higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

MATHEMATICS N2

(16030192)

19 November 2024 (X-paper)
09:00–12:00

Scientific calculators may be used.

This question paper consists of 6 pages, 1 addendum 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 a black or blue pen.
6. Answer QUESTION 5.1.6, 5.2.1 and 5.3.2 on the attached ADDENDUM.
7. Write your EXAMINATION NUMBER on the ADDENDUM, detach it from the question paper and submit it together with the ANSWER BOOK.
8. Write neatly and legibly.

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QUESTION 1

1.1 When 9 is deducted from six times a certain number, the result is -75.

Calculate the value of the number. (2)

1.2 Solve for x in the following equation by the quadratic formula method:

$(3-5x)^2 = (2x+2)^2$ (4)

1.3 A lady bought a dress (d) and two pairs of shoes (p) for R1500. However when she approached another shop, she bought four dresses and three pairs of shoes for R4500.

What is the average cost of a dress and a pair of shoes? (4)

1.4 Given the formula:

$$\frac{T^2}{t} = \frac{x^2}{q} - \frac{y^2}{c}$$

1.4.1 Make $'y'$ the subject of the formula. (3)

1.4.2 Calculate $'y'$ if $c = -5,\ x = 1.2,\ T = 5.2,\ t = 7$ and $q = 5$. (1)

[14]

QUESTION 2

2.1 Simplify the following algebraic fractions and factorize your answer completely:

2.1.1 $$\frac{6x+3}{x^2-8x+16} \div \frac{4x^2-1}{x^2-5x+4} \times \frac{x-4}{6x-6}$$ (6)

2.1.2 $$\frac{a}{2a^2-3ab+b^2} - \frac{b}{2a^2+ab-b^2} + \frac{1}{a+b}$$ (6)

2.2 Given the following algebraic expressions:

$mn^2 + mn - 5n^2 - 5n$ and $3m - 15$

2.2.1 Factorise each expression completely. (5)

2.2.2 Determine the HCF and LCM of the two expressions. (3)

[20]

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QUESTION 3

3.1 Solve for 'n' in the following equations:

3.1.1 $\frac{1}{8} = \left(\frac{1}{16}\right)^{3-2n} \times (32)^{4-2n}$ (4)

3.1.2 $1 + (\log n)^3 = 9$ (3)

3.2 Given that $\log 2 = 0.301$, $\log 3 = 0.477$ and $\log 5 = 0.699$, determine $\log \frac{6}{25}$ without using a calculator (Show all workings). (4)

3.3 Solve for m using laws of common logarithm if:

$$m = \frac{(9.18)^5 \times 3.89}{\sqrt[3]{237.4}}$$ (3)

[14]

QUESTION 4

4.1 A wastepaper bucket shown on the righthand side was built in shape of a cylinder with a lid in a shape of a half of a sphere.



The radius of the base and the top of the bucket is $16\ cm$. The height of the bucket is $50\ cm$ without lid.

Use the information given to calculate the following:

4.1.1 The volume of the lid.

4.1.2 The volume of the bucket without the lid.

4.1.3 The total volume of the bucket and lid.

4.1.4 The total surface area of the bucket and lid.

(4 × 2) (8)

4.2 Use the mid-ordinate rule to calculate the area enclosed by $x = 0;\ x = 17.5;\ y = 0$ and the curve passing through the points:

$\{(0; 4);\ (2.5; 6); (5; 8); (7.5; 11); (10; 17); (12.5; 12); (15; 10); (17.5; 9)\}$ (4)

[12]

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QUESTION 5

5.1 Given the function $f: y = x^2 + 8x$

5.1.1 Does the point $(-3; -6)$ lie on the graph of $f(x)$?

Do a calculation to motivate your answer. (2)

