



Province of the
EASTERN CAPE
EDUCATION

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Provinsie van die Oos Kaap: Departement van Onderwys
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NATIONAL SENIOR CERTIFICATE

GRADE 11

NOVEMBER 2025

TECHNICAL MATHEMATICS P1

MARKS: 150

TIME: 3 hours

This question paper consists of 12 pages, including a 2-page information sheet and an answer sheet.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of EIGHT questions.
2. Answer ALL the questions.
3. Answer QUESTION 6.4 on the ANSWER SHEET provided. Write your name, surname and class in the spaces provided and hand it in with your ANSWER BOOK.
4. Clearly show ALL calculations, diagrams, graphs, et cetera that you have used in determining the answers.
5. Answers only will NOT necessarily be awarded full marks.
6. You may use an approved scientific calculator (non-programmable and non-graphical) unless stated otherwise.
7. If necessary, round off your answers to TWO decimal places, unless stated otherwise.
8. Diagrams are NOT necessarily drawn to scale.
9. An information sheet with formulae is included at the end of the question paper.
10. Write neatly and legibly.

QUESTION 1

1.1 Simplify the following WITHOUT using a calculator.

1.1.1 $\frac{3a^0}{2} + \left(\frac{b}{3a}\right)^0$ (3)

1.1.2 $\left(\frac{1}{81}\right)^{-\frac{3}{4}}$ (2)

1.1.3 $\sqrt[3]{125x^6} - \sqrt[4]{81x^8} + (36x^4)^{\frac{1}{2}}$ (4)

1.1.4 $\frac{18^{2n+1} \cdot 9^{-2n} \cdot 16^{n-1}}{64^{n+1}}$ (6)

1.1.5 $\frac{3(x^4 \cdot y^{-4})^2}{2xy^2} \div \frac{(xy)^{-3}}{(3x^{-3} \cdot y^4)^2}$ (5)

1.2 Prove that:

1.2.1 $\frac{\sqrt{1000}}{\sqrt{2}(\sqrt{80} - \sqrt{45})} = 10$ (4)

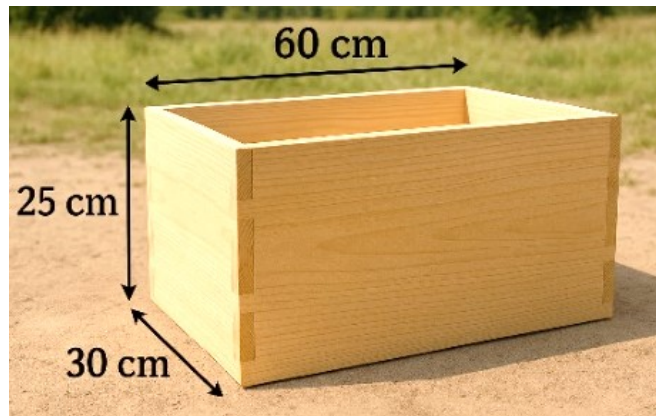
1.2.2 $\log_5 125 - \frac{\log 32 - \log 8}{\log 16} = \frac{5}{2}$ (5)

1.3 Consider the decimal number: A = 75 and B = 15

1.3.1 Determine the value of A+B (2)

1.3.2 Hence, write the sum as a binary number. (2)

- 1.4 A carpenter is building a wooden toolbox in the shape of a rectangular prism. The volume of the box can be calculated using: $V = l \times b \times h$



1.4.1 Calculate the volume of the toolbox. (2)

1.4.2 Write the answer to QUESTION 1.4.1 in scientific notation. (1)

[36]

QUESTION 2

2.1 Solve for $x \in \mathbb{R}$ WITHOUT using a calculator.

$$2.1.1 \quad 0,5x^3 = 0,0625 \quad (3)$$

$$2.1.2 \quad 3^x + 3^{x+1} = 36 \quad (4)$$

$$2.1.3 \quad \left(-2\sqrt{3+x}\right)^2 = 12 \quad (3)$$

$$2.1.4 \quad \log_3(x+4) + \log_3(x-4) = \log 100 \quad (6)$$

2.2 Electric power can be calculated using the formula:

$$P = \frac{V^2}{R}$$

Where:

- P is the power in watts
- V is the voltage in volts
- R is the resistance in ohms

$$2.2.1 \quad \text{Make V the subject of the formula.} \quad (2)$$

$$2.2.2 \quad \text{Given } P = 100 \text{ watt and } R = 25 \text{ ohms, calculate the voltage.} \quad (2)$$

[20]

