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higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

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NATIONAL CERTIFICATE

MATHEMATICS N2

(16030192)

18 November (X-Paper)
09:00 – 12:00

REQUIREMENTS: TWO sheets of graph paper.

This question paper consists of 8 pages and a 2-page information sheet.

**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 correctly according to the numbering system used in this question paper.
 4. Write neatly and legibly.
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QUESTION 1

1.1 Various options are given as possible answers to the following questions. Write only the letter (A – D) next to the question number (1.1.1 – 1.1.10) in the ANSWER BOOK.

1.1.1 $\left(\frac{x}{y}\right)^m$ can be written as ...

A $\left(\frac{x}{y}\right)^m$

B $\frac{y^m}{x^m}$

C $\frac{x^m}{y^m}$

D $\frac{x^{-m}}{y^{-m}}$

(1)

1.1.2 The $\log_3 27$ is the same as ...

A 9

B 3

C 18

D 27

(1)

1.1.3 $\sqrt{a+b}$ is equal to ...

A $\sqrt{a} + \sqrt{b}$

B $(a+b)^{\frac{1}{2}}$

C $\sqrt{a} \cdot \sqrt{b}$

D \sqrt{ab}

(1)

1.1.4 The trigonometric function $\cot x$ can be expressed as ...

A $\frac{1}{\tan x}$

B $\frac{1}{\sec x}$

C $\frac{\sin x}{\cos x}$

D $\frac{1}{\operatorname{cosec} x}$

(1)

1.1.5 $\sqrt[p]{a^m}$ is the same as ...

A a^{pm}

B $a^{\frac{m}{p}}$

C $a^{\frac{p}{m}}$

D p^{am}

(1)

1.1.6 The trigonometric function $\operatorname{cosec} \theta$ is positive in which quadrant?

A Third and fourth quadrant

B First and second quadrant

C Second and third quadrant

D First and fourth quadrant

(1)

1.1.7 $3\log_{27}3$ is the same as ...

A 9

B 18

C 1

D 27

(1)

1.1.8 The expression ' $\ln e$ ' can be written as ...

A $\log_e x$

B $\log_e e$

C $\log_x e$

D $\log_x x$

(1)

- 1.1.9 $\sqrt{8}$ can be expressed as ...
- A 4
 B $2\sqrt{2}$
 C $4\sqrt{2}$
 D 2
- (1)

- 1.1.10 $\sin^{-1} 0,5$ is equal to ...
- A 60°
 B 90°
 C 30°
 D 45°
- (1)

1.2 Indicate whether the following statements are TRUE or FALSE. Choose the answer and write only 'true' or 'false' next to the question number (1.2.1 – 1.2.10) in the ANSWER BOOK.

1.2.1 $\frac{1}{16}$ can be expressed as 2^{-4}

(1)

1.2.2 p^{-x} is the same as $\frac{x}{p}$

(1)

1.2.3 $x = \log_p t$ can be expressed as $p^x = t$

(1)

1.2.4 $(x^4 \cdot y^1 \cdot z^6)^\circ$ is the same as xyz

(1)

1.2.5 $\log_5 25$ can be written as 2

(1)

1.2.6 There are $61,3^\circ$ in 1,07 radians

(1)

1.2.7 $\sqrt{9^\circ}$ is equal to 3

(1)

1.2.8 $\sec \theta$ is the same as $\frac{1}{\cos \theta}$

(1)

1.2.9 $\sqrt{x^4 \cdot y^8}$ can be written as $x^2 \cdot y^4$

(1)

1.2.10 Converting 3,5 radians to degrees, the answer will be 20,0535

(1)
[20]

QUESTION 2

2.1 Find the factors of the following:

2.1.1 $2a^2 - 8b^2$ (3)

2.1.2 $3x^2 + 36x + 96$ (3)

2.1.3 $x^3y^2 - a^2x^2y + axy - a^3$ (3)

