higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

ENGINEERING

T930(E)(N17)T

NOVEMBER EXAMINATION

NATIONAL CERTIFICATE

MATHEMATICS N2

(16030192)

17 November 2014 (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.

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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 formulae, 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.

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QUESTION 1

1.1 Factorise the following

1.1.1 $\frac{1}{3}-3p^6$ (3)

1.1.2 $x^3y+2x^2y-63xy$ (3)

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

$x^2-15x+36$

$3x^2-27$

$5bx-15b$ (7)

1.3 Simplify fully:

1.3.1 $\frac{2x^2-32}{4xb+b}\times\frac{b}{x+4}\div\frac{8x-32}{4x+1}$ (4)

1.3.2 $\frac{3x}{x-3}-\frac{2x}{x^2-6x+9}$ (5)

[22]

QUESTION 2

2.1 Make x the subject of the formula:

$$F=\frac{1}{a\sqrt{cx}}+v$$ (5)

2.2 Calculate the value(s) of x if $(x+3)^2=25$ (3)

2.3 Solve for x if $3(x-2)-2(2x+1)=7-(3x+2)$ (3)

2.4 Consider FIGURE 1 below. The rectangular garden of 6 metres by 4 metres is surrounded by a path of uniform width. If the area of the path is 56 m^2, what is its width?

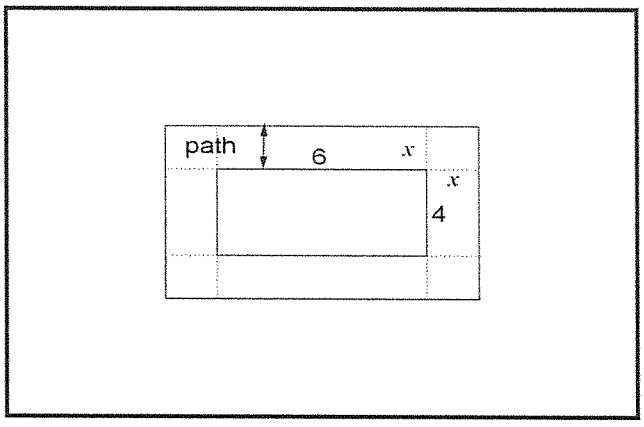


FIGURE 1 (5)

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2.5 An irregular metal sheet has a common distance of 31 mm between the ordinates. The ordinates are: 8 mm; 12 mm; 15 mm; 21 mm; 17 mm; 9 mm and 4 mm.

Determine the area of the metal sheet. (3)
[19]

QUESTION 3

3.1 Solve for x using logarithms if $x = \dfrac{\sqrt[3]{5\,897}}{0{,}12 \times (3{,}5)^3}$

Show ALL calculations. Answers only are not acceptable. (4)

3.2 Simplify :
$(\log_3 x)(\log_x 9)$
(3)

3.3 Determine the value of x if $\log_3 x = 4$. (2)

3.4 Simplify : $\dfrac{4^{x+1}.2^{2x+2}}{16^{x+1}}$
(3)

3.5 Consider FIGURE 2 below. A conical rain gauge is to be constructed with a radius of 53 cm and slant height of 102 cm.