QUESTION 3

3.1 Solve for x :

$$3.1.1 \quad x(x-1) = 0 \quad (2)$$

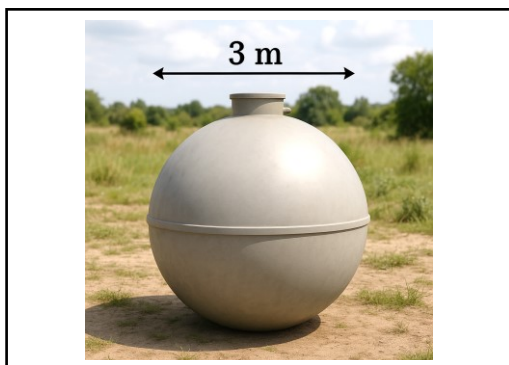
$$3.1.2 \quad x^2 - x = 1 \quad (\text{Correct to TWO decimal places}). \quad (4)$$

$$3.1.3 \quad (x-3)(x-4) \geq 0 \quad (3)$$

3.2 Solve for x and y simultaneously in the following equations.

$$2y + x = 5 \quad \text{and} \quad 2y^2 - xy - 4x^2 = 8 \quad (6)$$

- 3.3 A group of learners design a new type of water tank in the shape of a sphere to store water in rural areas. The tank has a diameter of 3 m.



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

$$D = 2r$$

- 3.3.1 Determine the volume of the tank in cubic meters. (3)
- 3.3.2 If $1 \text{ m}^3 = 1000 \text{ l}$, how many litres of water can the tank hold? (2)
- 3.3.3 If a household uses 250 litres of water per day, for how many days can the full water tank supply water? (2)
- [22]**

QUESTION 4

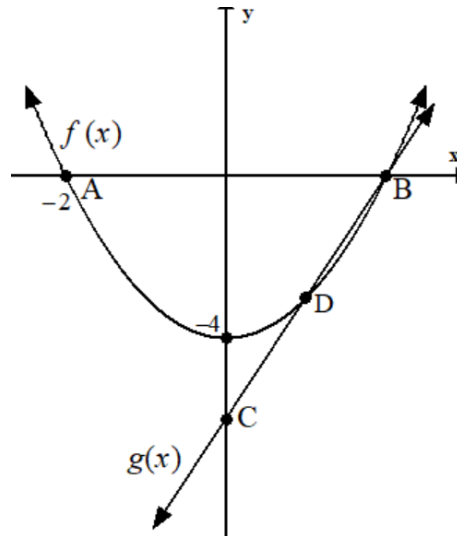
4.1 Consider: $m = \frac{2 - \sqrt{k-1}}{k}$

Determine the values of k for which m will:

- 4.1.1 Be equal to zero (2)
- 4.1.2 Have imaginary roots (2)
- 4.2 Determine, without solving the equation the nature of roots of $3x^2 - 13x + 12 = 0$. (3)
- 4.3 Determine for which value(s) of a the equation $ax^2 - 4x + 5 = 0$ will have real roots. (3)
- [10]**

QUESTION 5

The sketch below represents the graph of $f(x) = ax^2 - 4$ and $g(x) = 3x - 6$. f intersects the x -axis at A and B. g intersects the x - and y -axis at B and C. f and g intersect at D and B.



- 5.1 Write down the range of f . (2)
- 5.2 Determine the coordinates of B and C. (4)
- 5.3 Determine the value of a . (3)
- 5.4 Hence or otherwise, determine the coordinates of D. (5)
- 5.5 Write down the equation of the axis of symmetry of f . (1)
- 5.6 Determine the values of x for which $g(x) - f(x) \geq 0$ (2)
- 5.7 Write down the equation of $h(x)$ if $h(x) = -f(x) + 1$ (2)

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QUESTION 6

Consider the graphs of k and p defined by $k(x) = 2^x - 8$ and $p(x) = \frac{2}{x} - 8$

- 6.1 Determine the x -intercept of p . (2)
- 6.2 Determine x - and y -intercepts of k . (3)
- 6.3 Write down the domain of p . (2)
- 6.4 Sketch the graph(s) of k and p on the ANSWER SHEET provided. Clearly label all the intercepts and asymptote(s). (5)
- 6.5 Write down the equation of the axis of symmetry of k with a negative gradient. (2)
- 6.6 Use the graph to write the values of x for which $k(x) \geq 0$ (2)
- 6.7 Write down the range of k . (2)

[18]**QUESTION 7**

Consider a circle $y = -\sqrt{r^2 - x^2}$ with the center at the origin passing through (3 ; 1).

