higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

MATHEMATICS N1

(16030121)

20 November 2023 (X-paper)
09:00–12:00

REQUIREMENTS: Graph paper

Scientific calculators may be used.

This question paper consists of 8 pages and a formula sheet of 2 pages.

003Q1E2320

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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. Number the answers according to the numbering system used in this question paper.
4. Keep subsections of questions together.
5. Start each section on a new page.
6. Use only a blue or black pen.
7. Round off final answers to THREE decimal places (unless indicated otherwise).
8. Answer QUESTION 5.3 on GRAPH PAPER.
9. Write neatly and legibly.

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QUESTION 1

1.1 Simplify, without a calculator, by using exponential laws, and show all the steps:

$$\frac{15x^6y^{-4}z^3}{20x^3y^4z^6} \times \sqrt{64y^8} \times \left(\frac{1}{2}+\frac{1}{2}\right)^3$$ (7)

1.2 Simplify, without a calculator, by using logarithmic laws:

$$\log_6 4 + 2\log_6 3$$ (4)

1.3 Solve for x without a calculator, by using logarithmic laws:

$$3x = \log_2 64$$ (4)

[15]

QUESTION 2

2.1 Divide $y^3 - 6y + 20$ by $y - 3$ (7)

2.2 Find the sum of:

$$10x^2 - 5xy + 2y^2; \quad 4xy + 5y^2 - 4x^2; \quad -6y^2 + 9x^2 - 3xy$$ (3)

[10]

QUESTION 3

3.1 Fully factorise the following expressions:

$$2x(c-d) + 6y(c-d) - 8z(c-d)$$ (3)

3.2 Simplify the following:

$$\frac{5a}{b} - \frac{3a}{2b} + \frac{a}{3b}$$ (5)

3.3 Given: $16a^4b^8; \quad 8a^3b^7; \quad 36a^2b^3$
Determine the following from the algebraic terms:

3.3.1 The prime factors of each term (3)

3.3.2 The lowest common multiple (LCM) (2)

3.3.3 The highest common factor (HCF) (2)

[15]

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QUESTION 4

4.1 Solve for x:

$$(x+1)^2 = x^2 - 6x + 17$$ (6)

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

$$p = m^2 - \frac{x}{2}$$ (2)

4.3 A Boeing *747* airplane flies at a constant speed of 988 km/h. How long will it take to travel a distance of 1 261 km? Give the answer in hours, minutes, and seconds.



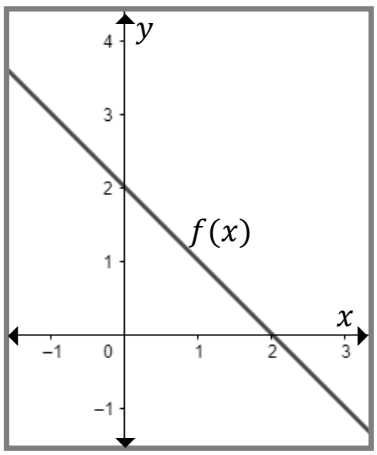
(6)

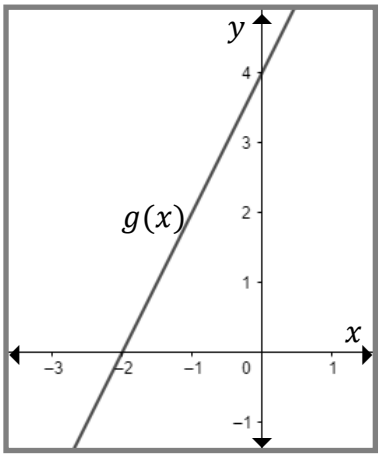
4.4 A flywheel rotates at a speed of 18,3 m/s and has a diameter of 0,8 m. What is the flywheel rotational frequency? (3)

[17]

