Province of the
EASTERN CAPE
EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE 12

SEPTEMBER 2025

MATHEMATICS P1

MARKS: 150

TIME: 3 hours

* M A T H E 1 *

This question paper consists of 12 pages including an information sheet and an answer book of 23 pages.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

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

QUESTION 1

1.1 Solve for x:

1.1.1 $x^2 = 3 - 2x$ (3)

1.1.2 $3x^2 - 9x + 2 = 0$ (correct to TWO decimal places) (3)

1.1.3 $9 > -x(x-6)$ (4)

1.1.4 $\sqrt{x+5} - \sqrt{x} = 1$ (4)

1.2 Solve for x and y simultaneously:

$2x = 1 - y$ and $y^2 - 2y - 3x + 1 = 3xy - 2x^2$ (6)

1.3 Given: $k = \dfrac{1}{x^2 + 7x + 5}$ and $p = \dfrac{1}{x^2 + 7x + 7}$

Determine the value of p if $\sqrt[3]{k} = 4^{\frac{1}{6}}$ (5)

[25]

QUESTION 2

2.1 Two learners, Amanda and Leroy were given a task to come up with any common ratio (r) that would be suitable to calculate the sum to infinity if it given that the first term, $a = 2$. Below are the calculations:

Amanda's calculation: $a=2$ and $r=3$

$$S_\infty = \frac{2}{1-3}$$
$$= -1$$

Leroy's calculation: $a=2$ and $r=\frac{1}{2}$

$$S_\infty = \frac{2}{1-\frac{1}{2}}$$
$$= 4$$

2.1.1 Which learner's response is incorrect? (1)

2.1.2 Hence, explain why the learner's response is incorrect. (2)

2.2 Evaluate: $\sum_{k=1}^{10} \frac{3}{2}(2)^k$ (4)

2.3 Which term of the sequence $8\ ;\ 6\ ;\ \frac{9}{2};\ \ldots$ will be the first to be less than $\frac{1}{100}$? (4)

[11]

QUESTION 3

3.1 The following information about a quadratic number pattern is given:

- $T_2 - T_1 = -4$
- $T_3 - T_2 = -3$
- Fourth term is equal to 1

3.1.1 Show that the general term of the quadratic number pattern is $T_n = \frac{1}{2}n^2 - \frac{11}{2}n + 15$ (4)

3.1.2 Determine the value of T_{16} (1)

3.1.3 Which TWO terms in the quadratic number pattern will have a difference of 45? (3)

3.2 Given: $S_n = 2n^2 - 6n$

3.2.1 Calculate the sum of the first thirty terms. (2)

3.2.2 Determine the value of n if $T_n = 300$ (3)

[13]

QUESTION 4

Given the function: $f(x) = 3x - 5$, for $x \in [-4;5]$

4.1 Determine the equation of f^{-1} (2)

4.2 Calculate the value of $f(5)$ (1)

4.3 Sketch the graphs of f and f^{-1} on the same set of axes and show the line of symmetry and the coordinates of the endpoints. (4)

4.4 Calculate the coordinates of the point of intersection of f and f^{-1} (4)

4.5 Given the following information:

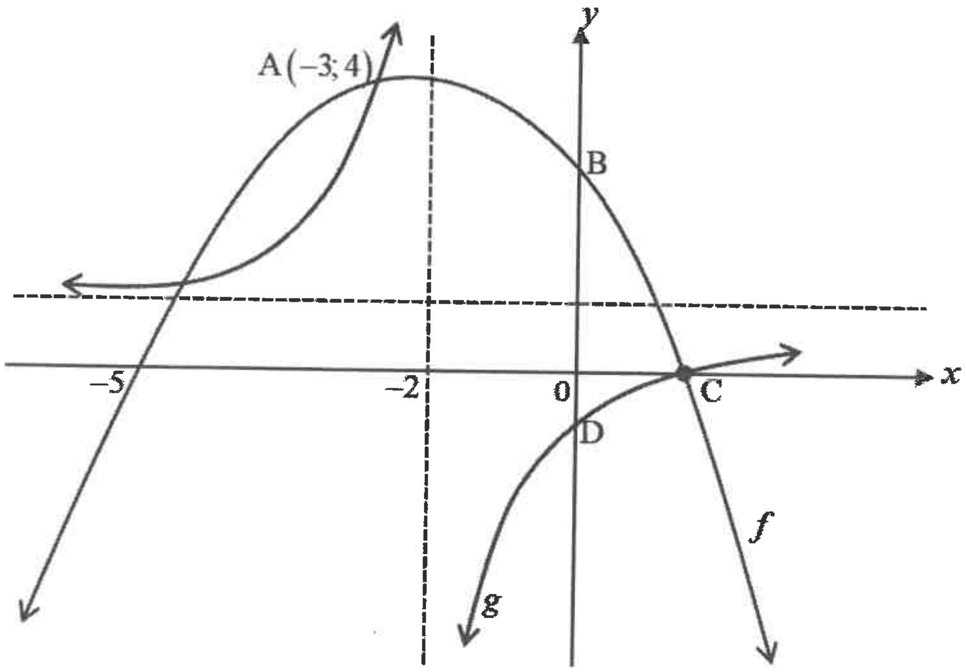
- $f(x) = g'(x)$
- $g(x)$ is a parabola, with y-intercept at $\frac{25}{6}$

