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higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T1020(E)(N18)T

NOVEMBER EXAMINATION

NATIONAL CERTIFICATE

MATHEMATICS N2

(16030192)

18 November 2013 (X-Paper)
09:00–12:00

Scientific calculators may be used.

This question paper consists of 5 pages, 2 formula sheets and 2 sheets of graph paper.

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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 calculations and simplify where possible.
5. ALL final answers must be rounded off to THREE decimal places.
6. Write neatly and legibly.

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QUESTION 1

1.1 Prove, without using a calculator, that $\frac{\log_x 64+\log_x 4-\log_x 8}{\log_x 1024}=\frac{1}{2}$ (4)

1.2 Simplify, with the aid of logarithmic laws, $\sqrt{\sqrt{4,83}\times(16,2)^2}$ (6)

1.3 Solve for x, without the use of a calculator:

$\log x+\log 250=3$ (4)

1.4 Simplify, without the use of a calculator:

$$\frac{\left(a^4\right)^{n+1}\times\left(a^2b\right)^{-3n}}{\left(ab\right)^{3n}\times b^n}$$ (4)

1.5 Solve for x:

$(x-a)^2=(x-b)^2$ (4)

[22]

QUESTION 2

2.1 The outside diameter of a water pipe is 100 mm and the wall thickness is 10 mm. The length of pipe is 2 m.

Calculate:

2.1.1 The volume of water in litre in the pipe, when the pipe is full. (3)

2.1.2 The outside dimensions in mm of a square pipe with the same wall thickness and same volume of water.
(Length is also the same as in QUESTION 2.1.1.) (3)

2.2 A circle sector has a radius of 200 mm. The angle of the sector is 20°.

Calculate:

2.2.1 The length of the arc. (2)

2.2.2 The area of the circle sector. (2)

2.3 The height of a segment of a circle is 8 mm and the length of the chord is 25 mm.

Calculate the radius of the circle. (3)

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2.4 A pulley rotates at 560 r/min.

Calculate:

2.4.1 The peripheral velocity of the pulley in metres per second if the diameter of the pulley 150 mm. (2)

2.4.2 The angular velocity of the pulley in rad/s. (2)

2.5 Calculate the area of an irregular plate by using the mid-ordinate rule. The length of the ordinates in mm are: 0; 4; 8; 6; 2; 0. The common interval is 3 mm. (3)

2.6 Make the letter in brackets the subject of the formula:

$$F = \frac{1}{2\pi\sqrt{LC}} \quad \text{(C)}$$

(3)
[23]

QUESTION 3

3.1 Use a calculator to determine the value of the following to THREE decimal places:

3.1.1 $\frac{1}{2}cosec150°$ (1)

3.1.2 $tan\ 40°42' + sec\ 30°40'$ (3)

3.2 Determine all the values of θ if $0 \leq \theta \leq 360°$

$2\cot\theta = -4,222$ (3)

3.3 A man wants to find the width of a river. From point A, he takes a sighting perpendicularly across the river to B. He then walks 50 m downriver to C and measures $A\hat{C}B$ to be 45°.

Determine the width of the river with the aid of a sketch. (3)

3.4 Determine the value of x in the following equation by using a quadratic formula:

$18x^2 - 4 = 0$ (3)

3.5 A man is 20 years older than his son. If the sum of their ages is 50 years, how old are they? (3)
[16]

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QUESTION 4

4.1 Use the table method and draw the graph $y = -x^2 + 4$ on graph paper.
Use $-3 \leq x \leq 3$. (5)

4.2 Also draw $y = 2$ and $x - 2 = y$ on the same system of axes as in QUESTION 4.1. (3)

4.3 Draw on graph paper and on the same system of axis the graphs of the following:

$y = sinx - 1$ and $y = 2cosx$

For x values from 0° to 180°. Use intervals of 30° (4)

4.4 From the graph in QUESTION 4.3 find the value of x for the following:

4.4.1 $Sinx - 1 = 2Cosx$ (1)

4.4.2 $2\cos x - 1 = 0$ (2)

4.4.3 $\sin x = 0$ (3)

[18]

QUESTION 5

5.1 Factorise the following:

5.1.1 $5 - \frac{45}{a^2}$ (3)

5.1.2 $6x^2 - 19 + \frac{15}{x^2}$ (2)

5.1.3 $a^2(m-n) - 2a(m-n) - n + m$ (4)

5.2 Find the lowest common multiple (LCM) and the highest common factor (HCF) of the equations:

$(m-n)(a-1)^2$
$(m-n)(m+n)(a-1)$
$(a+1)(a-1)(m+n)$ (5)

5.3 Simplify:

5.3.1 $1 + x - \frac{2x-1}{2}$ (3)

5.3.2 $\left(1 - \frac{x}{y}\right) \div \left(\frac{1}{x} - \frac{1}{y}\right)$ (4)

[21]

TOTAL: 100

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MATHEMATICS N2

INFORMATION SHEET

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 = $\frac{1}{3}$(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 and circumferential velocity

Angular velocity: $w = \frac{\theta}{t} = 2\pi n$ or $w = \frac{\theta}{t}$

Circumferential velocity: $v = \pi Dn$

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

Mid-ordinate rule

Area = (distance between ordinates) × (sum of mid-ordinates)

$= \left[\frac{First + Last\ ordinates}{2} + Sum\ of\ other\ ordinates\right]$ x Multiply by the distance between the ordinates.