QUESTION 5

5.1 Study the graphs below and answer the questions:





5.1.1 Given: $f(x)$ and $g(x)$ are straight lines.
Give the standard equation for a straight line.

5.1.2 Write down the coordinates of the y-intercept of $f(x)$.

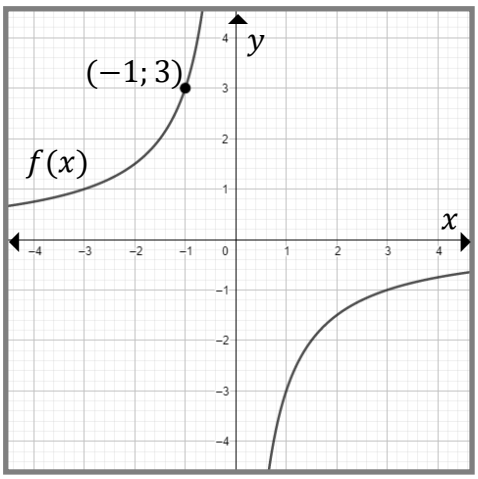
5.1.3 Write down the coordinates of the x-intercept of $g(x)$.

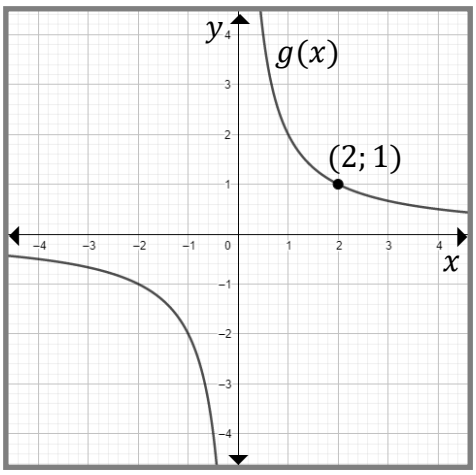
5.1.4 Determine the gradient of $f(x)$.

5.1.5 Determine the equation of $f(x)$.

(5 × 1) (5)

5.2 Study the graphs below and answer the following questions:





5.2.1 Give the name of the graphs of $f(x)$ and $g(x)$.

5.2.2 Write down the standard equations for the graphs of $f(x)$ and $g(x)$.

5.2.3 In which quadrants are the graph of $f(x)$?

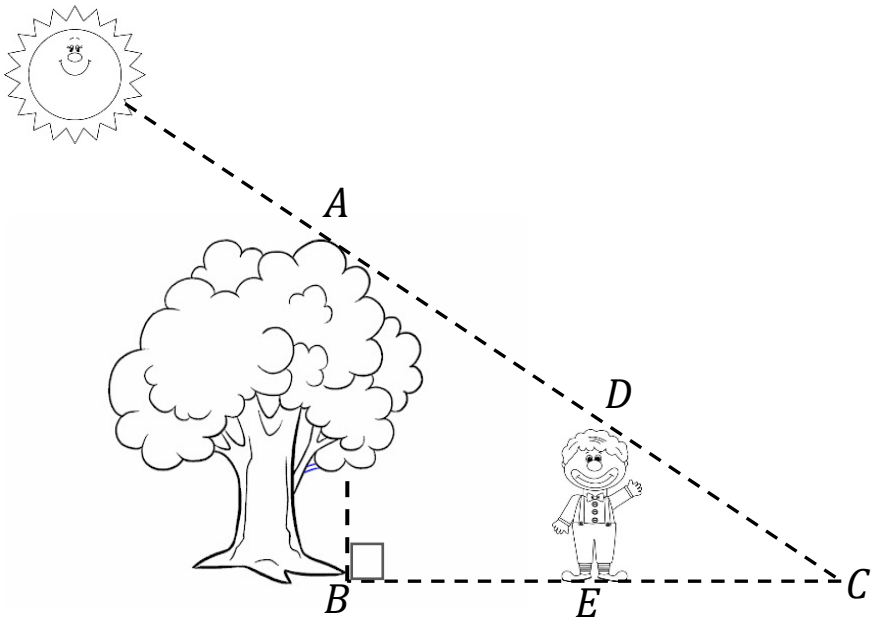
(3 × 1) (3)

5.3 Draw on graph paper the linear graph that passes through the points $(0; 2)$ and $(3; 5)$ and then determine the equation of the linear graph. (5)

[13]

QUESTION 6

6.1 Given: △ ABC and △ DEC are similar triangles.
The shadow of the tree, BC = 1371,6 cm, the shadow of the clown, EC = 274,32 cm and the height of the clown, DE = 182,88 cm.