5.1.2 Determine the y-intercept of the function. (1)

5.1.3 Determine the roots of the function. (2)

5.1.4 Determine the axis of symmetry of the function. (1)

5.1.5 Determine the y-ordinate of the turning point of the function. (1)

5.1.6 Use a system of axes provided in ADDENDUM A (attached) to draw the graph of $y = x^2 + 8x$.

Indicate all intercepts with the axes and the turning point. (3)

5.2 Give the function $g: 2x + y + 16 = 0$

5.2.1 Draw the graph of $g(x)$ on the same system of axes used for QUESTION 5.1.6 on ADDENDUM A.

5.2.2 Read from the graphs and write down the coordinates of the points of intersection of $f(x)$ and $g(x)$.

(2 × 2) (4)

5.3 Given the functions $h: y = 2cosx$ and $k: y = -2cosx$ where $0° \leq x \leq 180°$

5.3.1 Copy and complete the table below in your ANSWER BOOK.

x	0°	30°	60°	90°	120°	150°	180°
$h(x)$		1.732				-1.732	
$k(x)$		-1.732				1.732	

(2)

5.3.2 Use ADDENDUM A (attached) to draw the graphs of $h: y = 2cosx$ and $k: y = -2cosx$ on the same system of axes. (4)

[20]

QUESTION 6

6.1 What do you understand by one radian? (1)

6.2 The area of a sector of a circle is $64\ cm^2$. Given that the angle the sector subtends at the center of the circle is twice its radius, calculate the following:

6.2.1 The radius of the circle. (3)

6.2.2 The angle subtended at the centre of the circle. (1)

6.2.3 The arc length of the sector. (1)

6.3 A wheel of diameter $700\ mm$ rotates at an angular velocity of $80\ rads\ s^{-1}$.

Calculate the following:

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

6.3.2 The distance a point on the circumference of the wheel covers in 9 minutes. (1)

6.4 Calculate the length of the chord of a circle given that the diameter of the circle is $15\ cm$ and the height of the segment created by the chord is $10\ cm$. (3)

6.5 In ΔABC; $AC = 72\text{cm}$; $\hat{C} = 63°$ and $\hat{B} = 90°$.

Calculate the following:

6.5.1 The value of BC

6.5.2 The value of AB

6.5.3 The value of $\tan\hat{A}$

(3 × 2) (6)

6.6 If $\cos\theta = \frac{\sqrt{3}}{5}$ where $0° \leq \theta \leq 90°$, calculate the value of $\tan\theta$ without using a calculator. (2)

[20]

