higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

MATHEMATICS N2

(16030192)

1 April 2021 (X-Paper)
09:00–12:00

REQUIREMENTS: 2 sheets of graph paper (BOE 8/9)

Calculators may be used

This question paper consists of 7 pages and a formula sheet of 2 pages.

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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. Start each section on a new page.
5. Use only blue or black pen.
6. Write neatly and legibly.

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QUESTION 1

1.1 State whether the following equation is TRUE or FALSE

$$\log_a b = \frac{\log_c b}{\log_c a}$$ (1)

1.2 Simplify the following without using a calculator.

1.2.1 $$\frac{\log_e 1 - \log_4 16}{\log_4 2 - \log_4 32}$$ (4)

1.2.2 $$\frac{\sqrt[3]{\sqrt[4]{x^{24}y^{12}}}}{\sqrt[3]{x^3y^6} \times \sqrt{x^4y^4}}$$ (3)

1.3 Use the laws of logarithm to calculate the value of x given that

$$x = \frac{\sqrt[4]{265} \times (0,32)^2}{14,3}$$ (4)

1.4 Solve for x in the following equation:

$$1 = \frac{128}{32^{2x+1}}$$ (3)

[15]

QUESTION 2

2.1 Simplify the following algebraic fractions:

2.1.1 $$\frac{7}{x^2 - 2xy + y^2} \times \frac{2x^2 - 2y^2}{x^2 + 2xy + y^2} \div \frac{2x + 2y}{x - y}$$ (5)

2.1.2 $$\frac{3}{4x^2 - 9} - \frac{5}{4x^2 - 12x + 9}$$ (5)

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2.2 Given the following algebraic expressions:

$m^2 - 7m + 12$
$48 - 3m^2$
$m^2 - m - 12$

2.2.1 Fully factorise each expression (6)

2.2.2 Determine the Highest Common Factor (HCF) and Least Common Multiple (LCM) of all three expressions (4)

[20]

QUESTION 3

3.1 Solve for x in the following equation by using the quadratic formula

$7x^2 + 4x - 5 = 0$ Write the final answer(s) correct to THREE decimal places (4)

3.2 Given the formula: $n = \frac{Tpr}{u^2}$

3.2.1 Make 'u' the subject of the formula (3)

3.2.2 Find the value of 'u' if $T = 55,5$; $n = 9,25$; $p = 17,5$ and $r = 3,55$ (1)

3.3 Solve for 'a' and 'b' in the following simultaneous equation:

$3b + 4a + 2 = 0$ and $2a + 3b = 11$ (4)

3.4 Calculate the price of a watermelon if you buy four watermelons for R400 and get R16,60 in change (2)

[14]

QUESTION 4

4.1 A lead sphere is made by melting a lead cylinder (closed at both ends) of height 9 cm. Given that both shapes have the same radius; calculate the following:

4.1.1 The common radius of both shapes. (3)

4.1.2 The surface area of the sphere. (2)

4.1.3 The surface area of the cylinder. (2)

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4.2 Given the functions $\frac{x}{-4}+\frac{y}{-4}=1$ and $\frac{x}{-2}+\frac{y}{2}=1$ determine the following:

4.2.1 Draw the graphs of both functions on the same system of axes using a graph paper, indicating clearly the intercepts with the axes. (4)

4.2.2 Read from your graph, the coordinates of the point where the graphs intersect. (2)

4.3 FIGURE 1, below, represents the graphs of $f: y=-x^2+9x-18$ and $g: y=-18$ Study the diagram and answer the questions that follow.

