higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

MATHEMATICS N1

(16030121)

14 November 2022 (X-paper)
09:00–12:00

REQUIREMENTS: Graph paper

Nonprogrammable calculators may be used.

This question paper consists of 7 pages and a formula sheet of 2 pages.

003Q1E2214

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE
MATHEMATICS N1
TIME: 3 HOURS
MARKS: 100

INSTRUCTIONS AND INFORMATION

1. Answer all the questions.
2. Read all the questions carefully.
3. Answer QUESTION 5.1.4, QUESTION 5.2 and QUESTION 7.1 on graph paper.
4. Number the answers according to the numbering system used in this question paper.
5. Round off final answers to THREE decimals (unless indicated otherwise).
6. Keep subsections of questions together.
7. Start each section on a new page.
8. Use only a blue or black pen.
9. Write neatly and legibly.

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QUESTION 1

1.1 Simplify each of the following, without a calculator, by using exponential laws. Show ALL steps:

$128x^{-3} \times 16x^{-6} \div x^{-9}$ (4)

1.2 Simplify, without a calculator, the following by using logarithmic laws. Show ALL steps:

$$\frac{3\log x + \log x}{\log x^2}$$ (3)

1.3 Write the following in exponential form:

$$\log_x \sqrt{3} = \frac{1}{2}$$ (2)

1.4 Given: $7x(a-b) - 5x^4 - \frac{3x^2}{4} - 4 - 2x^5$

1.4.1 Write the expression in descending powers of x.

1.4.2 What is the constant term of the expression?

1.4.3 What is the coefficient of x^2?

(3 × 1) (3)

1.5 Show ALL calculations and use logarithms to base e (natural logarithms) to calculate the value of x:

$$x = \frac{e}{\sqrt{0{,}45}}$$ (3)

[15]

QUESTION 2

2.1 Divide $4x^3 - 2x^2y - 14xy^2 + 4y^3$ by $2x - 4y$ (6)

2.2 What must be added to $x + 2x^2 - 3$ to give $5 - 5x^2 - 3x$? (3)

[9]

QUESTION 3

3.1 Fully factorise the following expression:

$2x - 2y + 3a(y - x)$ (4)

3.2 Simplify the following:

$$\frac{12x^3y - 3(3xy - 5y^2x)}{3xy}$$ (4)

3.3 Simplify the following by first factorising:

$$\frac{36abc - 54a^2b^3c}{162abc}$$ (3)

3.4 Determine the following from the algebraic terms:

$68xy^2z^6$; $16x^4y^5z^3$

3.4.1 The prime factors of each term

3.4.2 The lowest common multiple (LCM)

3.4.3 The highest common factor (HCF)

(3 × 2) (6)

[17]

QUESTION 4

4.1 Solve for x:

$3(5x - 2) = 2(4x + 11)$ (6)

4.2 Manipulate the given formula and make s the subject of the formula:

$u^2 + 2as = v^2$ (2)

4.3 Use the answer in QUESTION 4.2 and substitute the following values to calculate the displacement (s):

If u = 0 m/s, v = 5 m/s and a = 3 m/s^2 (2)

4.4



A train travels from Cape Town to Cairo at 30 km/h. The train travels for 349 hours 38 minutes without stopping to reach its final destination.

Calculate the distance travelled in meter. (4)

4.5 A belt is driven by a pulley at 60 m/s. The pulley rotates at 560 r/min.

Calculate the rotational frequency in r/s. (2)

[16]

QUESTION 5

5.1 Given:

$$\frac{x}{2}+\frac{y}{3}=1$$

5.1.1 Write the equation in standard form: $y = mx + c$ (2)

5.1.2 Determine the gradient. (1)

5.1.3 Determine the y-intercept in coordinate form. (2)

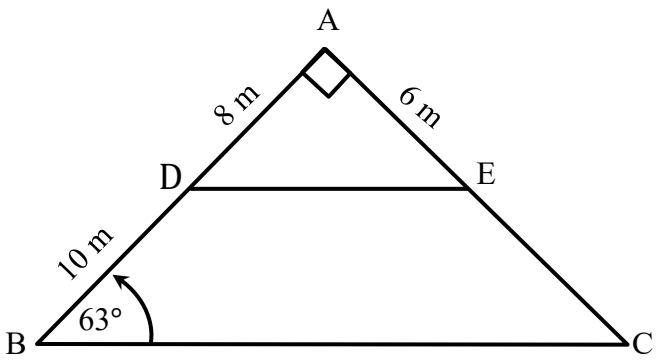
5.1.4 Draw the graph using the graph paper. (4)