Graphs

Straight line: $y = mx + c$ Parabola: $y = ax^2 + bx + c$

Axis of symmetry

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

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Roots:

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

Trigonometry

$90^\circ < \theta < 180^\circ \quad \sin\theta = \sin(180^\circ - \theta) \quad \cos\theta = -\cos(180^\circ - \theta)$

$\tan\theta = -\tan(180^\circ - \theta)$

Segments of circles

Cord 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:

$$\theta = \frac{360^\circ}{number\ of\ sides}$$

R = radius of circumscribed circle

$x = x =$ length of side

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

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

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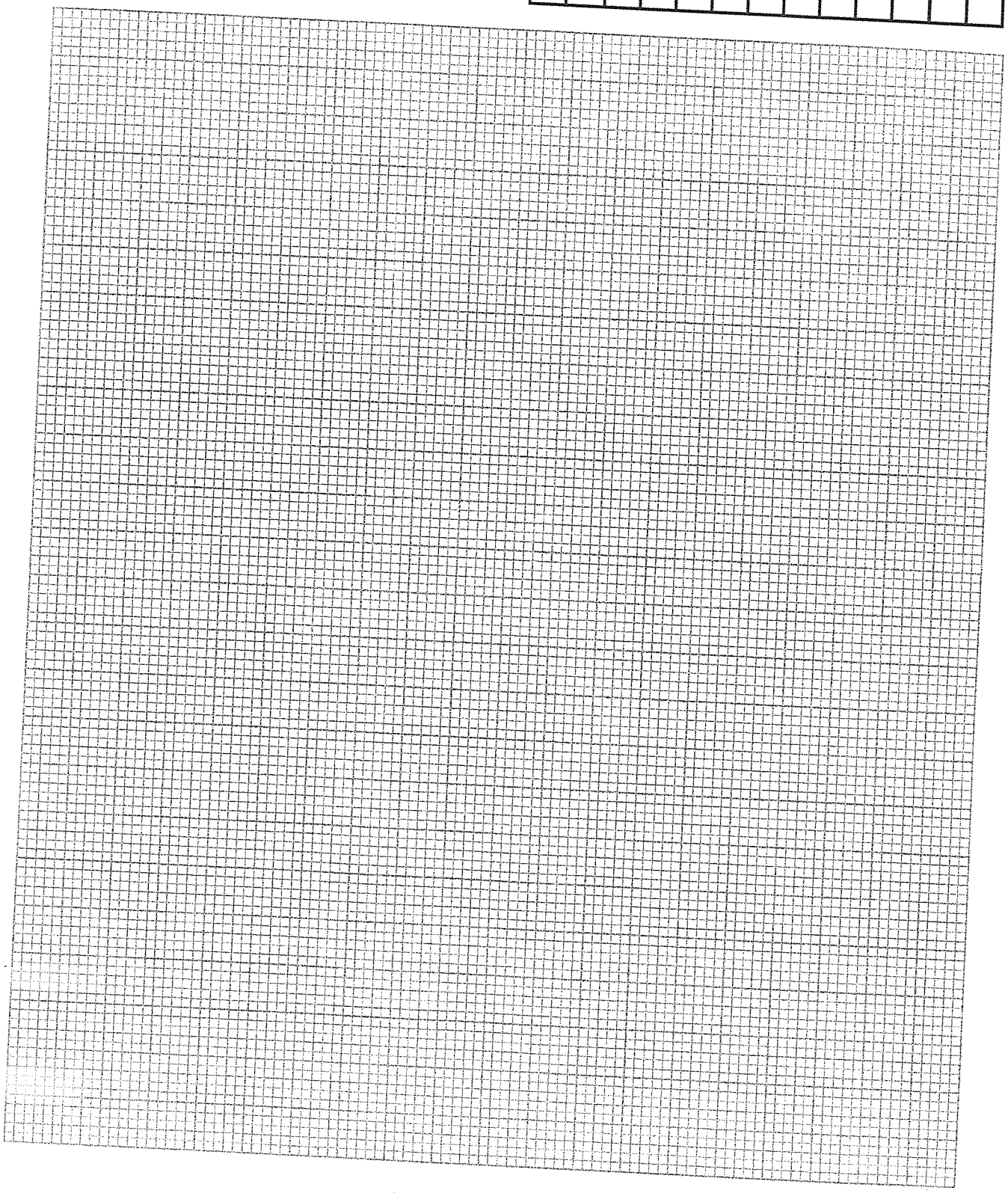
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