higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T1000**(E)**(M28)T

NATIONAL CERTIFICATE

MATHEMATICS N2

(16030192)

28 March 2019 (X-Paper)
09:00–12:00

REQUIREMENTS: 1 sheet of graph paper (BOE 8/9)

A scientific calculator 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
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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 intermediate steps and simplify where possible.
5. Final answers must be rounded off to THREE decimal places where applicable unless otherwise stated.
6. Questions may be answered in any order, but subsections of questions must be kept together.
7. Use only BLUE or BLACK ink.
8. Sketches must be large, neat and fully labelled.
9. ALL graph work must be done on the graph paper provided. Write your EXAMINATION NUMBER on every sheet of graph paper that you use.
10. Write neatly and legibly.

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QUESTION 1

1.1 Simplify the following WITHOUT the use of a calculator:

1.1.1 $$\frac{\left(x^6\right)^2\left(x^3y\right)^4\left(xy^0\right)^{-3}}{\left(x^2y^2\right)^3xy}$$ (3)

1.1.2 $$\left[\left(\log_4 64\right)^2+\left(\log_7\frac{1}{49}\right)^3\right]^{-1}$$ (3)

1.1.3 $$\log_4 5+\log_4\frac{1}{10}-\log_2 4$$ (4)

1.2 Solve for x if:

$$10\left(\frac{1}{32}\right)^{2+3x}=640$$ (4)

1.3 Given:

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

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

1.3.2 Calculate the value of 'h' if $r=2$ and $A=150$ (2)

[19]

QUESTION 2

2.1 Fully factorise the following expressions:

2.1.1 $12x^2-18x+6$ (3)

2.1.2 $16x^{36}-1$ (3)

2.1.3 $x^2+ab-ax-bx$ (3)

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2.2 Given:

$(x-3)(x+2)$
$(x+2)(x-1)^2$
$(x-3)(x-1)$

2.2.1 Determine the Lowest Common Multiple (LCM) (3)

2.2.2 Determine the Highest Common Factor (HCF) (1)

2.3 Simplify the following expressions:

2.3.1 $\dfrac{9}{3x^2-3y^2}+\dfrac{x}{xy-x^2}$ (5)

2.3.2 $\dfrac{1-\dfrac{1}{x-1}}{x^2-1}$ (4)

[22]

QUESTION 3

3.1 Determine the value(s) x in the following equation by means of factorisation

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

3.2 The sum of two integers is 41. When three times the smaller integer is subtracted from the larger integer, then the result is 17.

Find the TWO integers. (4)

3.3 A wheel with a diameter of 600 mm has a rotational frequency of 200 r/min.

Calculate the following:

3.3.1 The rotational frequency in r/s (1)

3.3.2 The peripheral velocity in m/s (3)

3.3.3 The angular velocity in rad/s (2)

3.4 Convert $60°30'36''$ to radians (2)

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3.5 A thin piece of metal plate is in the shape of a circle sector. The angle of the arc is 0,5 radians and the radius of the circle is 85 cm.

Determine the cost involved to treat the plate on one side against rust at a price of $R55{,}00$ per square meter (4)

3.6 A lead sphere with a diameter of 15cm is melted and recast into multiple smaller spheres. All the smaller spheres have a radius of 20mm

Determine

3.6.1 The volume of one smaller sphere in mm^3 (2)

3.6.2 The amount of smaller spheres created (4)

[25]

QUESTION 4

4.1 A college yard is divided into parallel strips at 6 m intervals and the lengths of the strips are 5 m, 9 m, 14 m, 19 m, 24 m, 30 m, 22 m, 15 m, 10 m and 5 m.

Calculate the area of the college yard. (3)

4.2 Determine the value of θ in radians if:

$\cot\theta = -0{,}5$ and $270° \leq \theta \leq 360°$ (4)

4.3 Mr Mphanya is standing 20 m away from a tree and he measures the angle of elevation to the top of the tree as $38°$

Determine the height of the tree (Ignore the height of Mr Mphanya) (3)

4.4 Draw the graphs of $f(x) = \cos x + 1$ and $g(x) = \sin x + 1$ on the same system of axes if $0° \leq x \leq 360°$ (6)

Use the graphs drawn to determine the x-values where:

4.4.1 $f(x) = g(x)$ (2)

4.4.2 $\cos x + 1 = 0$ (1)

4.4.3 $\sin x + 1 = 2$ (1)

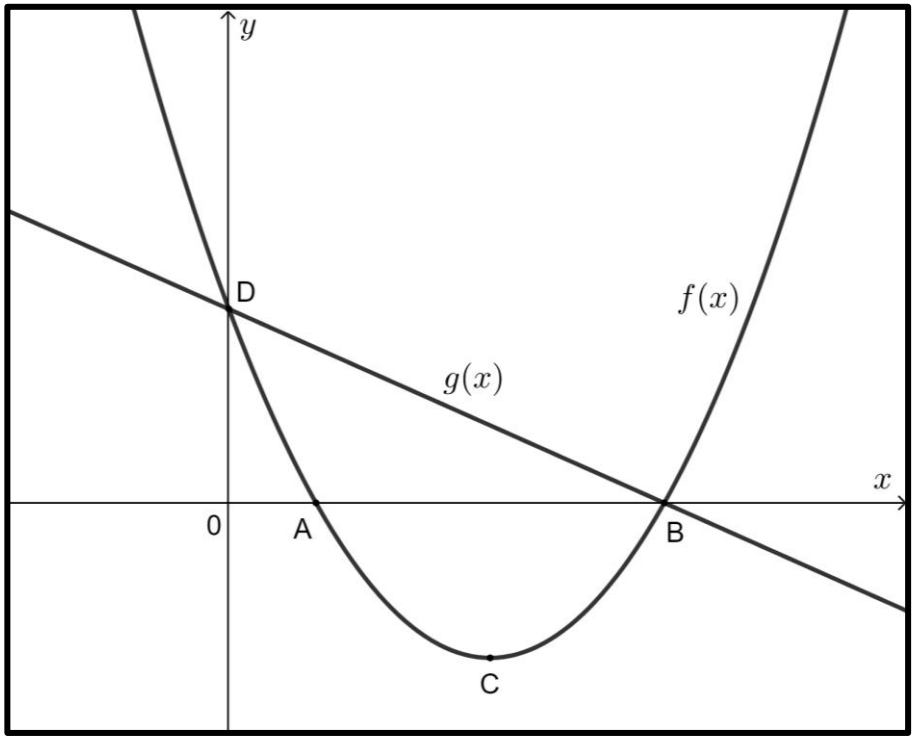
4.4.4 $\cos x + 1 = 2$ (2)

[22]

QUESTION 5

Below are the graphs of $f(x)=(x-3)^2-4$ and the straight line $g(x)$

- A and B are the x-intercepts of $f(x)$
- C is the turning point of $f(x)$
- D is the y-intercept of both $f(x)$ and $g(x)$



Determine the following:

5.1 The co-ordinates of points A and B (4)

5.2 The co-ordinates of point D (2)

5.3 The equation of the axis of symmetry of $f(x)$ (2)

5.4 The co-ordinates of point C (2)

5.5 The equation of the line $g(x)$ (2)

[12]

TOTAL: 100

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MATHEMATICS N2

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)

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Midordinate rule

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

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

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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