higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

MATHEMATICS N2

(16030192)

15 November 2022 (X-paper)
09:00–12:00

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

Scientific calculators may be used.

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

036Q1E2215

Copyright reserved

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 a black or a blue pen.
6. Write neatly and legibly.

Copyright reserved

QUESTION 1

1.1 Simplify the following WITHOUT the use of a calculator:

1.1.1 $\dfrac{\sqrt[4]{(a^2b^2)^6}}{a^5b^7 \times a^{-2}b^{-4}}$ (3)

1.1.2 $\left[(\log_3 27)^2 + \left(\log_8 \dfrac{1}{64}\right)^3\right]^{-1}$ (3)

1.2 Solve for x if $\log_x 9 + \log_3 1 - \log_4 \dfrac{1}{16} = 3$ (4)

1.3 Solve for x if $\dfrac{64^{2x+1}}{16^{x-2}} = 256$ (3)

1.4 Given:

$s = \pi r(4r + 2h)$

1.4.1 Make 'h' the subject of the formula (3)

1.4.2 Calculate the value of 'h' if $r = 2{,}45$ and s= 149,7 correct to THREE decimal places (2)

1.5 Solve for all values of x in the following equation:

$20x^2 + 9x = 18$ (3)

[21]

QUESTION 2

2.1 Fully factorise the following expressions:

2.1.1 $6b^2 - 27b - 15$ (3)

2.1.2 $1 - 16x^{20}$ (3)

2.1.3 $5x - 3a^2 - 5a + 3ax$ (3)

2.2 Given:

$(a + 2)(a + 1)$
$(a + 1)(a - 7)$
$(a + 1)(a + 1)$

2.2.1 Determine the lowest common multiple (LCM) (4)

2.2.2 Determine the highest common factor (HCF) (1)

Copyright reserved

2.3 Simplify the following expressions:

2.3.1 $\frac{6}{a+3}+\frac{a-2}{6-a-a^2}$ (3)

2.3.2 $\frac{a^2-4a+4}{a^2-1}\div\frac{a^2-2a}{a^2-a}$ (4)

[21]

QUESTION 3

3.1 Solve for x and y in the following equations algebraically:

$3y+6=6x$
$x=2y-2$ (4)

3.2 The diameter of a wheel is 80 mm and the wheel rotates at 0,25 r/min. Calculate the following:

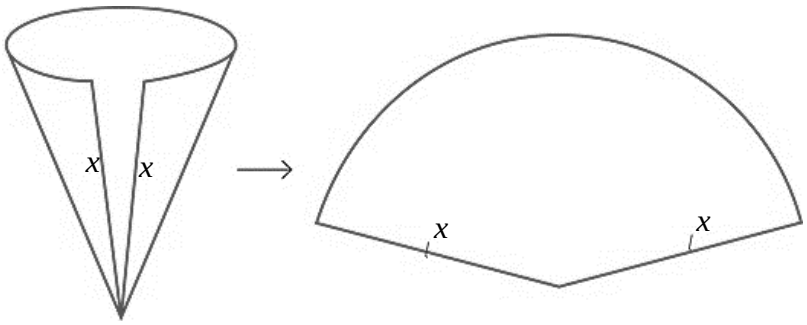
3.2.1 Angular velocity of the wheel (2)

3.2.2 Peripheral velocity of the wheel (3)

3.3 Calculate the area of a sector if the circumference of the circle is 25 cm and the angle of the sector is 55°. (5)

3.4 A sheet of paper in the shape of a circle sector found to have a radius of 1,3 cm and an area of 0,6 cm^2. If the sector is bent in the shape of a cone, calculate the perpendicular height of the cone.

HINT:



(4)

3.5 The volume of closed cylinder is 506,6 cm^3 and the height is 30 cm. Calculate the surface area of the cylinder. (4)

3.6 Calculate the area of a farm when ordinates are surveyed 500 km apart. The ordinates are found to be:

0,25	1,3	3,1	3,7	2,9	2,7	2,8	1,6	0,3

(4)

[26]

