Confidential

basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

SENIOR CERTIFICATE EXAMINATIONS/ NATIONAL SENIOR CERTIFICATE EXAMINATIONS

MATHEMATICS P1

MAY/JUNE 2025

MARKS: 150

TIME: 3 hours

This question paper consists of 9 pages and 1 information sheet.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of 11 questions.
2. Answer ALL the questions in the SPECIAL ANSWER BOOK provided.
3. Clearly show ALL calculations, diagrams, graphs, etc. which 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 correct 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 $x^2 - 3x - 10 = 0$ (3)

1.1.2 $3x^2 + 6x + 1 = 0$ (correct to TWO decimal places) (3)

1.1.3 $2^{x+4} + 2^x = 8\,704$ (3)

1.1.4 $(x-8)(x+2) \leq 0$ (3)

1.1.5 $x + 3\sqrt{x+2} = 2$ (4)

1.2 A rectangle having sides of $(y - 3)$ metres and $(x + 2)$ metres has a perimeter of 24 metres and an area of 32 square metres. Calculate the values of x and y. (6)

1.3 Show that $\left(1 + x^m + x^{-n}\right)^2 - \left(1 - x^m - x^{-n}\right)^2$ is divisible by 2 for all real values of m and n. (3)

[25]

QUESTION 2

2.1 Given the arithmetic series: $5 + 7 + 9 + \ldots + 93$

2.1.1 Determine the general term of the series, T_n, in the form $T_n = pn + q$. (2)

2.1.2 The given series represents the number of kilometres that an athlete ran each week in preparation for an ultramarathon. The athlete ran 93 km in the last week of the training programme. How long, in weeks, was the training programme? (2)

2.1.3 The athlete used this opportunity to raise funds for her high school. The community sponsored her R10 for each kilometre run during the training programme. Calculate the total amount that the athlete raised for her school. (3)

2.2 The general term of a geometric sequence is $T_n = 2^{n+2}$

2.2.1 Write down:

(a) The first term (1)

(b) The common ratio (1)

2.2.2 Calculate T_{20} (Write your answer as a power of 4.) (2)

2.2.3 Calculate $\sum_{n=1}^{\infty} \frac{1}{T_n}$ (3)

2.2.4 Consider the first 21 terms of the sequence $T_n = 2^{n+2}$. Calculate the sum of the terms in this sequence that are not powers of 4. (4)
[18]

QUESTION 3

Given the quadratic sequence: $14 \; ; \; 9 \; ; \; 6 \; ; \; 5 \; ; \; \ldots$

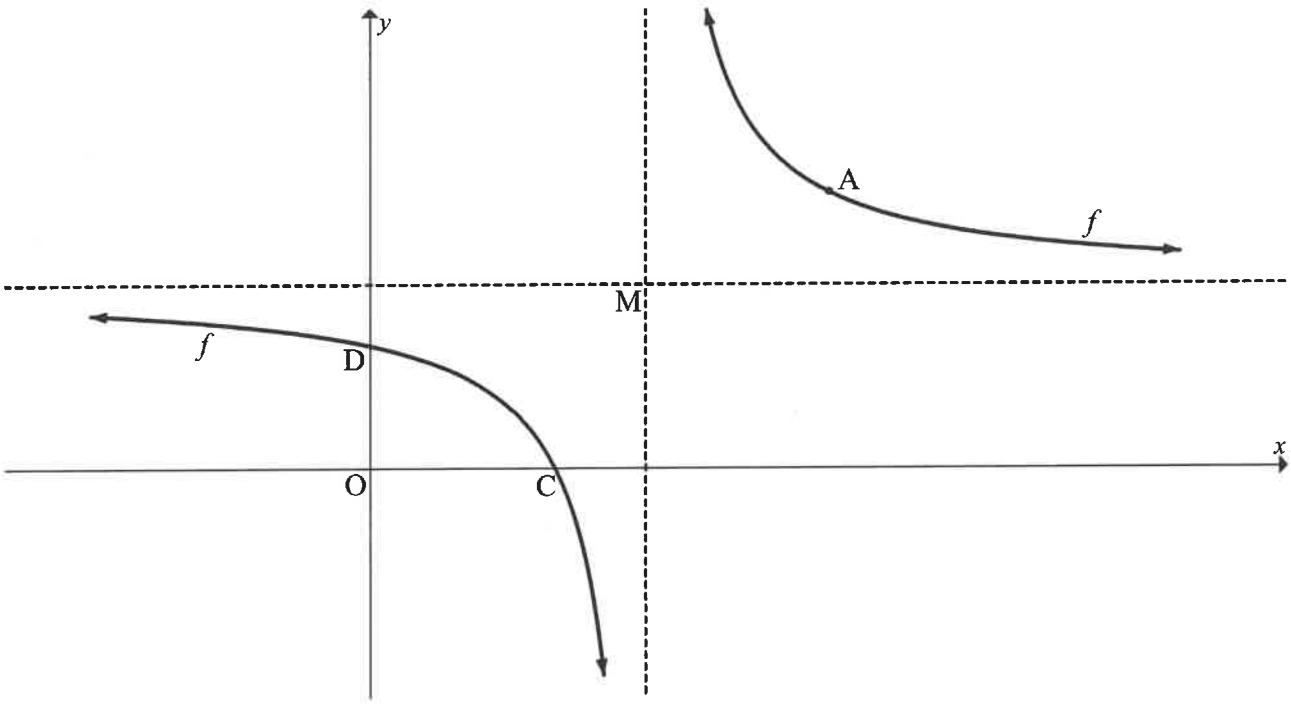
3.1 Show that the general term of this sequence is $T_n = n^2 - 8n + 21$. (3)

