

higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T920(E)(M28)T
APRIL EXAMINATION

NATIONAL CERTIFICATE

MATHEMATICS N2

(16030192)

28 March 2014 (Y-Paper)
13:00–16:00

Scientific calculators may be used.

This question paper consists of 6 pages and an information 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

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INSTRUCTIONS AND INFORMATION

1. Answer ALL the questions in blue or black ink.
2. Read ALL the questions carefully.
3. Number the answers according to the numbering system used in this question paper.
4. Show ALL formulae and 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 subsections of questions must be kept together.
7. Write neatly and legibly.

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QUESTION 1

1.1 Fully factorise the following expressions:

1.1.1 $8a^2b^2 - 64ab^3$ (2)

1.1.2 $3a^2 + 4a - 3a - 4$ (3)

1.2 Factorise the following expressions and then give the LCM (lowest common multiple) and HCF (highest common factor) of:

$x^2 - 16$,
$x^2 - 7x + 12$,
$2px - 8p$ and
$2x^2 - 2x - 24$.

Clearly indicate the LCM and HCF in your answer. (7)

1.3 Simplify:

$$\frac{4x^2 - 1}{4x^2 + 2x}$$

(3)

1.4 Simplify the following fractions:

1.4.1 $$\frac{x^2 + x - 6}{3x^2 - 12x} \div \frac{x^3 - 2x^2}{x^2 - 16} \times \frac{3x^3}{x + 4}$$ (5)

1.4.2 $$\frac{3}{x} + \frac{2}{x^2} - \frac{5}{3ax}$$ (3)

[23]

QUESTION 2

2.1 A metal cone has a base diameter of 140 mm and a perpendicular height of 350 mm. It is melted into a sphere. Calculate the radius of the sphere. (4)

2.2 Calculate the area of an irregular metal sheet with the following ordinates in mm:

3; 8; 10; 16; 15; 13; 6; 0 .

The common distance between the ordinates is 9 mm. (3)

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2.3 Make 'v' the subject of the formula :

$$F = \frac{mv^2}{gr}$$ (2)

2.4 Make 'r' the subject of the formula:

$$A = \pi\left(R^2 - \frac{r}{x}\right)$$ (3)

2.5 The length of a rectangle is twice the width. The perimeter of the rectangle is 6 m. Calculate the length and the width of the rectangle. (4)
[16]

QUESTION 3

3.1 Solve the following equation by using the quadratic formula:

$3x^2 - 15x = 42$ (4)

3.2 Simplify the following:

$$\frac{25^{x+2}.5^{x-1}}{125^{x+1}}$$ (4)

3.3 Solve for x:

$3^{8x-2} = 1$ (2)

3.4 Simplify, without the use of a calculator:

3.4.1 $\log_5 25 + 2\log 100 - 3\log_3 27$ (4)

3.4.2 $$\frac{\log 4}{3\log 64}$$ (2)

3.5 Use natural logarithms to find the value of the following:

$$x = \frac{12{,}3 \times \sqrt{10{,}8}}{(4{,}6)^2}$$

Show ALL the steps. Answers only are not acceptable. (5)
[21]

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QUESTION 4

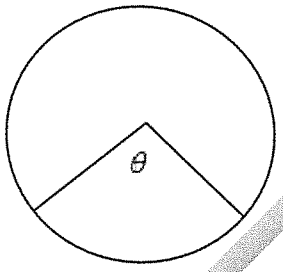
4.1 The pulley of a machine turns at 100 revolutions per minute. The diameter of the pulley is 29 cm.

Calculate:

4.1.1 The angular velocity of the pulley in radians per second. (3)

4.1.2 The circumferential velocity in meters per second. (3)

4.2 A small circle sector with a radius of 12,3 m has an area of 169,8 m^2.



4.2.1 Calculate the angle θ in radians. (3)

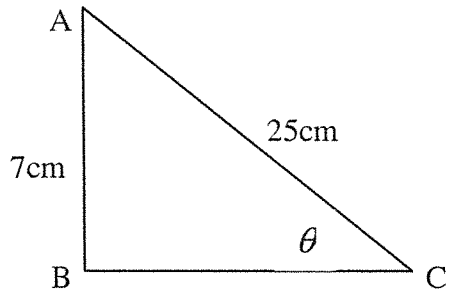
4.2.2 Convert this angle to degrees and minutes. (1)

4.3 The diameter of a circle is 88 cm. A segment of this circle has a height of 12,4 cm. Calculate the length of the chord of this segment. (4)

[14]

QUESTION 5

5.1 The sketch below shows ΔABC with $\hat{B} = 90^\circ$, AB=7cm and AC=25cm.



5.1.1 Calculate the length of BC. (3)

5.1.2 Determine, without the use of a calculator:

$5\sin\theta + 12\tan\theta$. (3)

5.1.3 Calculate the magnitude of θ. (2)

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5.2 Calculate the value of:

5.2.1 $\cos 34^\circ 12' + 4\sec 120^\circ$ (1)

5.2.2 $\dfrac{\sqrt{9\sin 90^o}}{3\cos 180^o}$ (1)

5.3 A ladder with a length of 12 m is placed against a wall so that the top of the ladder is 10 m from the ground level.

What is the angle of elevation to the top of the wall? (3)
[13]

QUESTION 6

6.1 Sketch, on the same system of axes, the graphs of :

$y = \cos x + 1$ and $y = 2\sin x$ for $0^o \le x \le 180^o$ (5)

6.2 Given: $y = x^2 - 3x$ and $4x + 3y = 12$

6.2.1 Use graph paper and sketch $4x + 3y = 12$ on a system of axes by calculating $x-$ and $y-$intercepts. (2)

6.2.2 Sketch the graph of $y = x^2 - 3x$ on the same system of axes used for Question 6.2.1 by calculating and indicating the x-intercepts, y-intercept and turning point. (4)

6.2.3 From your graphs, give the coordinates of the points of intersection of the two graphs. (2)
[13]

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 = 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)

$$= \left[\frac{first + last \quad ordinates}{2} + sum\ of\ other\ ordinates\right] x\ distance\ between\ ordinates$$

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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