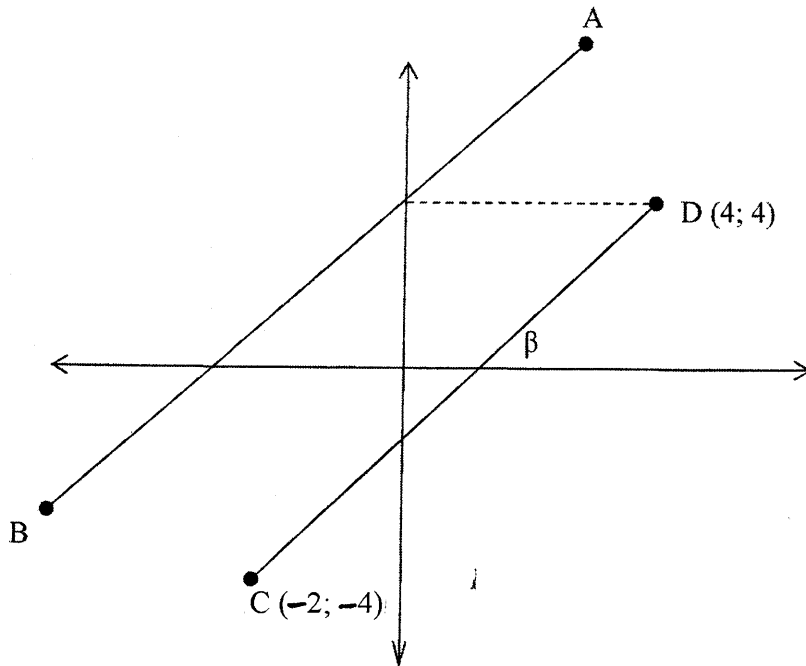
3.1.1 $\frac{x^2}{256} + \frac{y^2}{64} = 1$ (3)

3.1.2 $y = \pm \sqrt{49 - x^2}$ (3)

3.1.3 $y = x^2 - 7x + 10$ (3)

3.2 Calculate the equation of a straight line that passes through the point (2 ; 3) and is parallel to the line $y = 2x + 1$ (3)3.3 Calculate the equation of the tangent to the circle $x^2 + y^2 = 8$ and that passes through the point (2 ; -2). (4)

3.4 In the following sketch AB is parallel to CD:



Calculate the following:

- 3.4.1 The gradient of line AB (3)
 - 3.4.2 The equation of line BC (2)
 - 3.4.3 The length of line CD (2)
 - 3.4.4 The magnitude of β (1)
- [24]

QUESTION 4

4.1 Differentiate from first principles:

$$f(x) = 3x^2 \quad (3)$$

4.2 Determine $f'(x)$ by using the rules of differentiation:

$$f(x) = \sqrt{x} + \frac{2}{x} \quad (2)$$

4.3 Given that $f(x) = x^3 + 2x^2 - 15x$. Calculate the x -coordinates of the turning points. (4)

[9]

QUESTION 5

5.1 Calculate values of the θ that will satisfy the following trigonometric equation for

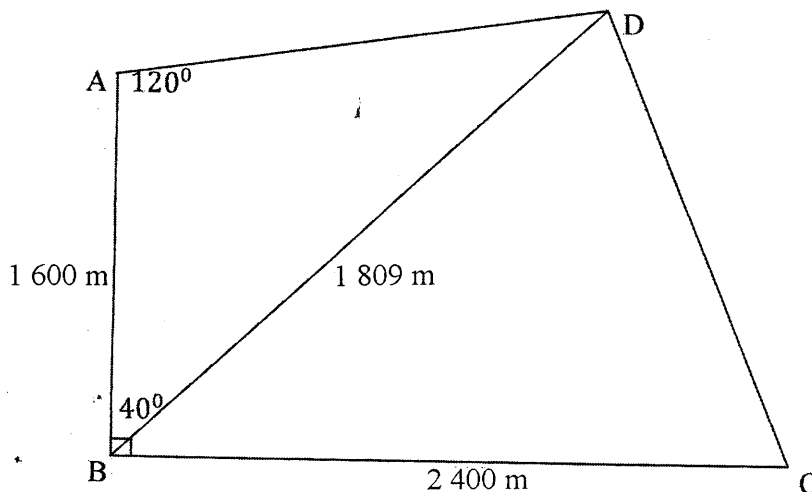
$$0^\circ \leq \theta \leq 360^\circ :$$

