



higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T1000(E)(N15)T

NATIONAL CERTIFICATE

MATHEMATICS N2

(16030192)

15 November 2018 (X-Paper)
09:00–12:00

Scientific calculators may be used.

REQUIREMENTS: TWO sheets of graph paper

This question paper consists of 6 pages and 2 information sheets.

DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA
NATIONAL CERTIFICATE
MATHEMATICS N2
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 this question paper.
 4. Show ALL intermediate steps and simplify where possible.
 5. ALL final answers must be rounded off to THREE decimals.
 6. Questions may be answered in any order, but subsections of questions must be kept together.
 7. Questions must be answered in BLUE or BLACK ink.
 8. Sketches must be large, neat and fully labelled.
 9. ALL graph work must be done on the graph paper provided.
 10. Write neatly and legibly.
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QUESTION 1

1.1 Simplify the following:

$$1.1.1 \quad \frac{\sqrt[4]{x^{32}y^{48}}}{x^3y^4} \quad (2)$$

$$1.1.2 \quad \frac{5^{-3a} \times 3 \times (75)^{2a}}{3^a \cdot (15)^{a+1}} \quad (4)$$

$$1.1.3 \quad \frac{\log_2 25 + \log_3 4}{\log_2 125 - \log_3 \frac{1}{8}} \quad (3)$$

$$1.2 \quad \text{Solve for } x \text{ if } \log_x 16 + \log_3 27 - \log_4 \frac{1}{4} = 6 \quad (4)$$

$$1.3 \quad \text{Solve for } x \text{ if } 4^{2x} = 8^{3x-4} \quad (3)$$

1.4 Make d the subject of the formula in the following equation

$$S = \frac{n}{2}[2a + (n-1)d] \quad (3)$$

[19]

QUESTION 2

2.1 Factorise the following expressions:

$$2.1.1 \quad x^2y + x^2 - 4xy - 16 \quad (4)$$

$$2.1.2 \quad (x-2y)^2 - \frac{16}{49} \quad (2)$$

2.2 Given:

$$x^2y - xy^2$$

$$3x - 3y$$

$$x^2 - 2xy + y^2$$

2.2.1 Fully factorise each of the given expressions (3)

2.2.2 Now, give the Highest Common Factor (HCF) of the three expressions (1)

2.2.3 Give the Lowest Common Multiple (LCM) of the three expressions (3)

2.3 Simplify the following expressions:

$$2.3.1 \quad \frac{x}{x^2 - 5x + 6} + \frac{1}{x - 2} + \frac{3}{x - 3} \quad (3)$$

$$2.3.2 \quad \frac{x^3}{x^2 - 1} \times \frac{x^2 + x - 2}{x^4} \div \frac{x^2 + 4x + 4}{x^2} \quad (4)$$

[20]

QUESTION 3

3.1 Algebraically solve for x and y in the following equations:

$$3x + 2y = 6 \text{ and } 2y - 4x - 4 = 0 \quad (4)$$

3.2 Determine the dimensions of a rectangle if its perimeter is 98 m and the length is 3 m longer than its width. (4)

3.3 The second hand of a clock takes 30 seconds to move through an arc of 180 degrees.
What is the angular velocity? (3)

3.4 Express an angular velocity of 0,105 rad/s as revolutions per minute. (2)

3.5 The arc length of a sector is 3 m and it subtends an angle of 10 rad.

Calculate the following:

3.5.1 Radius

3.5.2 Area of the sector (2 × 2) (4)

3.6 A solid cylinder has a base diameter of 10 mm and a perpendicular height of 25 mm.

3.6.1 Calculate the surface area of the cylinder (3)

3.6.2 Calculate the maximum volume of the cylinder (2)

3.6.3 The cylinder is melted and recast as a square. Calculate the dimensions of the square (3)

[25]

QUESTION 4

4.1 The ordinates in cm of an irregular metal sheet are as follows:

4; 6; 7; 9; 12; 15; 19; 23; 28 and 32

The area was found to be 411 cm^2 . Use the mid-ordinate rule to calculate the common interval between the ordinates.

