higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

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APRIL EXAMINATION

NATIONAL CERTIFICATE

MATHEMATICS N2

(16030192)

1 April 2015 (Y-Paper)
13:00–16:00

Scientific calculators may be used.

This question paper consists of 6 pages and 1 information sheet of 2 pages.

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. 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. Questions must be answered in BLUE or BLACK ink.
8. Write neatly and legibly.

QUESTION 1

1.1 Simplify the following expressions without the use of a calculator:

1.1.1 $$\frac{\sqrt[3]{x^6y^3}}{\left(2xy^{\frac{1}{2}}\right)^2}$$ (3)

1.1.2 $$\log(x+2)^2 - \log\left(x^2-4\right)$$ (4)

1.2 Solve for x in the following equation:

$$5^{x-1}.25^{x-1}=1$$ (4)
[11]

QUESTION 2

2.1 Fully factorise the following expression:
$9x^2+15x-6$ (3)

2.2 Given:
$3x^2-27$
$5ax+15a$
x^2-6x+9

2.2.1 Fully factorise each of the given expressions. (3)

2.2.2 Now, give the HCF (highest common factor) of the three expressions. (2)

2.2.3 Give the LCM (lowest common multiple) of the three expressions. (3)

2.3 Simplify:

2.3.1 $$\frac{b^2+4b+3}{b^2} \div \frac{b^2+3b+2}{b}$$ (5)

2.3.2 $$\frac{1}{x}+\frac{2}{y}-\frac{3}{z}$$ (3)

2.4 The area of an irregular metal sheet is given as 2437 cm^2.
The ordinates used to calculate the area are 210; 240; 299; 305; 302; 255; 198 and 101.

Use the mid-ordinate rule to calculate the common distance between the ordinates. (5)
[24]

QUESTION 3

3.1 Given: $3x-\frac{5}{x}=-14$

3.1.1 Give the equation in standard form. (1)

3.1.2 Now, use the quadratic formula to solve for x.
Show the formula and all calculations. (4)

3.2 Solve the following equations simultaneously for x and y:
$3x-4y=2$ and $6x-4y=7$ (4)

3.3 Change the subject of the formula to the symbol in brackets:

$A=r\sqrt{\frac{b}{c^2}}$ .....(c) (4)

3.4 The area of a rectangular room is 96 m². The length of the rectangular room is 4m longer than its breadth. Determine the dimensions of the room. (4)
[17]

QUESTION 4

4.1 A segment of a circular disk has a height of 45 cm, a chord length of 23 cm and is 5 cm thick.

4.1.1 Calculate the diameter of the circular disk. (3)

4.1.2 Now, calculate the area of the base of the disk. (3)

4.1.3 Calculate the volume of this circular disk. (3)

4.2 A pulley turns with an angular velocity of 455,12 radians per minute.

4.2.1 Calculate the angular velocity in radians per second. (2)

4.2.2 Calculate the revolutions per second (3)

4.2.3 Calculate the circumferential velocity in metres per second if the diameter of the pulley equals 13 cm. (3)

4.3 Change 2,345 radians to degrees. (1)
[18]

QUESTION 5

5.1 Given: $\frac{x}{-3}+\frac{y}{3}=1$ and $y=9-x^2$

5.1.1 Sketch both graphs on the same system of axes.

Show ALL the x-intercepts, y-intercepts and the turning point. (7)

5.1.2 Using your graphs in Q5.1.1. give the points of intersection of the graphs. (2)

5.2 Given: $f(x)=3\cos x$ and $g(x)=2\sin x$

5.2.1 Give the amplitude of $f(x)$ (1)

5.2.2 Sketch both the graphs on the same system of axes using $0°\leq x\leq 180°$ (6)

5.2.3 From your graphs give the value(s) of x for which $f(x)=g(x)$ (2)

[18]

QUESTION 6

6.1 Calculate the values of θ that will satisfy the following equation for $0°\leq\theta\leq 360°$:
$0,5\cos\theta+0,5=0,7$ (4)

6.2 Consider FIGURE 1. A supervisor must train a new team of loggers to estimate the heights of trees. As an example, she walks off 12 m from the base of a tree and estimates the angle of elevation to the tree's peak to be 62°. Determine how tall is the tree? (4)

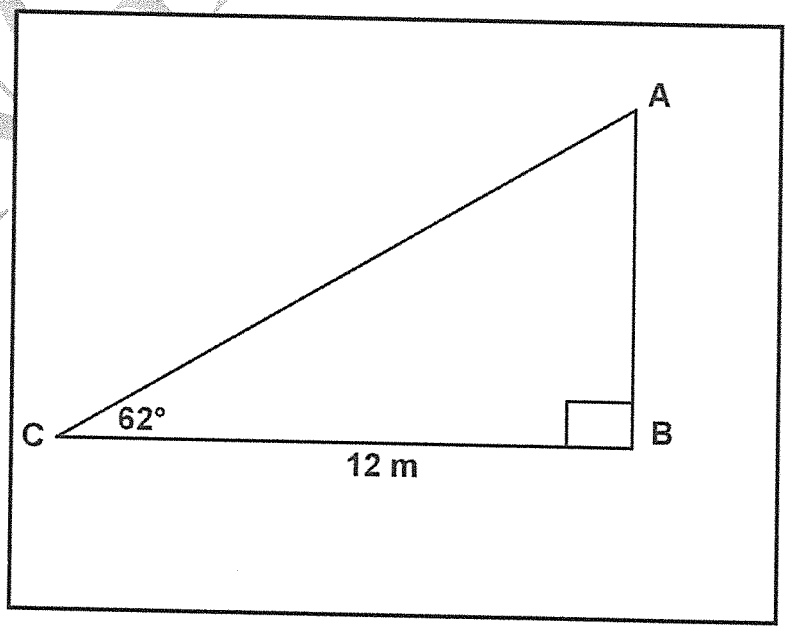

FIGURE 1

6.3 Use a calculator to find the value of:

6.3.1 $\dfrac{3\sin 12°42'}{4\tan 42°}$ (2)

6.3.2 $\sqrt{9\cos 360°}+1-2\sin^2\dfrac{\pi}{3}$ (2)

[12]

TOTAL: 100

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: $w = 2\pi n$

Circumferential velocity: $v = \pi Dn$

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

Mid-ordinate rule

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

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

Graphs

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

Axis of symmetry

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

Roots:

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

Trigonometry

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

$\tan\theta = -\tan(180° - \theta)$

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:

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

R = radius of circumscribed circle

x = length of side

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

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