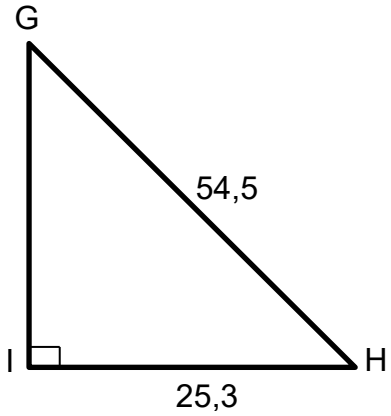
6.1.1 Calculate the length of side AB, the height of the tree.

6.1.2 Calculate the magnitude of angle $\hat{C}$.

6.1.3 Calculate the magnitude of angle $\hat{A}$.

(3 × 3) (9)

6.2 Given:



Calculate the length of side GI, by using the theorem of Pythagoras. (3)

[12]

QUESTION 7

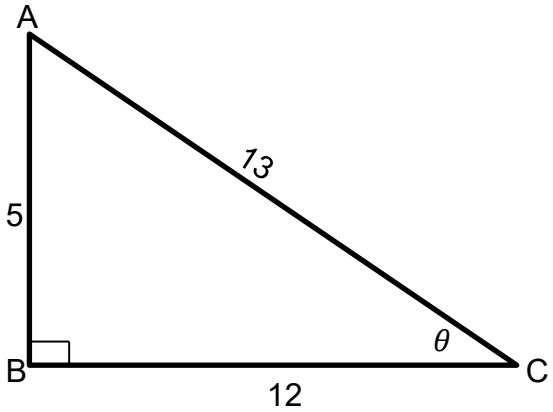
7.1 Determine, accurately to THREE decimals, the value of:

7.1.1 $cos315{,}2° \times tan22{,}6°$

7.1.2 $\dfrac{tan115{,}678°}{\sqrt{sin26{,}587°}} + cos^2257{,}519°$

(2 × 1) (2)

7.2 In $\Delta ABC, \hat{B} = 90°, \hat{C} = \theta, AB = 5, BC = 12$ *and* $AC = 13$.



Write down the values of:

