Province of the
EASTERN CAPE
EDUCATION

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NATIONAL SENIOR CERTIFICATE

GRADE 12

SEPTEMBER 2026

TECHNICAL MATHEMATICS P1

MARKS: **150**

TIME: **3 hours**

This question paper consists of 9 pages, a 2-page information sheet, and a 27-page SPECIAL ANSWER BOOK.

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INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

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

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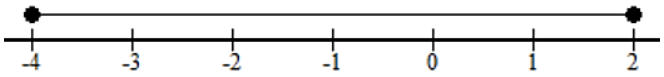
QUESTION 1

1.1 Solve for x:

1.1.1 $x(3x-1)=0$ (2)

1.1.2 $-3x(2x+1)+5=4$ (Correct to TWO decimal places) (4)

1.2 Consider the number line given:



1.2.1 Write down the critical values. (2)

1.2.2 Write the solution in interval notation. (1)

1.3 Given: $x+4y=0$ and $x^2+2xy+y=0$

1.3.1 Make x the subject of the equation $x+4y=0$ (1)

1.3.2 Solve for x and y simultaneously. (5)

1.4 The formula used to determine the area (A) of a trapezium is given as:

$$A=\frac{1}{2}(a+b)h$$

Where: A = area in square units
a and b = parallel sides of the trapezium
h = perpendicular height

1.4.1 Make h the subject of the formula. (1)

1.4.2 Hence determine the height (h) of the trapezium if $A = 250\ m^2$; $a = 5\ m$ and $b = 15\ m$. (2)

1.5 Given: $x = 50$ and $y = 2$

1.5.1 Evaluate $\frac{3x}{y}$ (2)

1.5.2 Write the answer in QUESTION 1.5.1 as a binary number. (2)

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QUESTION 2

2.1 Given: $x^2+2x+1=0$

2.1.1 Determine the value of the discriminant. (2)

2.1.2 Hence, describe the nature of roots. (1)

2.2 Consider: $x^2-nx+2x+1=0$

2.2.1 Write the equation in the form $ax^2+bx+c=0$ (1)

2.2.2 Hence, determine the value(s) of n for which the equation will have real roots. (5)
[9]

QUESTION 3

3.1 Simplify the following, **showing ALL calculations,** where applicable:

3.1.1 $\sqrt{16^x}$ (1)

3.1.2 $\dfrac{\sqrt{16^x}-2^{2x-1}}{\left(2^x\right)^2}$ (3)

3.2 Given: $\log 4-\log 2$

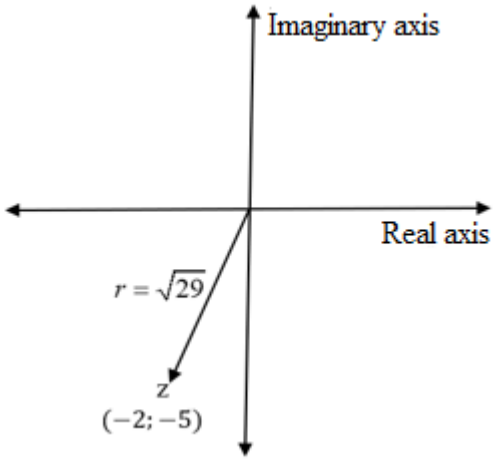
3.2.1 Simplify into a single logarithmic expression. (2)

3.2.2 If $\log 16=a$, express the simplified expression in QUESTION 3.2.1 in terms of a. (2)

3.3 Solve for x: $2\log x+\log 5-\log(x-1)=\log 20$ (5)

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3.4 Consider the argand diagram below:



