education

Department:
Education
REPUBLIC OF SOUTH AFRICA

T1210(E)(M30)T
APRIL 2010

NATIONAL CERTIFICATE

MATHEMATICS N2

(16030192)

30 March (X-Paper)
09:00 – 12:00

REQUIREMENTS: **ONE sheet of graph paper**

Scientific calculators may be used.

This question paper consists of 6 pages and a 2-page information sheet.

DEPARTMENT OF EDUCATION
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 correctly according to the numbering system used in this question paper.
4. Questions may be answered in any order, but subsections of questions may not be separated.
5. Show ALL calculations and intermediary steps and simplify where possible.
6. ALL the graph work must be done on the graph paper provided.
7. ALL final answers must be approximated accurately to THREE decimal places.
8. Write neatly and legibly.

QUESTION 1

1.1 Factorise:

1.1.1 $2x^2 + 6x + 4$ (2)

1.1.2 $x^8 - y^8$ (3)

1.1.3 $20x^2y^3 - 8xp^2 - 6p^2 + 15xy^3$ (3)

1.2 Solve for x:

1.2.1 $\log_2 x^4 = 4$ (2)

1.2.2 $\sqrt{4x-3} = \sqrt{x}$ (3)

1.2.3 $\frac{4^{2x}}{8^x} = 32$ (2)

[15]

QUESTION 2

2.1 Simplify:

2.1.1 $\frac{(ab^2)^4 \times (a^2 b^3)^2}{a^3 b \times (ab)^4}$ (3)

2.1.2 $\log_8 64 + \log_8 16 - 2\log_8 4$ (3)

2.1.3 $\frac{a^2+b^2}{a+b} \times \frac{a^2-b^2}{ab} \div \frac{a-b}{ab}$ (3)

2.1.4 $\frac{ab}{a^2+ab} + \frac{2a^2}{b^2-a^2} - \frac{a}{a-b}$ (4)

2.2 Determine the highest common factor (HCF) of:

$a^2 - a - 12$

$a^2 - 7a + 12$

$a^2 - 16$

(4)

2.3 Determine the lowest common multiple (LCM) of:

$a^3 - ab^2$

$2a^2 + ab - 3b^2$

$2a^2 - 4ab + 2b^2$

(4)

2.4 Make the indicated variable in brackets the subject of the formula:

$t = \frac{2vr}{p+2} \ldots (p)$

(4)
[25]

QUESTION 3

3.1 $p = \frac{wv^2}{32r}$; find the value of v if $p = 19{,}76$; $w = 101{,}2$ and $r = 982{,}7$ (3)

3.2 Solve for x and y using the following simultaneous equations:

$8x = 7 - 3y$

$9y = -20x + 13$ (4)

3.3 Given: $3r - 2 = -4r^2$; use the quadratic formula to determine the value of r. (4)

3.4 Calculate the surface area and the volume of a sphere with a diameter of 68 mm. (4)
[15]

QUESTION 4

4.1 The peripheral velocity of a wheel with a diameter of 1,25 metres is 45,3 kilometres per hour. How many revolutions does the wheel complete?

Calculate the values:

4.1.1 Per minute (2)
4.1.2 Per second (2)

4.2 The arc length of a sector is 9,5 cm. Calculate the angle in degrees and minutes if the radius is 3,5 cm, then calculate the area. (4)

4.3 Write the following degrees and minutes in radians: 88°51'. (2)

4.4 Write the following revolutions in degrees and minutes: 0,35 revolutions. (2)

4.5 Write the following in degrees and minutes: 225,25°. (2)

4.6 If $\sin\theta = 0{,}6$; determine the following equations without using a calculator:

4.6.1 $\tan\theta$ (1)

4.6.2 $\cos\theta$ (1)

4.6.3 $\sin\theta - \cos\theta$ (2)

4.6.4 $\tan\theta + \cos\theta$ (2)

4.7 Determine the size of the following angles with a calculator:

4.7.1 cos 121° (1)

4.7.2 sin 70° (1)

4.7.3 sec 45° (1)

4.7.4 cot 116° (1)

[24]

QUESTION 5

5.1 A is a point 68,4 m from the foot of a chimney. The angle of elevation to the top of the chimney is 25°48'. What is the height of the chimney? (3)

5.2 Draw the graphs of $y = 2\cos x$ and $y = \sin x$ on the same system of axes. Use 30° intervals and draw the graph and determine the values for x from 0° to 360°. (6)

Read off the values of x from the graphs of:

5.2.1 $2\cos x - 3\sin x = 0$ (1)

5.2.2 $2\cos x - 1 = 0$ (1)

5.2.3 $12\sin x + 3 = -1{,}5$ (1)

5.3 A lead cast in the shape of a cone with base diameter of 250 mm and a perpendicular height of 150 mm is melted and recast in the shape of a sphere.

Calculate:

5.3.1 The diameter of the sphere (3)
5.3.2 The surface area of the sphere (1)

5.4 Given the function: $y = x^2 - x - 6$

Determine:

5.4.1 The roots (2)
5.4.2 The axis of symmetry (1)
5.4.3 The y-intercept (1)
5.4.4 The turning point (1)
[21]

TOTAL: 100

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 = $\frac{1}{3}$ (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° = 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: $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

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