7.2.1 $tan\theta$

7.2.2 $cos\theta$

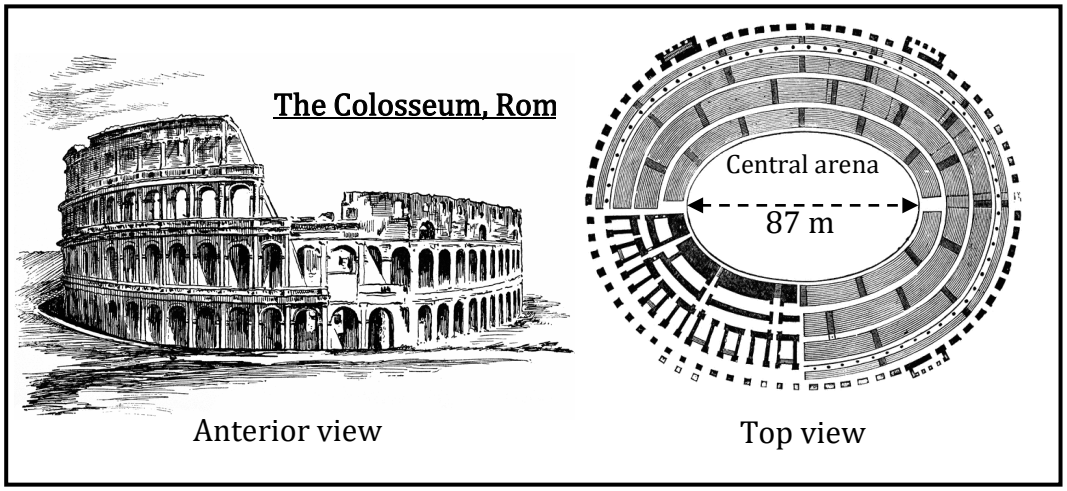
7.2.3 $sin\theta$

(3 × 1) (3)

[5]

QUESTION 8

8.1 The Colosseum in Rome has a central arena in the shape of an ellipse. The area of the arena is 3 758,130 m^2 and the length (major axis) is 87 m.

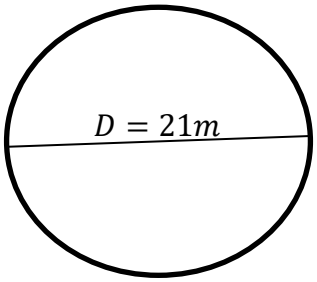


8.1.1 Calculate the width (minor axis) of the central arena. (3)

8.1.2 If 1 m^2 grass costs R60,00 $\frac{p}{m^2}$, how much will it cost to cover the central arena of the Colosseum with grass? (2)

8.2 The volume of a cylinder with a radius of 5 cm, is 1099,6 cm^3. Calculate the height of the cylinder. (3)

8.3 Given:
A circle has a diameter of 21 m. Calculate the surface area of the given circle.
Leave the answer in square centimeter.



(3)

8.4 A tutor earned R1 438,00 for a week's work. If 20% of his earnings is deducted for income tax, how much did he pay in taxes? (2)

[13]

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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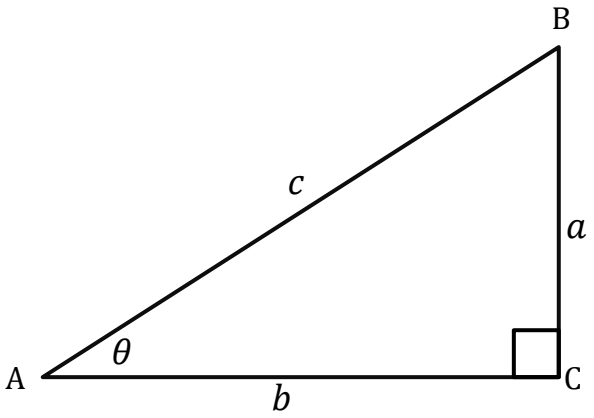
Cylinder:

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:



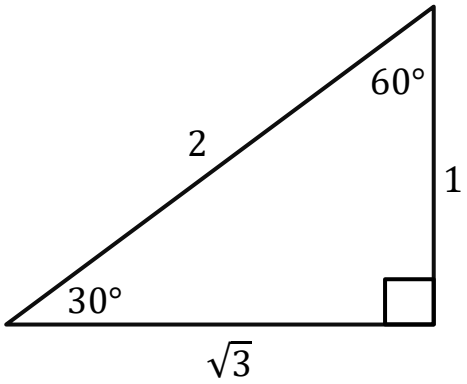
The theorem of Pythagoras:

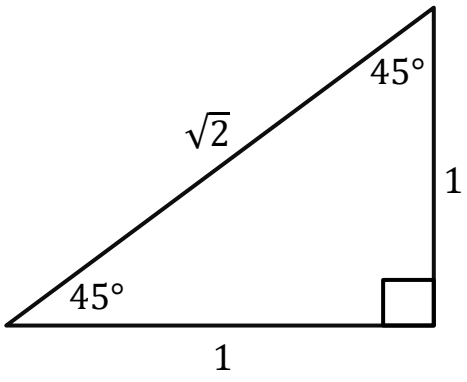
$c^2 = a^2 + b^2$

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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