$$2 \cos \theta + 2 = 3 \tag{3}$$

5.2 Make use of basic trigonometric identities to prove that:

$$(\tan \alpha + \cot \alpha) \sin \alpha = \sec \alpha \tag{4}$$

5.3 Given the following sketch:



5.3.1 Calculate the length of AD. (2)

5.3.2 Determine the total area of the sketch. (4)

5.4 Determine the exact value without using the calculator:

$$\frac{\sin 120^\circ \times \tan 210^\circ + \sin 150^\circ + \frac{1}{2} \tan 330^\circ}{\frac{1}{2} \cos 240^\circ} \tag{4}$$

5.5 Sketch the graph represented by the following trigonometric function for $0^\circ \leq x \leq 180^\circ$:

$$y = 4 \cos 2x \tag{3}$$

[20]

TOTAL: 100

MATHEMATICS N3**FORMULA SHEET**

Any applicable formula may also be used.

1. Factors/ Faktore

$$a^3 - b^3 = (a - b)(a^2 + ab + b^2)$$

$$a^3 + b^3 = (a + b)(a^2 - ab + b^2)$$

**3. Quadratic formula/
Kwadratiese formule**

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

4. Parabola/ Parabool

$$y = ax^2 + bx + c$$

$$y = \frac{4ac - b^2}{4a}$$

$$x = \frac{-b}{2a}$$

2. Logarithms/ Logaritmes

$$\log ab = \log a + \log b$$

$$\log \frac{a}{b} = \log a - \log b$$

$$\log_b a = \frac{\log_c a}{\log_c b}$$

$$\log a^m = m \log a$$

$$\log_b a = \frac{1}{\log_a b}$$

$$\log_a a = 1 \therefore \ln e = 1$$

$$a^{\log_a t} = t \therefore e^{\ln m} = m$$

5. Circle/ Sirkel

$$x^2 + y^2 = r^2$$

$$D = \frac{x^2}{4h} + h$$

$$x = \sqrt{4Dh - 4h^2}$$

6. Straight line/ Reguitlyn

$$y - y_1 = m(x - x_1)$$

Perpendicular:

$$\text{Loodreg: } m_1 \cdot m_2 = -1$$

Parallel lines:

$$\text{Ewewydige lyne: } m_1 = m_2$$

Distance:

$$\text{Afstand: } D = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Midpoint:

$$\text{Middelpunt: } P = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$$

Angle

of inclination:

7. Differentiation/ Differensiasie

$$\frac{dy}{dx} = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$$

$$\frac{d}{dx}(x^n) = nx^{n-1}$$

Max/Min

Maks/Min

For turning points:

Vir draaipunte: $f'(x) = 0$

8. Trigonometry/ Trigonometrie

$$\sin\theta = \frac{y}{r} = \frac{1}{\operatorname{cosec}\theta}$$

$$\cos\theta = \frac{x}{r} = \frac{1}{\operatorname{sec}\theta}$$

$$\tan\theta = \frac{y}{x} = \frac{1}{\operatorname{cot}\theta}$$

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

$$1 + \tan^2\theta = \operatorname{sec}^2\theta$$

$$1 + \operatorname{cot}^2\theta = \operatorname{cosec}^2\theta$$

$$\tan\theta = \frac{\sin\theta}{\cos\theta}$$

$$\operatorname{cot}\theta = \frac{\cos\theta}{\sin\theta}$$

$$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$