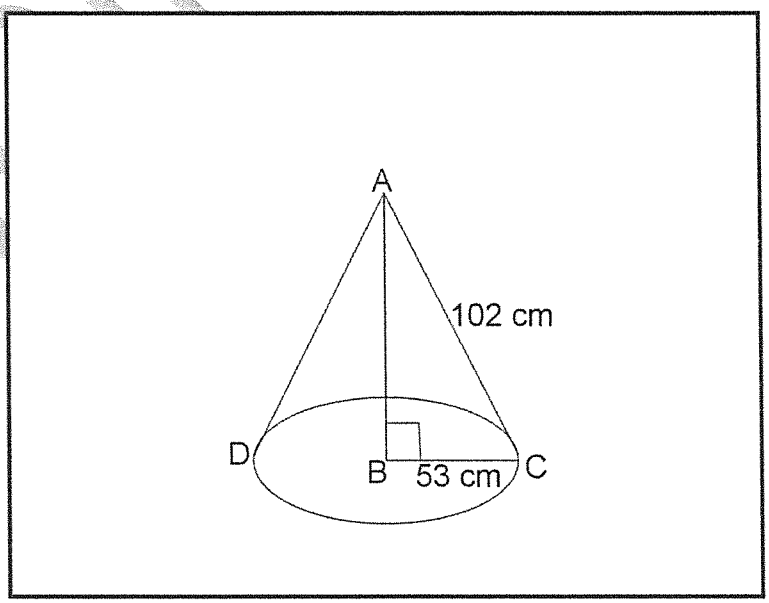


FIGURE 2

3.5.1 Calculate the perpendicular height of the rain gauge. (2)

3.5.2 How many litres of rain water will the rain gauge hold when full? (4)
[18]

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QUESTION 4

4.1 The arc of a circle subtends an angle of 56° at the centre. The diameter of the circle is 298 mm.

4.1.1 Calculate the length of the arc of the sector. (4)

4.1.2 Calculate the area of the circle sector. (3)

4.2 A wheel has a peripheral velocity of 2,3 meter per second.

4.2.1 If the wheel turns 130 revolutions per minute, calculate the diameter of the wheel. (4)

4.2.2 Calculate the angular velocity of the wheel in radians per second. (3)
[14]

QUESTION 5

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

$y=1+\sin x$ and $y=-2\cos x$ for values of $x\in[0°;180°]$
Use intervals of 30°. (5)

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

5.2.1 Sketch the graphs on the same system of axes. Clearly indicate the x-intercepts, the y-intercepts and the turning point. (6)

5.2.2 Using the graphs, read off the co-ordinates of the points where the TWO graphs in QUESTION 5.2.1 cut each other. (2)
[13]

QUESTION 6

6.1 Express $\frac{7}{9}$ of a right angle in radians. (2)

6.2 Evaluate $e^{\circ}-\log_3 1+\cos^2 0°+0,25\cos\left(\ln\frac{\pi}{4}\right)$ (2)

6.3 Determine the magnitude of the angle β if $5\cos\beta=3;\ \beta\in[0°;360°]$ (3)

6.4 Simplify the following expression: $\frac{\sin(180°-\theta)\sin(360°-\theta)\cot(180°+\theta)}{\cos(360°-\theta)\tan(180°+\theta)}$ (4)

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6.5 Consider FIGURE 3. What is the angle of elevation of the sun when a 30 m vertical pole casts a 3 m shadow?

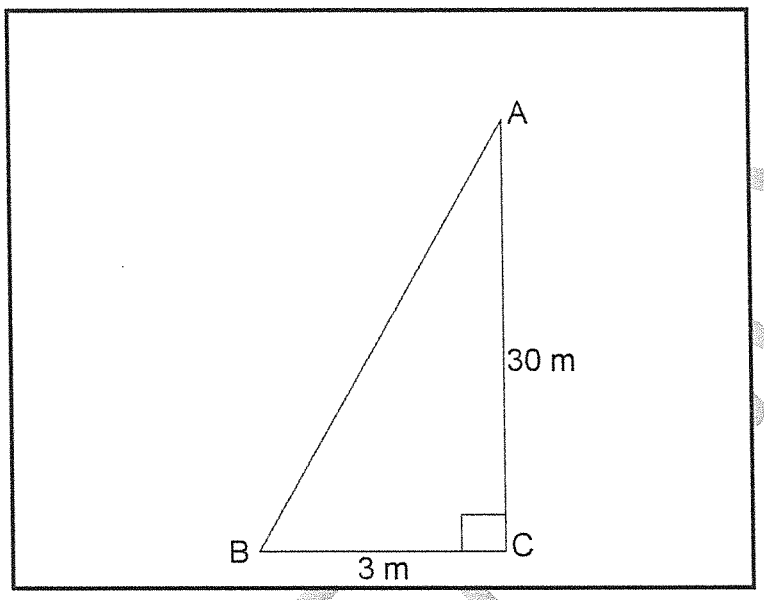


FIGURE 3

(3)
[14]

TOTAL: 100

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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° = 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

$$\text{Area} = \left[\frac{\text{First ordinate + last ordinate}}{2} + \text{Sum of the ordinates}\right] \times \text{distance between the ordinates}$$

Graphs

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

Axis of symmetry: $x = \frac{-b}{2a}$

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

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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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