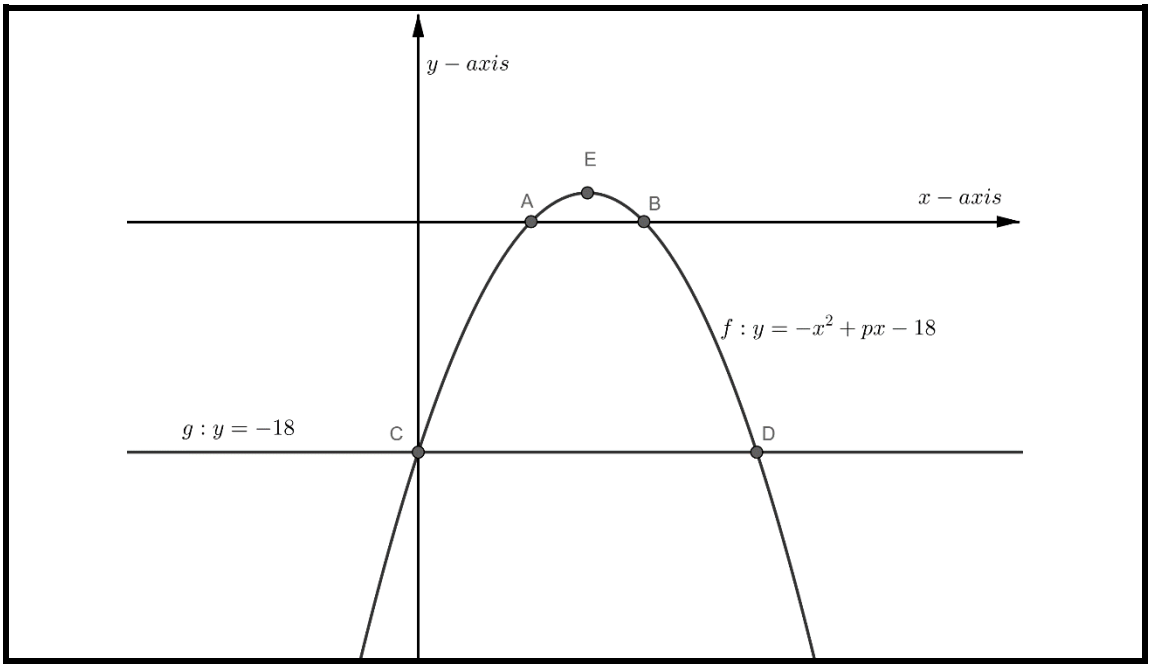


FIGURE 1

4.3.1 Determine the coordinates of A and B (i.e. *x*-intercepts of *f*). (2)

4.3.2 Determine the coordinates of C and D (i.e. intersection points of *f* and *g*). (2)

4.3.3 Determine the coordinate of E (i.e. the turning point of f). (2)

[19]

QUESTION 5

5.1 Given the function $y = \sin x$ for $0° \leq x \leq 360°$

5.1.1 Draw the graph on its own system of axes using a graph paper. (4)

5.1.2 Read from the graph the values of x for which $y = -\frac{1}{2}$ (2)

5.2 Calculate the value of $\cot 26°48'$. Show all workings. (2)

5.3 Consider FIGURE 2, below (not drawn to scale), and calculate the following:

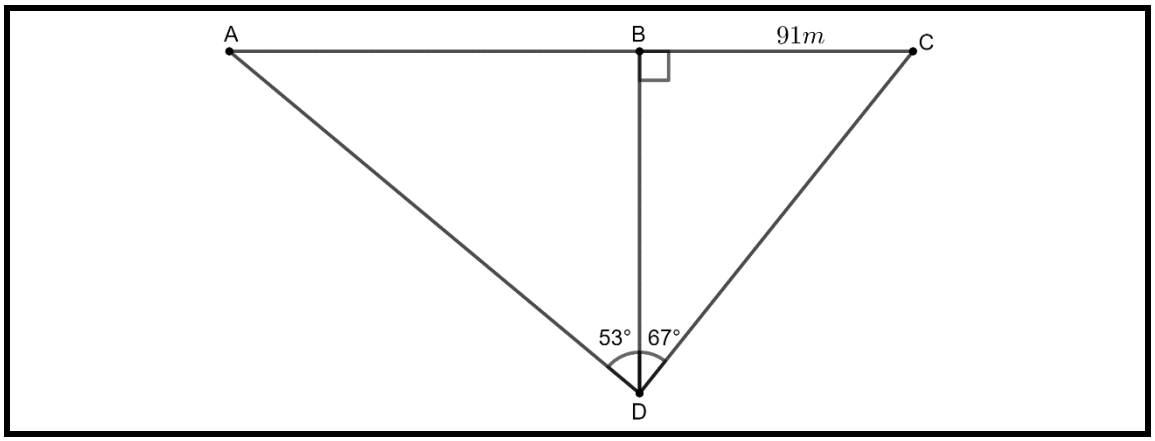


FIGURE 2

5.3.1 The length of BD (2)

5.3.2 The length of AC (3)

5.4 Given that $\sin\theta = \frac{4}{5}$ and $0° \leq \theta \leq 90°$ calculate the value of $\cos^2\theta + \tan^2\theta$ without using a calculator. (3)

[16]

QUESTION 6

6.1 Convert 5,6 *rads* to degrees and minutes (2)

6.2 The circumference of a circle is 45,5 cm and this circle is divided into 5 equal sectors.

Calculate the following:

6.2.1 The arc length of each sector. (1)

6.2.2 The angle of each sector in radians (1)

6.2.3 The area of each sector. (3)

6.3 A plane flies in a circle of radius 7250 *m* above an airport before being given the right to land. If it takes 10 seconds to complete one revolution.

Calculate:

6.3.1 The peripheral velocity in *m/s*. (2)

6.3.2 The angular velocity in radians per seconds. (2)

6.4 Given that the diameter of a circle has the same length as the chord of the same circle; calculate the height of the segment in terms of the diameter. (2)

6.5 A farm has one straight border such that every **350 m** apart; ordinates are measured with the following lengths:

3 km; 6,1 km; 8,2 km; 7,2 km; 9,2 km; 7,3 km; 1,3 km; 3,1 km; and 0,52 km.

Calculate the area of the farm in $\boldsymbol{km^2}$ (3)

[16]

TOTAL: 100

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MATHEMATICS N2

INFORMATION SHEET

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

Right cone

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

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

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

$180° = \pi$ rad

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

Angular velocity and circumferential velocity

Angular velocity: $\omega = 2\pi n$

Circumferential velocity: $v = \pi D n$

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

Midordinate rule

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

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

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Graphs

Straight line: $y = mx + c$

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

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

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

Trigonometry

$90° < \theta < 180°$

$\sin\theta = \sin(180° - \theta)$ $\cos\theta = -\cos(180° - \theta)$ $\tan\theta = -\tan(180° - \theta)$

Segment of circles

Chord length = x Height of the segment = h Diameter of circle = D

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

Regular polygons

Angle subtended at centre of circumscribed circle by one side:

$\theta = \dfrac{360°}{\text{number of sides}}$

R = radius of circumscribed by circle
x = length of the side

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

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

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