basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

SENIOR CERTIFICATE EXAMINATIONS/
NATIONAL SENIOR CERTIFICATE EXAMINATIONS

TECHNICAL MATHEMATICS P1

MAY/JUNE 2026

MARKS: 150

TIME: 3 hours

This question paper consists of 11 pages, a 2-page information sheet and a 22-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, etc. that you have used in determining your 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 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.

QUESTION 1

1.1 Solve for x:

1.1.1 $x^2 - 8x = 0$ (2)

1.1.2 $4 + x^2 + 3x = 5$ (round off your answer to TWO decimal places) (4)

1.1.3 $-x(x-2) \geq 0$ (2)

1.2 Given: $y + 2 = 2x$ and $2x^2 = 2 - y^2$

1.2.1 Make y the subject of the equation $y + 2 = 2x$ (1)

1.2.2 Hence, or otherwise, solve for x and y simultaneously. (5)

1.3 The formula $V = I \times Z$ represents the relationship between the voltage, the current and the impedance in an alternating current circuit.

Where: V = voltage (in volts)
I = current (in amperes)
Z = impedance (in ohms)

1.3.1 Express Z as the subject of the formula. (1)

1.3.2 Given: $V = 4 - 3i$ and $I = 3i$

(a) Write down the conjugate of I. (1)

(b) Hence, determine Z (showing ALL your working). (4)

1.4 Evaluate $\frac{110100_2}{2}$ and leave your answer in binary form. (2)

[22]

QUESTION 2

2.1 Given: $x = \dfrac{1 \pm \sqrt{1 + 40k}}{20 - k}$, the roots of a quadratic equation

2.1.1 Write down the numerical value of k for which the roots will be undefined. (1)

2.1.2 Describe the nature of the roots if the value of $k = 2$ (3)

2.2 Determine the value of q for which the equation $3x^2 - 4x + q = 0$ has real roots. (4)
[8]

QUESTION 3

3.1 Simplify the following **without the use of a calculator**:

3.1.1 $\left(2y^3\right)^4$ (1)

3.1.2 $\left(3\sqrt{a} - \sqrt{b}\right)\left(3\sqrt{a} + \sqrt{b}\right)$ (2)

3.1.3 $\dfrac{3^{4x+1} \times 81^{-x}}{3}$ (3)

3.1.4 $\log 4 + \log 25 - \log_2 16$ (3)