Copyright reserved

QUESTION 4

4.1 The graphs $y = -x^2 + 8x + 12$ and $y = 2x + 12$ are shown in FIGURE 1 below.

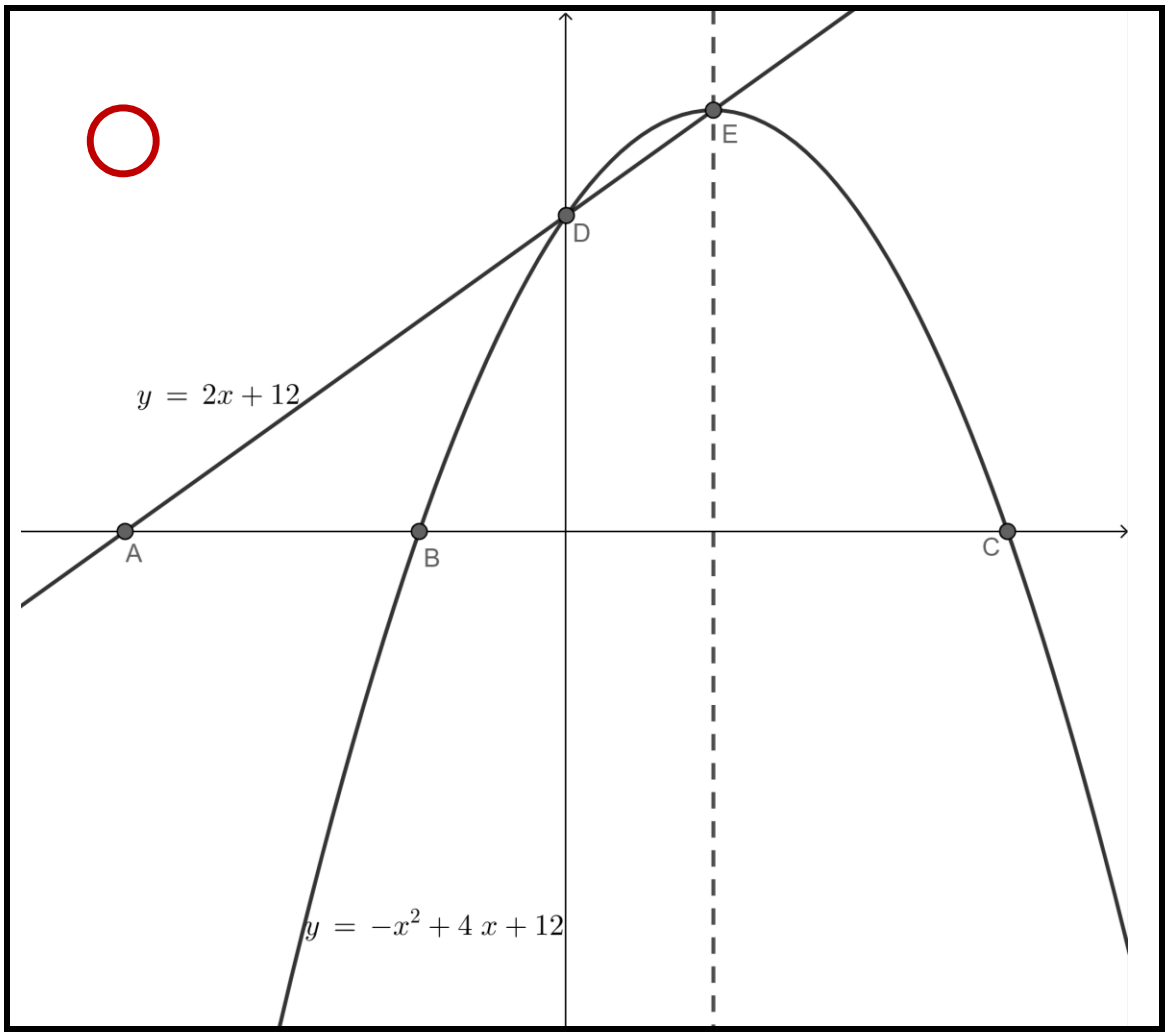


FIGURE 1

Determine each of the following coordinates:

4.1.1 A and D (the axes intercepts of $y = 2x + 12$) (2)

4.1.2 B and C (the x intercepts of $y = -x^2 + 8x + 12$) (2)

4.1.3 E (the turning point of $y = -x^2 + 8x + 12$) (2)

4.2 Given the functions $f: y = x^2 - 3x - 4$ and $g: x = 2$

4.2.1 Draw the functions f and g on the same system of axes (5)

4.2.2 Provide the coordinates of the point of intersection between the graphs drawn in QUESTION 4.2.1. (2)

Copyright reserved

4.3 Given the functions $h: y = \cos x + 1$ and $j: y = \sin x$

4.3.1 Draw the functions h and j on the same system of axes (6)

4.3.2 Provide the coordinates of the point of intersection between the graphs drawn in QUESTION 5.3.1 (2)

[21]