5.2 On the same set of axes as used in QUESTION 5.1.4, draw the hyperbola $y = \frac{6}{x}$ (3)

[12]

QUESTION 6

Given: Δ ABC *III* Δ ADE, AD = 8 m, DB = 10 m, AE = 6 m, $\hat{A} = 90°$ and $\hat{B} = 63°$



6.1 Explain the meaning of the symbol *III*. (1)

6.2 Name TWO conditions for two triangles to be *III*. (2)

6.3 Calculate the length of side DE in ΔADE by using Pythagoras' theorem. (2)

6.4 Calculate the length of side BC by using the properties of III triangles. (3)

6.5 Calculate the magnitude of angle $\hat{C}$. (2)

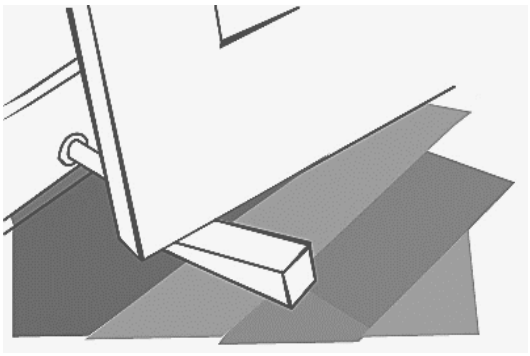
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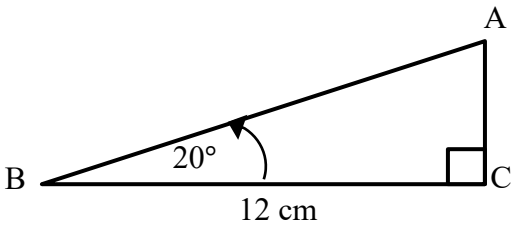
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QUESTION 7

7.1 Draw the graph of $y = \sin x$ for $0° \leq x \leq 180°$ on graph paper. (4)

7.2



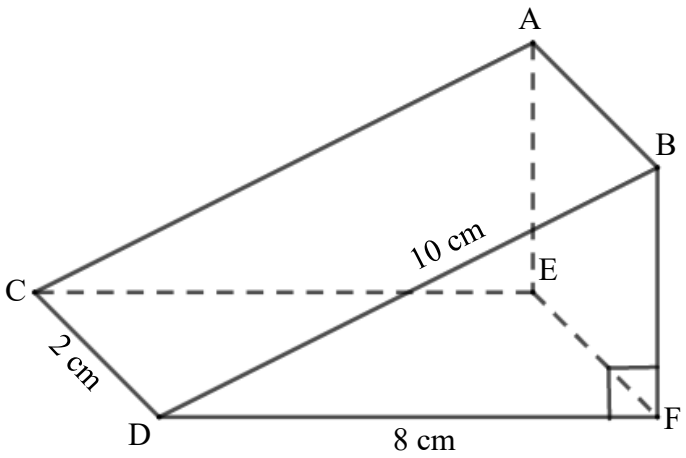


A doorstop wedge is shaped as a triangular prism. The wedge's angle of elevation must be 20° in order for the wedge to be effective.

Calculate the vertical height of the wedge if the horizontal length is 12 cm with the aid of trigonometric functions. (3)

[7]

QUESTION 8



Emelda wants to sell funky doorstop wedges shaped as a right triangular prism.