3.2 Solve for x: $\log x - \log 5 = -1$ (3)

3.3 Given the complex number: $z = -\sqrt{3} + i$

3.3.1 Represent z on the Argand diagram on the complex plane provided in the SPECIAL ANSWER BOOK. (2)

3.3.2 Hence, express z in polar form. Show ALL your calculations. (5)

3.4 Write down the numerical values of m and n if $m + ni = -3i + 12$ (2)
[21]

QUESTION 4

4.1 Given: $f(x) = -\frac{1}{2}x^2 - x + 4$

4.1.1 Write down the y-intercept of f. (1)

4.1.2 Determine the x-intercepts of f. (3)

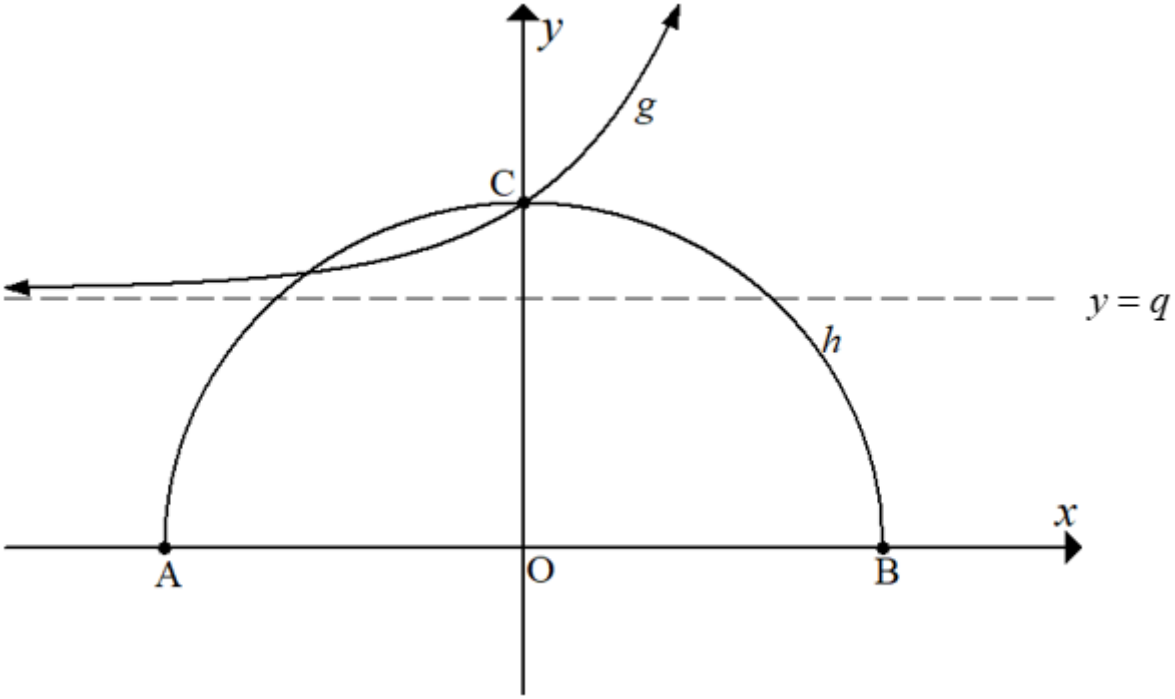
4.1.3 Write down the domain of f. (1)

4.1.4 Determine the coordinates of the turning point of f. (3)

4.1.5 Sketch the graph of f on the set of axes provided in the SPECIAL ANSWER BOOK. Clearly show ALL the intercepts with the axes and the turning point. (3)

4.1.6 Write down the equation of p resulting from shifting f three units upwards. (1)

4.2 The graph below represents the functions defined by $h(x) = \sqrt{16 - x^2}$ and $g(x) = 2^x + q$
A and B are the x-intercepts of h.
C is the y-intercept of h and g.
$y = q$ is the asymptote of g.



4.2.1 Write down the coordinates of C. (2)

4.2.2 Determine the length of AB. (2)

4.2.3 Write down the range of h. (2)

4.2.4 Determine the value of q. (2)

4.2.5 Determine the equation of a straight line through point A and parallel to the straight line that passes through points B and C.
Give your answer in the form $y = ...$ (4)
[24]

QUESTION 5

5.1 At the beginning of 2021, the population of a city was 107 200. It is growing at a compound rate of 7,5% per annum up to the end of 2030.

5.1.1 Write down the number of years from the beginning of 2021 to the end of 2030. (1)

5.1.2 Determine the population of the city at the end of 2030. (3)

5.2 A transport company bought a truck valued at R2 520 000. The value of the truck decreased at a rate of 21% per annum to $\frac{1}{5}$ of its original value, based on the reducing-balance method over a period of time.

5.2.1 Calculate $\frac{1}{5}$ of the original price of the truck. (1)

5.2.2 Determine how long (in years) it will take for the truck to be worth $\frac{1}{5}$ of its original value. (5)

5.3 Phumza decided to save R200 000 for her children's education over a period of 7 years.

- She deposited R60 000 into an investment account on 1 March 2022.
- The interest rate for the first year was 11% per annum, compounded quarterly.
- A further R15 000 was deposited on 1 March 2023.
- The interest rate then changed to 13,7% per annum, compounded semi-annually.
- Phumza plans to further deposit R20 000 on 1 March 2026. The interest rate remains unchanged.