QUESTION 5

5.1 Solve for all values of θ in the equation below if

$\tan\theta = -1\ ;\ 0° \leq \theta \leq 360°$ (3)

5.2 An artisan must determine lengths between several points on a floor plan. The information available is limited and shown in FIGURE 2 below.

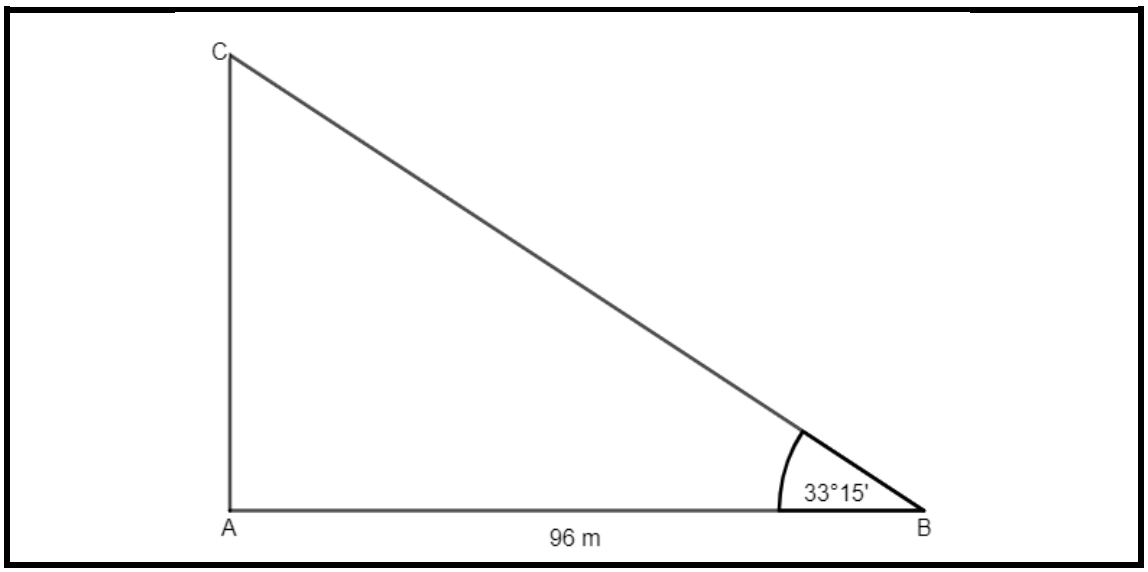


FIGURE 2

Determine the following:

5.2.1 The length of AB (3)

5.2.2 The length of BC (2)

5.3 Calculate the length of the chord of a circle of which the diameter is 42 mm, and the height of the segment is 10 mm. (3)

[11]

TOTAL: 100

MATHEMATICS N2

The right cone

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

$$\boldsymbol{Surface\ area} = \pi r\sqrt{h^2 + r^2} + \pi r^2$$
$$= \pi r\ell + \pi r^2$$

The right pyramid

Volume = ⅓ (area of base) × (perpendicular height)

The prism

Volume = (area of base) × (perpendicular height)

The cylinder

Volume $= \pi r^2 h$

Surface area $= 2\pi r^2 + 2\pi rh$

The sphere

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

Degrees and radians

$180° = \pi\ rad$

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

Angular velocity

Angular velocity: $w = 2\pi n$

Circumferential velocity: $v = \pi Dn$

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

Copyright reserved

Mid-ordinate rule

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

$$\text{A} = \left[\frac{1^{st} \text{ ordinate + Last ordinate}}{2} + \text{Sum of other ordinates} \right] \times \text{common distance between the ordinates}$$

Graphs

Straight line: $y = mx + c$

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

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

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

Trigonometry

$90° < \theta < 180°$

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

Segments of circles

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

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

Regular polygons

Angle subtended at centre of circumscribed circle by one side:

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

R = radius of circumscribed circle

x = length of side

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

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

Copyright reserved