2.2 Find the lowest common multiple (L.C.M) and the highest common factor (HCF) of the following:

$$\begin{array}{l} xy + y^2 \\ x^2 - y^2 \\ x^2 + xy \end{array} \quad (6)$$

2.3 Simplify the following:

2.3.1 $\frac{a^2 + a - 6}{a^2 - a - 12} \div \frac{a^2 - 4}{a^2 - 16}$ (3)

2.3.2 $\frac{27a^{-3}b^{-2}}{3^{-4}a^2b^{-3}}$ (2)

[20]**QUESTION 3**3.1 Solve for x in the following equations:

3.1.1 $\left(\frac{1}{2}\right)^{2x} = 32$ (3)

3.1.2 $27^x \cdot 3^x = 81$ (3)

3.2 Simplify WITHOUT using the calculator:

3.2.1 $\log_3 27 + \log_6 36 - \frac{1}{2} \log_7 49$ (3)

3.2.2 $\frac{\log 3 - \log 5}{\log 9 - \log 25}$ (3)

3.3 Use logarithms to find the value of the following:

$$P = (3,8)^4 \div 0,943 \quad (2)$$

3.4 Solve for x and y in the following simultaneous equations:

$$\begin{aligned} 2x + 2y &= 2 \\ 2x - 3y &= 3 \end{aligned} \quad (4)$$

3.5 Solve for x in the following equation with the aid of a quadratic formula:

$$3x^2 - 2x - 1 = 0 \quad (4)$$

[22]

QUESTION 4

4.1 Calculate the surface area and volume of a sphere with a diameter of 68 mm. (4)

4.2 The ordinates of an irregular sheet of metal are as follows:

120; 127; 139; 143; 147; 163; 157; 153; 148; 136 en 118 mm. The common interval is 16 mm. Use the mid-ordinate rule to calculate the area of the sheet metal. (4)

4.3 A wheel with a diameter of 80 mm rotates at 21 r/s.

Calculate the following:

4.3.1 The peripheral velocity (2)

4.3.2 The angular velocity of the wheel (2)

4.4 The angle of a sector of a circle is 55° and its radius is 3,978 cm.

Calculate the following:

4.4.1 The arc length of the sector in cm (2)

4.4.2 The area of the sector in cm^2 (2)

4.5 Determine the value of the following:

$$\sin(24,8^\circ + 173,4^\circ) \quad (2)$$

[18]

QUESTION 5

5.1 Calculate the value of the gradient and the y -intercept, if:

$3y = 4x - 6$ (4)

5.2 Given the function $y = x^2 + 2x - 8$

Determine the following:

5.2.1 The axis of symmetry (2)

5.2.2 The turning point (2)

5.2.3 The x -intercept (2)

5.2.4 The y -intercept (1)

5.3 Draw the graphs of $y = \cos\theta$ and $y = \sin\theta$ on the same system of axis for the values of θ where $0^\circ \leq \theta \leq 180^\circ$. (3)

From the graphs above determine the values of θ where:

5.3.1 $\cos\theta + 1 = 0$ (1)

5.3.2 $\sin\theta = 1$ (1)

5.3.3 $\sin\theta = \cos\theta$ (1)

5.3.4 $\sin\theta = 0$ (2)

5.3.5 $\cos\theta = 1$ (1)

[20]

TOTAL: 100

MATHEMATICS N2**INFORMATION SHEET**

This sheet must accompany the question paper.

The right cone

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

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

The right pyramid

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

The prism

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

The cylinder

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

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

The sphere

$$V = \frac{4}{3}\pi r^3 ; A = 4\pi r^2$$

Degrees and radians

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

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

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)

Mid-ordinate rule

$$\text{Area} = (\text{distance between ordinates}) \times (\text{sum of mid-ordinates})$$

$$= \left[\frac{\text{First ordinate} + \text{Last ordinate}}{2} + \text{Sum of other ordinates} \right]$$

Multiply by the distance between the ordinates.

Graphs

$$\text{Straight line: } y = mx + c$$

$$\text{Parabola: } y = ax^2 + bx + c$$

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

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

Trigonometry

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

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

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

Segments of circles

Chord length = x

Height of 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 circle

x = length of side

$$x = 2R \sin \frac{\theta}{2}$$

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