Determine whether she will reach her goal to save enough money for her children's education by the end of the 7th year. (6)
[16]

QUESTION 6

6.1 Determine $f'(x)$, using FIRST PRINCIPLES, if $f(x) = -5$ (4)

6.2 Determine:

6.2.1 $\frac{dy}{dx}$ if $y = -3x^{-2} + 4x^{\frac{1}{2}}$ (2)

6.2.2 $\mathrm{D}_x\left[\left(\frac{3}{x} + 5\right)(2x - 1)\right]$ (6)

6.3 Given the expression: $-2\sqrt{16x^3}$

6.3.1 Write the expression in simplified exponential form. (1)

6.3.2 Hence, or otherwise, determine $\frac{d}{dx}\left(-2\sqrt{16x^3}\right)$ (1)

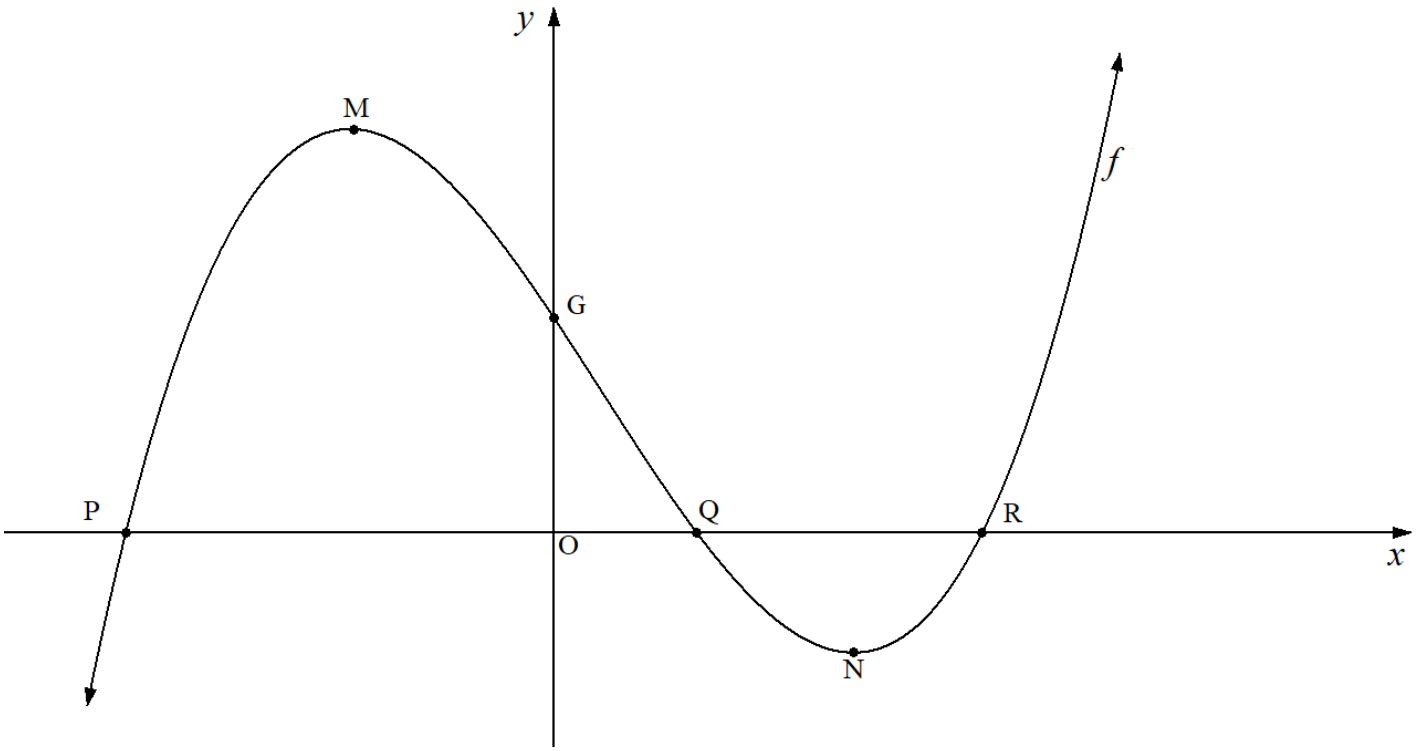
6.4 Given: $g(x) = -2x^2 + 3x$

6.4.1 Determine $g(-1)$. (1)

6.4.2 Hence, determine the equation of the tangent to g at $x = -1$ (5)