Determine the minimum value of $h(x)$ if $h(x) = 2^{g(x)}$ (5)

[16]

QUESTION 5

The graphs of $f(x)=-\frac{1}{2}(x+2)^2+4\frac{1}{2}$ and $g(x)=\frac{a}{x+p}+q$ are drawn below. The graphs of f and g cuts the y-axis at $2\frac{1}{2}$ and $-\frac{1}{2}$ respectively. One of the points of intersection of the graphs is $A(-3;4)$. Point C is the point of intersection and x-intercept of f and g. The vertical asymptote of g is $x=-2$



5.1 Write down the coordinates of B. (1)

5.2 Calculate values of a, p and q (6)

5.3 Determine the range of f (2)

5.4 Determine an equation for the axis of symmetry of g that has gradient equal to -1. (2)

5.5 Determine the average gradient of f between B and C (3)

5.6 For which values of x is:

5.6.1 $f(x)\geq 0$? (2)

5.6.2 $g(x).g'(x)>0$? (2)

5.7 If $h(x)=x$, determine the value(s) of k for which $f(x)=h(x)+k$ has two roots that have different signs. (2)

[20]

QUESTION 6

6.1 Lester invests R8 000 at 13% per annum, compounded quarterly. At the end of the investment period he receives R22 350.

For how long did he invest the money? (4)

6.2 Brian deposits R700 at the end of each month into a saving account for 15 years. Exactly 5 years after the first payment, R5 200 was paid in the account as an additional payment. The interest rate on the savings account is 12% per annum, compounded monthly.

Determine the accumulated amount at the end of the investment period. (5)

6.3 Mr Faku was granted a loan of R900 000, over a period of 20 years. The loan is repaid in equal monthly instalments at the end of each month. The interest rate is 11,5% per annum compounded monthly. The first instalment is paid 4 months after the loan was granted.

6.3.1 Determine Mr Faku's monthly payments. (4)

6.3.2 The balance immediately after 16 years is R379 811,29. Determine how much interest he paid till the end of 16 years. (3)

[16]

QUESTION 7

7.1 Determine $f'(x)$ from first principles if $f(x)=x^2+2$ (4)

7.2 Determine:

7.2.1 $f'(x)$ if $f(x)=(5x-7)(5x+7)$ (2)

7.2.2 Given that $p'(x)=2x^3$, determine $D_x\left[p(x)-\sqrt[3]{x}+\dfrac{5}{x^4}\right]$ (4)

[10]

QUESTION 8

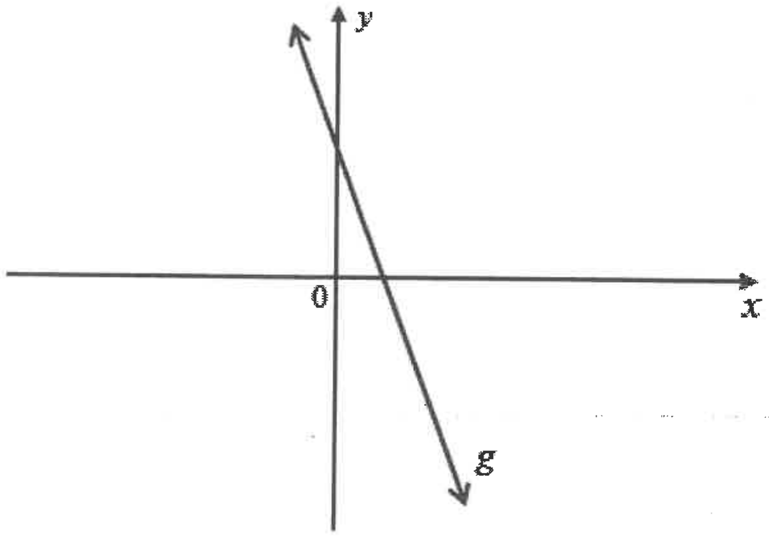
8.1 Given the function: $f(x)=-x^3+5x^2+8x-12$

8.1.1 Determine the x- and y-intercepts of the graph of f (4)

8.1.2 Determine the coordinates of the turning points of f (4)

8.1.3 Sketch the graph of f. Show clearly all the turning points as well as the intercepts on the axes. (3)

8.2 Given: $f(x)=kx^3+px^2+4x-3$ and $g(x)=-6x+10$, where $g(x)=f''(x)$
Below is the sketch of g



8.2.1 Calculate the values of k and p (3)

8.2.2 For which values of x will $f(x)$ be concave up? (2)

[16]

QUESTION 9

The sum of two numbers is 25. Determine the two numbers such that the square of the one number plus three times the square of the other number is a minimum.