Given: CD = 2 cm, DF = 8 cm and BD = 10 cm

8.1 Calculate the volume of the wood needed to manufacture ONE door wedge in cm^3. (4)

8.2 The floor of a room is 7 m × 3 m. The floor is covered with ceramic tiles of 300 mm × 300 mm.

8.2.1 Determine the surface area of the room.

8.2.2 Determine the surface area of ONE tile in meter square.

8.2.3 How many tiles will be needed to tile the room if no tiles are broken? Round up.

8.2.4 If 2% of the tiles is broken while tiling, how many extra tiles are needed?

(4 × 2) (8)

8.3 Convert 2 500 000 mm^3 to m^3 (2)

[14]

TOTAL: 100

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FORMULA SHEET

Rectangle:
Perimeter $= 2(l + b)$
Area $= l \times b$

Square:
Perimeter $= 4a$
Area $= a^2$

Triangle:
Perimeter $= a + b + c$
Area $= \frac{1}{2} b \times\perp h$

Circle:
Circumference $= \pi D$ OR $2\pi r$
Area $= \frac{\pi D^2}{4}$ OR πr^2

Parallelogram:
Area $= b \times\perp h$

Trapezium:
Area $= \frac{1}{2}(a + b) \times h$

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

Ellipse:
Area $= \frac{\pi}{4}$(major axis $\times$ minor axis)

Rectangular prism:
Volume $= l \times b \times h$

Right triangular prism:
Volume $= \frac{1}{2} b \times h \times l$

Right pyramid:
Volume $= \frac{1}{3}$(base area $\times h$)

Right cone:
Volume $= \frac{\pi D^2}{4} \times \frac{h}{3}$ OR $\frac{\pi r^2 h}{3}$

Cube:
Volume $= a^3$

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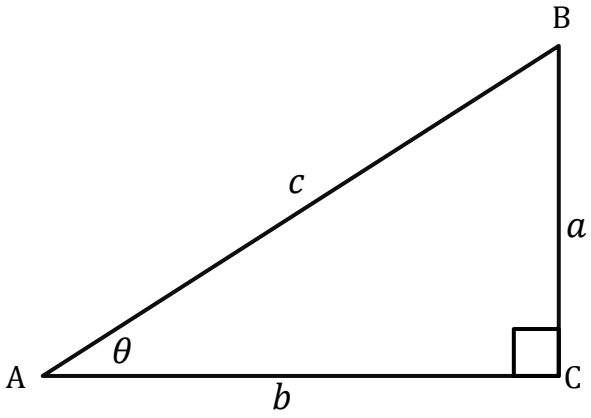
Cylinder:

Volume $= \frac{\pi D^2}{4} \times h$ OR $\pi r^2 h$

Sphere:

Volume $= \frac{4\pi r^3}{3}$

The right-angled triangle:



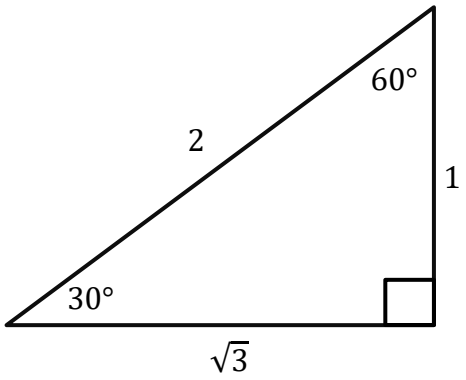
The theorem of Pythagoras:

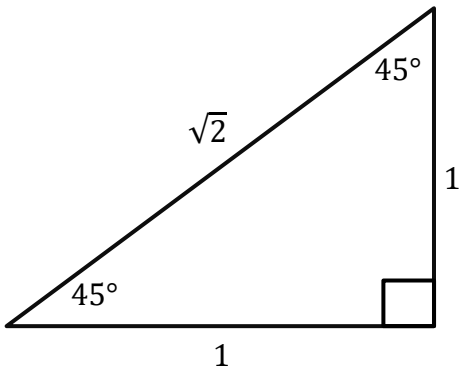
$c^2 = a^2 + b^2$

Ratios of angle θ:

$\sin\theta = \frac{a}{c}$ $\cos\theta = \frac{b}{c}$ $\tan\theta = \frac{a}{b}$

Special angles:





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