[20]

QUESTION 7

The graph below shows the function defined by $f(x) = (x + 3)(x - 1)(x - 3)$
P, Q and R are the x-intercepts of f.
G is the y-intercept of f.
M and N are the turning points of f.



7.1 Determine the equation of f in the form $f(x) = ax^3 + bx^2 + cx + d$ (2)

7.2 Write down the coordinates of G. (2)

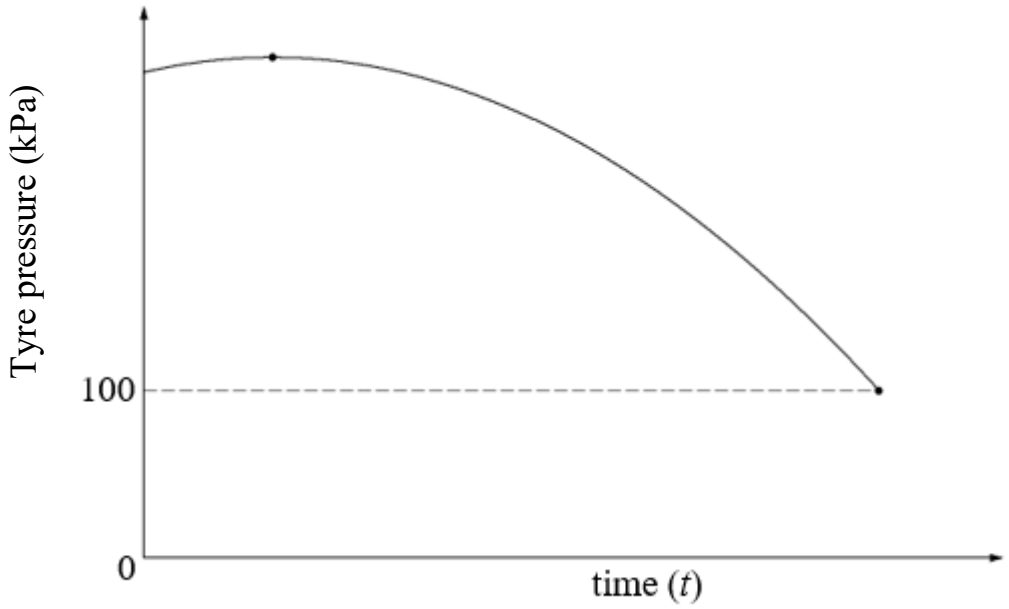
7.3 Determine the average gradient of f between points P and G. (2)

7.4 Determine the coordinates of points M and N, the turning points of f. (5)

7.5 For which values of x is $f(x) < 0$? (3)
[14]

QUESTION 8

The graph below shows the function $\mathrm{P}(t) = -\frac{1}{4}t^2 + 3t + 291$ where $\mathrm{P}(t)$ represents the tyre pressure in kPa at time t in seconds.



