higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

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NATIONAL CERTIFICATE

MATHEMATICS N2

(16030192)

24 July 2018 (X-Paper)
09:00–12:00

REQUIREMENTS: TWO sheets of graph paper

Scientific calculators may be used.

This question paper consists of 6 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. Show ALL formulae, intermediate steps and simplify where possible.
5. ALL final answers must be rounded off to THREE decimal places (unless indicated otherwise).
6. Questions may be answered in any order, but keep subsections of questions together.
7. Use only blue or black ink.
8. ALL graph work must be done on the GRAPH PAPER provided.
9. Write neatly and legibly.

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QUESTION 1

1.1 Simplify each of the following expressions without the use of a calculator. Show all the steps.

1.1.1 $\dfrac{3^2\ e^{-2}\ fg^{-5}}{81e^{-4}\ f^3\ g^3}$ (2)

1.1.2 $\dfrac{3\log_8 64-\log_2 64\ -\log_7 2\ 401}{\log 1000+\ 2\log_2 8}$ (3)

1.1.3 $\log_3 189-(\log_7 3)^{-1}$ (3)

1.2 Solve for x:

1.2.1 $3x^{\frac{3}{2}}=24$ (3)

1.2.2 $\log_3 x+\log_3(x-2)=1$ (4)

1.3 Make 'C' the subject of the formula:

$$f=\frac{1}{2\pi\sqrt{LC}}$$ (3)

[18]

QUESTION 2

2.1 Given:

$a^2+7a-18$

$4m^2-9y^2$

$2m^2-3ym$

2.1.1 Fully factorise each of the given expressions (3)

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

2.1.3 Give the Highest Common Factor (HCF) of the three expressions (1)

2.2 Simplify each of the following:

2.2.1 $\dfrac{x^2-x-12}{x^2-3x-10}\div\dfrac{x^2-9x+20}{x^2-2x-8}\times\dfrac{x-5}{x+3}$ (5)

2.2.2 $\dfrac{2}{x^2+3x-4}+\dfrac{4}{x^2-4x+3}$ (4)

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2.3 Fully factorise each of the following expressions:

2.3.1 $20x^2 - x - 1$ (2)

2.3.2 $\frac{3}{64} - 27y^2$ (3)

[21]

QUESTION 3

3.1 Peter gave one quarter of his money to Morris and one half to Ayanda. Ayanda received R35 less than Morris.

How much money did Peter have originally? (5)

3.2 Solve for x:

3.2.1 $\frac{2x-1}{3} = x - 1$ (2)

3.2.2 $13x^2 - 8 = 7x$ (3)

3.3 The angular velocity of a flywheel is 272 rad/s.

Calculate the following:

3.3.1 The rotational frequency (2)

3.3.2 The circumferential velocity of the flywheel if the radius is 3 cm (3)

3.3.3 The angular displacement, in radians, after 5 minutes (3)

3.4 Calculate the area of a sector with a radius of 2,8 cm and an angle of 45°. (3)

3.5 Convert 68°45′54" to radians. (2)

[23]

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QUESTION 4

4.1 Calculate the area enclosed by a curve passing through the following points:

$(0;4)(3;6)(6;8)(9;10)(12;8)(15;7)$ (3)

4.2 A soccer ball has a diameter of 280 mm.

Calculate the volume of the soccer ball in cm^3. (3)

4.3 Given: $\cos\beta = 0{,}65$

Calculate all possible values of β between 0º and 360º (3)

4.4 A rectangular-shaped block of bronze with a length of 5 mm, breadth of 3 mm and a height of 4 mm, is melted and recast in a circular sphere.

Calculate the diameter of the newly formed circular sphere. (5)

4.5 A person standing at point A finds the angle of elevation of a nearby tower to be 65º. From A, the person walks a distance of 280 m to B, the base of the tower.

Determine the following:

4.5.1 The height of the tower (2)

4.5.2 The distance from A to the top of the tower (2)

[18]

QUESTION 5

5.1 Given: $y = x^2 + 6x - 7$

Calculate the following:

5.1.1 The roots (x - intercepts) (2)

5.1.2 The axis of symmetry (1)

5.1.3 The turning point (2)

5.1.4 The y - intercept (1)

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5.2 Draw on the GRAPH PAPER and on the same set of axes the following functions:

5.2.1 $y = x^2 + 6x - 7$ (2)

5.2.2 $y = 2x - 3$ (2)

5.2.3 Determine the point(s) of intersection between the graphs plotted in Q 5.2.1 and Q 5.2.2 (2)

5.3 Draw on the GRAPH PAPER and on the same set of axes the following functions:

5.3.1 $f(x) = \sin x \ (0° \leq x \leq 360°)$ (3)

5.3.2 $g(x) = 2\cos x - 0{,}5 \ (0° \leq x \leq 360°)$ (3)

5.3.3 From the graphs drawn in Q 5.3.1 and Q 5.3.2 give the value(s) of x for which $f(x) = g(x)$ (2)

[20]

TOTAL: 100

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FORMULA SHEET

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

Right cone

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

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

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

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

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

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

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

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

Regular polygons

Angle subtended at centre of circumscribed circle by one side:

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

R = radius of circumscribed by circle

x = length of the side

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

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

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