- 7.1 Write down the value of the radius. (2)
- 7.2 Determine the equation of the circle. (1)
- 7.3 Write down the range of the circle. (2)
- 7.4 Reflect the circle about x -axis and write down the coordinates of the y -intercept of the reflected function. (2)

[7]

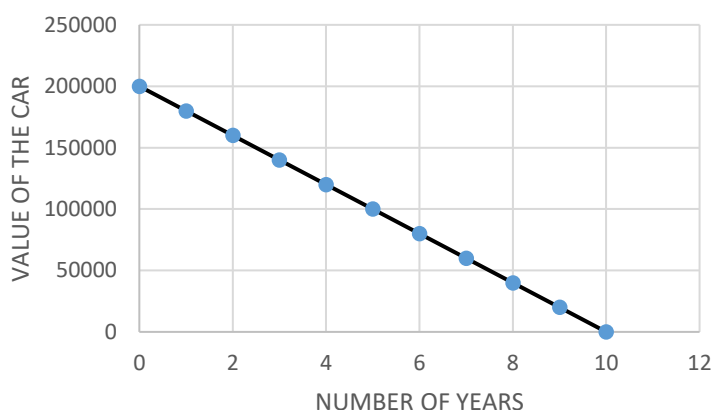
QUESTION 8

8.1 Mr Fizer deposited R10 000 into a savings account at 4,32% per annum compounded quarterly for 12 years.

8.1.1 Calculate the value of the investment after 12 years. (3)

8.1.2 Determine the equivalent effective annual rate. (3)

8.2 The value of the car depreciated as illustrated in the graph below.



8.2.1 Write down the initial value of the car. (1)

8.2.2 After 6 years the value of the car depreciated to R80 000. Determine the rate of linear depreciation. (3)

8.3 A certain type of bacteria grows at 22% per hour. Each plate starts off with approximately 34 bacteria cells. Determine how long it takes for the plate to have 81 bacteria cells. (3)

8.4 R50 000 is deposited into a savings account. The interest rate for the first 3 years of the savings is 12% per annum compounded semi-annually. Thereafter, the interest rate changes to 18% per annum compounded monthly. The money is left to grow for a further four years. Calculate the future value of the investment at the end of the seven year saving period. (5)

[18]

TOTAL: 150

INFORMATION SHEET: TECHNICAL MATHEMATICS

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

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

$$y = \frac{4ac - b^2}{4a}$$

$$a^x = b \Leftrightarrow x = \log_a b, \quad a > 0, a \neq 1 \text{ and } b > 0$$

$$A = P(1 + ni)$$

$$A = P(1 - ni)$$

$$A = P(1 + i)^n$$

$$A = P(1 - i)^n$$

$$i_{eff} = \left(1 + \frac{i}{m}\right)^m - 1$$

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$M\left(\frac{x_1 + x_2}{2}; \frac{y_1 + y_2}{2}\right)$$

$$y = mx + c$$

$$y - y_1 = m(x - x_1)$$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m = \tan \theta$$

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$

In $\triangle ABC$:

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\text{Area} = \frac{1}{2} ab \sin C$$

$$\sin^2 \theta + \cos^2 \theta = 1$$

$$\tan^2 \theta + 1 = \sec^2 \theta$$

$$1 + \cot^2 \theta = \operatorname{cosec}^2 \theta$$

$$\pi \text{ rad} = 180^\circ$$

$$\text{Angular velocity} = \omega = 2 \pi n \quad \text{where } n = \text{rotation frequency}$$

$$\text{Angular velocity} = \omega = 360^\circ n \quad \text{where } n = \text{rotation frequency}$$

$$\text{Circumferential velocity} = v = \pi D n \quad \text{where } D = \text{diameter and } n = \text{rotation frequency}$$

$$\text{Circumferential velocity} = v = \omega r \quad \text{where } \omega = \text{angular velocity and } r = \text{radius}$$

$$\text{Arc length} = s = r\theta \quad \text{where } r = \text{radius and } \theta = \text{central angle in radians}$$

$$\text{Area of a sector} = \frac{rs}{2} \quad \text{where } r = \text{radius, } s = \text{arc length}$$

$$\text{Area of a sector} = \frac{r^2 \theta}{2} \quad \text{where } r = \text{radius and } \theta = \text{central angle in radians}$$

$$4h^2 - 4dh + x^2 = 0 \quad \text{where } h = \text{height of segment, } d = \text{diameter of circle and } x = \text{length of chord}$$

$$A_T = a(m_1 + m_2 + m_3 + \dots + m_n) \quad \text{where } a = \text{width of equal parts, } m_1 = \frac{o_1 + o_2}{2}$$

$$o_n = n^{\text{th}} \text{ ordinate and } n = \text{number of ordinates}$$

OR

$$A_T = a \left(\frac{o_1 + o_n}{2} + o_2 + o_3 + \dots + o_{n-1} \right) \quad \text{where } a = \text{width of equal parts, } o_n = n^{\text{th}} \text{ ordinate}$$

$$\text{and } n = \text{number of ordinates}$$

ANSWER SHEET

NAME AND SURNAME: _____ CLASS: _____

QUESTION 6.4