3.4.1 Use the Argand diagram above and write down the complex number in the form $z = a + bi$. (2)

3.4.2 Calculate the value of the argument (θ) of z. (3)

3.4.3 Hence, write z in the polar form $z = r(\cos\theta + i\sin\theta)$. (1)

3.5 Write down the numerical value of p and q if $i^4 + pi = q - 6i$. (3)

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QUESTION 4

4.1 Given functions g and h defined by $g(x) = \frac{-1}{x} - 3$ and $h(x) = 2^{-x} - 3$ respectively.

4.1.1 Write down the equations of the asymptotes of g. (2)

4.1.2 Determine the x- and y-intercept of h. (4)

4.1.3 Determine the x-intercept of g. (2)

4.1.4 Write down the range of h. (1)

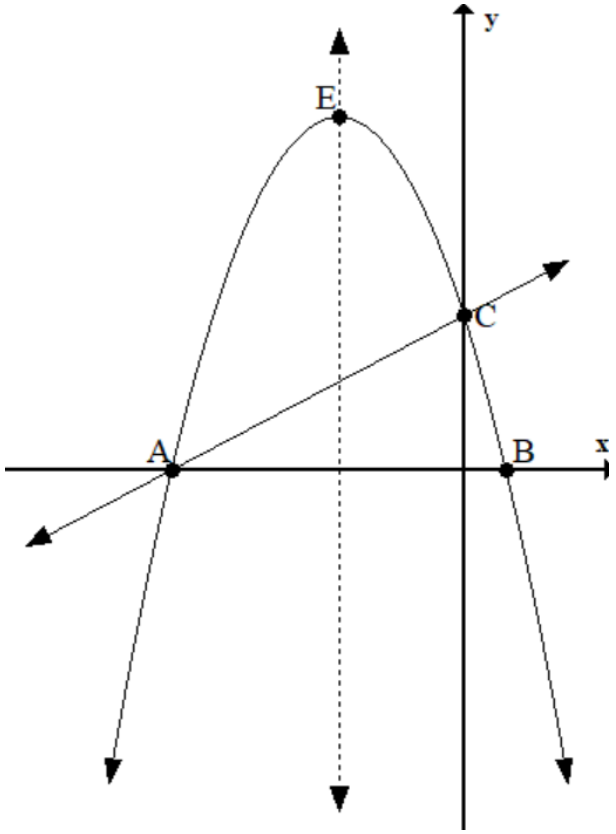
4.1.5 Sketch the graphs of g and h on the same set of axes provided in the SPECIAL ANSWER BOOK. Clearly show ALL intercepts and asymptotes. (5)

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4.2 The sketch below shows graphs of f and y defined by $f(x) = -x^2 - 6x + 7$ and $y = x + c$ respectively.

- A, B and C are the intercepts of f.
- E is the turning point of f.



4.2.1 Determine the coordinates of A and B, the x-intercepts of f. (3)

4.2.2 Write down the equation of the axis of symmetry. (2)

4.2.3 Hence or otherwise, determine the coordinates of E. (2)

4.2.4 Determine the equation of a straight line passing through A and C. (2)

4.2.5 Determine the values of x for which $f(x) < 0$ (2)

4.3 Given the function k defined by $k(x) = -\sqrt{r^2 - x^2}$.

- Range: $-\sqrt{2} \leq y \leq 0$

4.3.1 Write down the value of the radius. (1)

4.3.2 Hence, write the equation of k. (2)

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QUESTION 5

5.1 A lump sum of R50 000 is invested at 10,5% per annum compounded monthly.

5.1.1 Determine the equivalent effective annual rate. (3)

5.1.2 Determine how much will be in the savings account in 6 years. (3)

5.2 The thickness of a vehicle's brake pads decreases linearly from 12 mm to 3 mm over a period of 6 months.

5.2.1 Write down the formula to calculate simple depreciation. (1)

5.2.2 Hence, calculate the rate of depreciation of the brake pads. (3)

5.3 Mr Kiza deposits R30 000 in a bank account and leaves the money in the account for 4 years. For the first 2 years, interest is calculated at 4,3% p.a. compounded quarterly. For the remaining 2 years, interest is calculated at 5% p.a. compounded monthly. How much money will be in the account at the end of the 4 years? (5)

[15]

QUESTION 6

6.1 Given: $f(x)=1-\frac{1}{2}x$

Determine $f'(x)$ using FIRST PRINCIPLES. (5)

6.2 Given: $y=\frac{5x^9}{4x^{11}}+12$, determine:

6.2.1 $\frac{d}{dx}(12)$ (1)

6.2.2 $\frac{dy}{dx}$ (2)

6.3 Evaluate: $D_x\left[2\sqrt{16x^3}\right]$ (2)

6.4 The graph of $f(x)=x-2x^2$ has a tangent with a gradient equal to 9.

6.4.1 Calculate the coordinates of the point of contact between the tangent and the graph. (5)

6.4.2 Hence, determine the equation of the tangent. (2)

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QUESTION 7

Given: $g(x) = x^3 + ax^2 - 5x - 3a$

7.1 If $(x-1)$ is a factor of g, show that the numerical value of $a = -2$. (2)

7.2 Hence, write down the coordinates of the y-intercept of g. (2)

7.3 Determine the coordinates of the x-intercepts of g. (4)

7.4 Determine the coordinates of the turning point of g. (5)

7.5 Sketch the graph of g on the system of axes provided in the SPECIAL ANSWER BOOK. Clearly show ALL intercepts with the axes, as well as the turning point. (4)

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QUESTION 8

The voltage across a capacitator in an electrical circuit is modelled by the function

$$V(t) = t^3 - 6t^2 + 9t + 2$$

Where:

- $V(t)$ is the voltage, measured in volts (V), and
- t is the time, measured in seconds (s) after the circuit is switched on

8.1 Determine the expression for the rate of change of voltage with respect to time. (1)

8.2 Hence, calculate the rate of change of voltage at $t = 2$ seconds. (2)

8.3 Determine the maximum voltage across the capacitator. (5)

[8]