(3)

4.2 Determine the following trigonometric ratios without using a calculator if $\sin \theta = 0,2$ and $90^\circ \leq \theta \leq 180^\circ$

4.2.1 $\cot \theta$ (3)

4.2.2 $\sec \theta$ (1)

4.2.3 $\operatorname{cosec} \theta - \sec \theta$ (2)

4.2.4 $\cot \theta + \operatorname{cosec} \theta$ (1)

4.3 Use graph paper and draw the graphs of $f(x) = 3 \cos x$ and $g(x) = 2 \sin x$ on the same system of axes if $0^\circ \leq x \leq 180^\circ$

(6)

4.4 Use the graphs drawn in QUESTION 4.3 to determine the value(s) of x where:

4.4.1 $2 \sin x - 1 = 0$ (2)

4.4.2 $3 \cos x - 2 \sin x = 0$ (1)

4.4.3 $3 \cos x = 0$ (1)

4.5 While out swimming one day you spot a coin at the bottom of a pool 10 m deep with the angle between the top of the water and the coin being 15° .

How far away is the coin from you along the bottom of the pool?

(3)
[23]

QUESTION 5

5.1 Given:

$$g(x) = x + 2 \text{ and } f(x) = -x^2 + 4x + 12$$

Determine the following:

5.1.1 Equation of the axis of symmetry of $f(x)$ (1)

5.1.2 Roots of $f(x)$ (2)

- 5.1.3 Coordinates of the turning point of $f(x)$ (2)
- 5.1.4 y - intercept of the function $f(x)$ (1)
- 5.2 Use the given equations in QUESTION 5.1 to draw the graphs of $f(x)$ and $g(x)$ on the same system of axes on the graph paper provided (5)
- 5.3 From the graphs drawn in QUESTION 5.2 read the value(s) of x for which $f(x) = g(x)$ (2)
- [13]

TOTAL: 100

MATHEMATICS N2**FORMULA SHEET**

Any applicable formulae not found on this formula sheet may also be used

Right cone

$$\text{Volume} = \frac{1}{3} \pi r^2 h$$

$$\begin{aligned} \text{Surface area} &= \pi r \sqrt{h^2 + r^2} + \pi r^2 \\ &= \pi r l + \pi r^2 \end{aligned}$$

Cylinder

$$\text{Volume} = \pi r^2 h$$

$$\text{Surface area} = 2\pi r^2 + 2\pi r h$$

Sphere

$$\text{Volume} = \frac{4}{3} \pi r^3$$

$$\text{Area} = 4\pi r^2$$

Right pyramid

$$\text{Volume} = \frac{1}{3} (\text{area of base}) \times (\text{perpendicular height})$$

Prism

$$\text{Volume} = (\text{area of base}) \times (\text{perpendicular height})$$

Degrees and radians

$$180^\circ = \pi \text{ rad}$$

$$\theta = \frac{\text{arc}}{\text{radius}}; A = \frac{1}{2} r^2 \theta$$

Angular velocity and circumferential velocity

$$\text{Angular velocity: } \omega = 2\pi n$$

$$\text{Circumferential velocity: } v = \pi D n$$

n = rotation frequency (r/s = revolution per second)

Midordinate rule

$$\text{Area} = (\text{distance between ordinates}) \times (\text{sum of other midordinates})$$

$$\text{Area} = \left[\frac{(\text{First ordinate} + \text{Last ordinate})}{2} + \text{Sum of all other ordinates} \right] \times \text{The distance between the ordinates}$$

Graphs

Straight line: $y = mx + c$

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

Axis of symmetry: $x = \frac{-b}{2a}$

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

Trigonometry

$90^\circ < \theta < 180^\circ$

$$\sin \theta = \sin (180^\circ - \theta)$$

$$\cos \theta = -\cos (180^\circ - \theta)$$

$$\tan \theta = -\tan (180^\circ - \theta)$$

Segment of circles

Chord length = x

Height of the segment = h

Diameter of circle = D

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

Regular polygons

Angle subtended at centre of circumscribed circle by one side:

$$\theta = \frac{360^\circ}{\text{number of sides}}$$

R = radius of circumscribed by circle

x = length of the side

$$x = 2R \sin \left(\frac{\theta}{2} \right)$$

$$\text{Annulus: } A = \pi(R^2 - r^2)$$