[7]

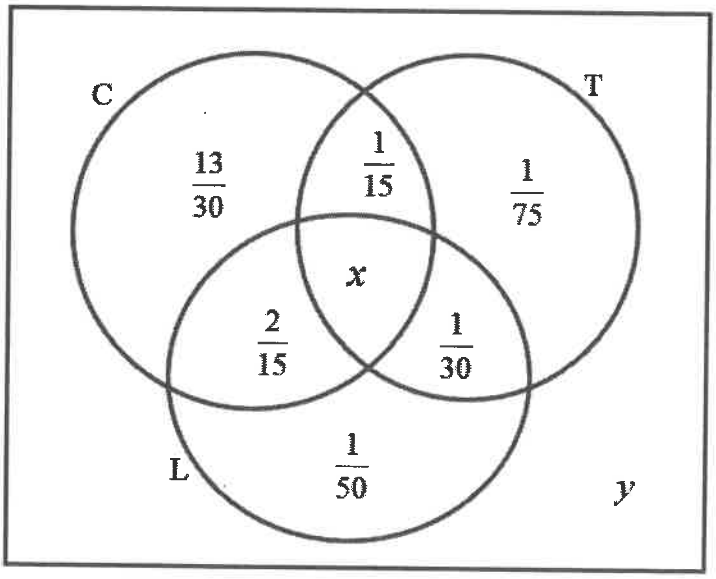
QUESTION 10

10.1 Two mutually exclusive events, A and B are such that $P(A)=0,5$ and $P(\text{not } B)=0,7$

10.1.1 Determine $P(B)$ (2)

10.1.2 Determine $P[\text{not}(A \text{ or } B)]$ (3)

10.2 A survey was conducted on the digital devices that learners own. A certain number of learners were surveyed, and the results were recorded. The survey revealed that there were learners owning cellphones (C), tablets (T) and laptops (L). Below are the results (as probabilities) on the Venn diagram.



10.2.1 Determine the values of x and y if the probability of owning at least one of the three devices is $\frac{9}{10}$ (3)

10.2.2 Calculate the probability that a learner owns a cellphone and tablet. (1)

10.2.3 If the total number of participants in the survey is 150, calculate the number of learners who own laptops only. (2)

[11]

QUESTION 11

Codes of 3 symbols are formed using the twenty-six letters of the alphabet (A–Z) and the ten digits (0–9). Repetition is allowed.

11.1 How many codes (letters and digits) can be formed using at least one letter? (4)

11.2 What is the probability that a code in QUESTION 11.1 will start with a vowel and the second and third symbols form an even number? (1)
[5]

TOTAL: 150

INFORMATION SHEET

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

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

$T_n = a + (n-1)d$ $S_n = \frac{n}{2}(2a + (n-1)d)$

$T_n = ar^{n-1}$ $S_n = \frac{a(r^n - 1)}{r-1}$; $r \neq 1$ $S_\infty = \frac{a}{1-r}$; $-1 < r < 1$

$F = \frac{x[(1+i)^n - 1]}{i}$ $P = \frac{x[1-(1+i)^{-n}]}{i}$

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

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

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

$(x-a)^2 + (y-b)^2 = r^2$

In ΔABC: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$ $a^2 = b^2 + c^2 - 2bc.\cos A$ $area\,\Delta ABC = \frac{1}{2}ab.\sin C$

$\sin(\alpha + \beta) = \sin\alpha.\cos\beta + \cos\alpha.\sin\beta$ $\sin(\alpha - \beta) = \sin\alpha.\cos\beta - \cos\alpha.\sin\beta$

$\cos(\alpha + \beta) = \cos\alpha.\cos\beta - \sin\alpha.\sin\beta$ $\cos(\alpha - \beta) = \cos\alpha.\cos\beta + \sin\alpha.\sin\beta$

$$\cos 2\alpha = \begin{cases} \cos^2\alpha - \sin^2\alpha \\ 1 - 2\sin^2\alpha \\ 2\cos^2\alpha - 1 \end{cases}$$ $\sin 2\alpha = 2\sin\alpha.\cos\alpha$

$\bar{x} = \frac{\sum x}{n}$ $\sigma^2 = \frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n}$

$P(A) = \frac{n(A)}{n(S)}$ $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$

$\hat{y} = a + bx$ $b = \frac{\sum(x - \bar{x})(y - \bar{y})}{\sum(x - \bar{x})^2}$