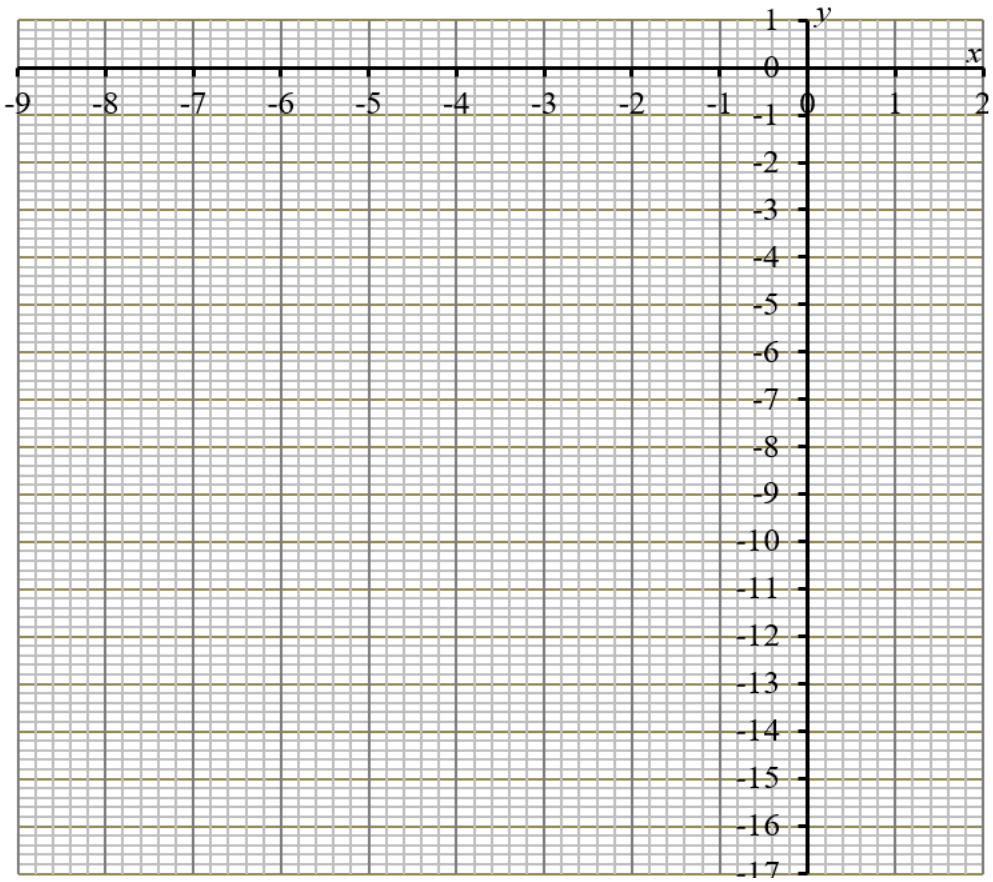
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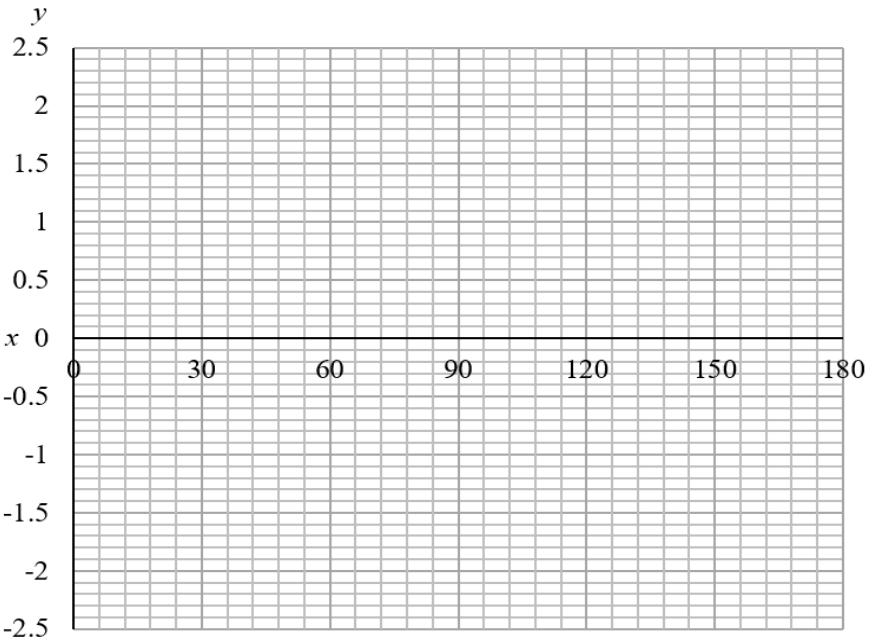
ADDENDUM A

EXAMINATION NUMBER:

5.1.6 and 5.2.1



5.3.2



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MATHEMATICS N2

INFORMATION SHEET

This sheet must accompany the question paper.

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

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

$= \pi r\ell + \pi r^2$

The right pyramid
Volume = α (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° = π rad

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

Angular velocity and circumferential velocity
Angular velocity: $w = 2\pi n$
Circumferential velocity: $v = \pi Dn$
n = rotation frequency (r/s = revolution per second)

Mid-ordinate rule
Area = (distance between ordinates) × (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
Straight line: $y = mx + c$ Parabola: $y = ax^2 + bx + c$

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

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

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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

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

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

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

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

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