8.1 Write down the initial tyre pressure, in kPa. (1)

8.2 Determine the maximum tyre pressure. (4)

8.3 At what time (in seconds) will the tyre pressure $\mathrm{P}(t)$ be equal to 100 kPa? (4)

[9]

QUESTION 9

9.1 Determine:

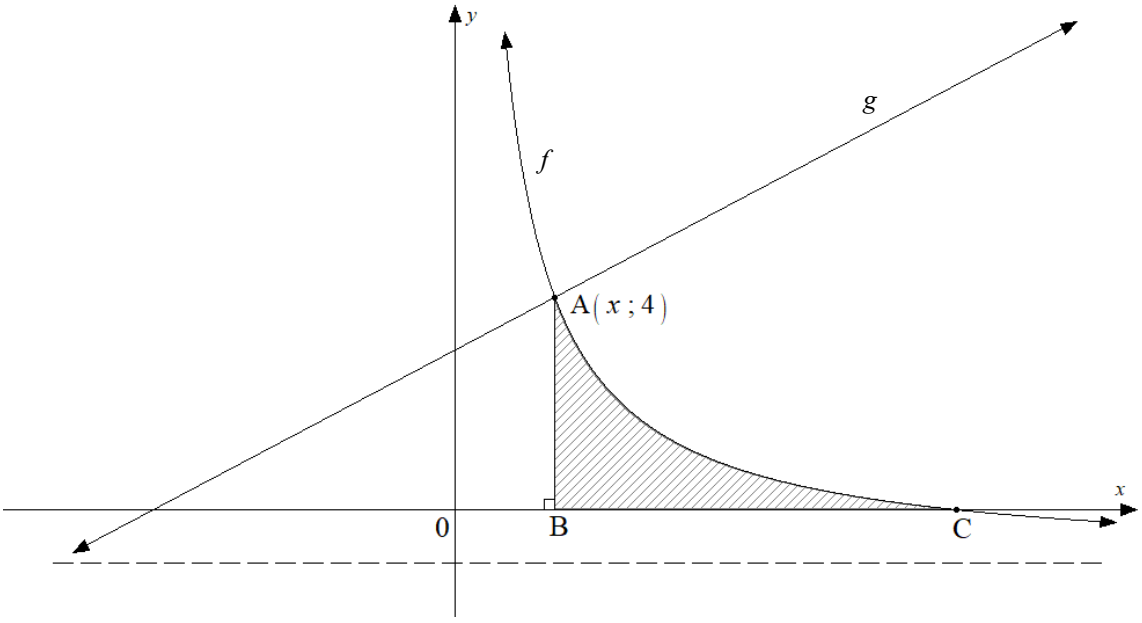
9.1.1 $\int\left(4x^4 + x^{-2} + 5\right)dx$ (4)

9.1.2 $\int\left(\frac{3}{5^{2x}}\right)dx$ (2)

9.1.3 $\int\left(\frac{x^2 - 10x}{x}\right)dx$ (3)

9.2 The diagram below shows the graphs of $f(x) = \frac{5}{x} - 1$, where $x > 0$ and $g(x) = x + 3$

f and g intersect at point $\text{A}(x\,;4)$.
C is the x-intercept of f.
AB is perpendicular to the x-axis.



Calculate the shaded area bounded by the curve f and the x-axis, between $x = \text{B}$ and $x = \text{C}$. (7)

[16]

TOTAL: 150

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INFORMATION SHEET: TECHNICAL MATHEMATICS

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

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

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

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

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

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

$$\int \frac{k}{x} dx = k \cdot \ln x + C, \ \ x > 0$$

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

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

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

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

$$\text{In } \Delta ABC: \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} \qquad a^2 = b^2 + c^2 - 2bc \cdot \cos A$$

$$\text{Area of } \Delta ABC = \frac{1}{2} ab. \sin C$$

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

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π rad $= 180°$

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

Circumferential velocity $= v = \pi D n$ 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 $= \dfrac{r\,s}{2}$ where r = radius, s = arc length

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

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

$A_T = a\left(m_1 + m_2 + m_3 + ... + m_n\right)$ where $a =$ width of equal parts, $m_1 = \dfrac{o_1 + o_2}{2}$ $o_n = n^{th}$ ordinate and n = number of ordinates

OR

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

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