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QUESTION 9

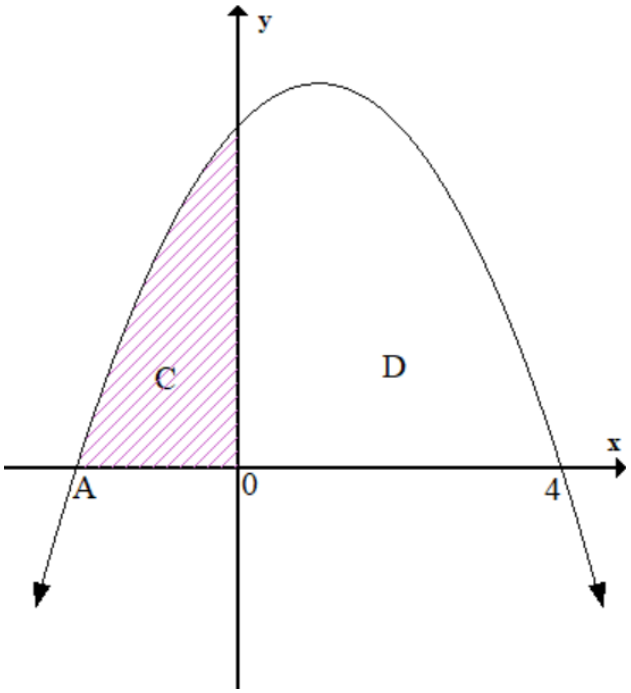
9.1 Determine:

9.1.1 $\int 2^x \, dx$ (2)

9.1.2 $\int \left(7 - 2x^{-1} + 9x^4\right) dx$ (3)

9.2 The sketch below shows a curve defined by $f(x) = -x^2 + 2x + 8$

- The shaded area C is bounded by the curve f and the x-axis x_A and $x = 0$.
- The unshaded area D is bounded by the curve f and the x-axis $x = 0$ and $x = 4$.



Calculate the value of the shaded area, if the area bounded by x_A and $x = 4$ is equal to 36 square units. (7)

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TOTAL: 150

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INFORMATION SHEET: TECHNICAL MATHEMATICS

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

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

$$A = P(1 + ni) \qquad A = P(1 - ni) \qquad A = P(1 + i)^n \qquad A = P(1 - i)^n$$

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

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

$$\int x^n dx = \frac{x^{n+1}}{n+1} + C \quad , \quad n \neq -1 \qquad \int kx^n dx = k \cdot \frac{x^{n+1}}{n+1} + C \quad , \quad n \neq -1$$

$$\int \frac{1}{x} dx = \ln(x) + C, \quad x > 0 \qquad \int \frac{k}{x} dx = k \cdot \ln(x) + C, \quad x > 0$$

$$\int a^x dx = \frac{a^x}{\ln a} + C \quad , \quad a > 0 \qquad \int ka^{nx} dx = k \cdot \frac{a^{nx}}{n \ln a} + C \quad , \quad a > 0$$

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \qquad \text{M}\left(\frac{x_1 + x_2}{2}; \frac{y_1 + y_2}{2}\right)$$

$$y = mx + c \qquad y - y_1 = m(x - x_1) \qquad m = \frac{y_2 - y_1}{x_2 - x_1} \qquad m = \tan\theta$$

$$x.x_1 + y.y_1 = r^2$$

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

In ΔABC:

$$\frac{a}{\sin \text{A}} = \frac{b}{\sin \text{B}} = \frac{c}{\sin \text{C}} \qquad a^2 = b^2 + c^2 - 2bc\cos \text{A} \qquad \text{Area} = \frac{1}{2}ab.\sin \text{C}$$

$$\sin^2\theta + \cos^2\theta = 1 \qquad \tan^2\theta + 1 = \sec^2\theta \qquad 1 + \cot^2\theta = \text{cosec}^2\theta$$

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$\pi rad = 180°$

Angular velocity = $\omega = 2\pi n$ where n = rotation frequency

Angular velocity = $\omega = 360°n$ where n = rotation frequency

Circumferential velocity = $v = \pi Dn$ where D = diameter and n = rotation frequency

Circumferential velocity = $v = \omega r$ where ω = Angular velocity and r = radius

Arc length $s = r\theta$ where r = radius and θ = central angle in radians

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

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

$4h^2 - 4dh + x^2 = 0$ where h = height of segment, d = diameter of the circle and x = length of chord

$A_T = a\left(m_1 + m_2 + m_3 + \ldots + m_{n-1}\right)$ where a = width of equal parts, $m_1 = \frac{o_1 + o_2}{2}$ and n = number of ordinates

OR

$A_T = a\left(\frac{o_1 + o_n}{2} + o_2 + o_3 + o_4 + \ldots + o_{n-1}\right)$ where a = width of equal parts, $o_i = i^{th}$ ordinate and n = number of ordinates

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