3.2 Two consecutive terms of the quadratic sequence have a difference of 33. Calculate the value of the larger term. (3)

3.3 The value of m is added to each term in the quadratic sequence. Determine the values of m for which only the terms between T_1 and T_7 of the quadratic sequence will have negative values. (3)
[9]

QUESTION 4

The graph of $f(x)=\dfrac{4}{x-3}+4$ is drawn below. M is the point where the asymptotes of f intersect. C and D are the x- and y-intercepts respectively of f. A is the point on f that is closest to M.



4.1 Write down the coordinates of M. (2)

4.2 Calculate the coordinates of D. (2)

4.3 If $y=x+t$ is the equation of a line of symmetry of f, calculate the value of t. (2)

4.4 Determine the values of x for which $f(x)\leq 0$. (4)

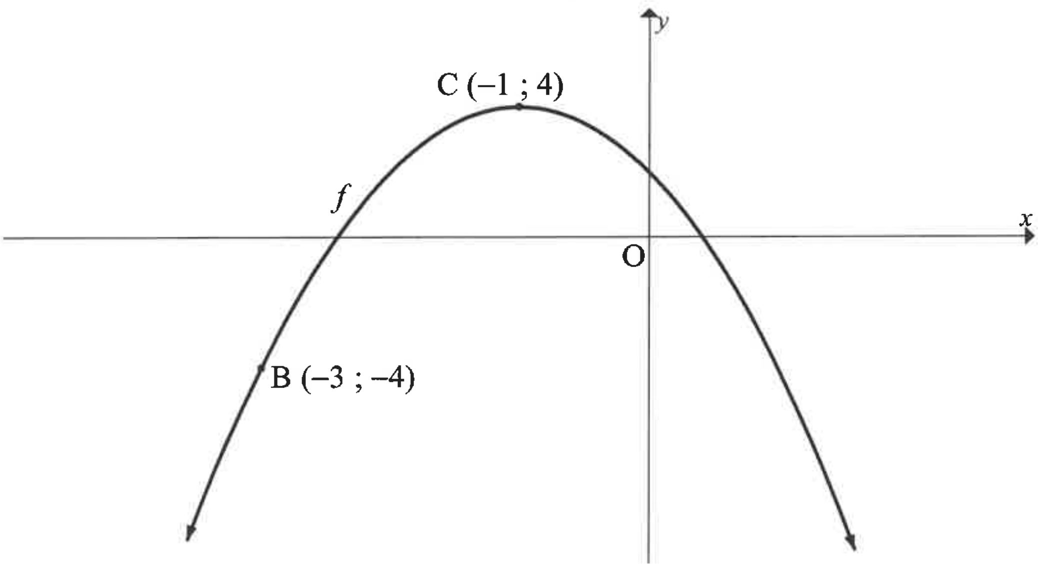
4.5 Calculate the coordinates of A. (3)

4.6 A single transformation is applied to f to obtain a new graph defined as $h(x)=\dfrac{-4}{x+3}+4$. A$'$ is the image of A under this transformation. Calculate the length of AA$'$. (2)

[15]

QUESTION 5

The graph of $f(x) = a(x+p)^2 + q$ is drawn below. C(– 1 ; 4) is the turning point of *f*. B(– 3 ; – 4) is a point on *f*.



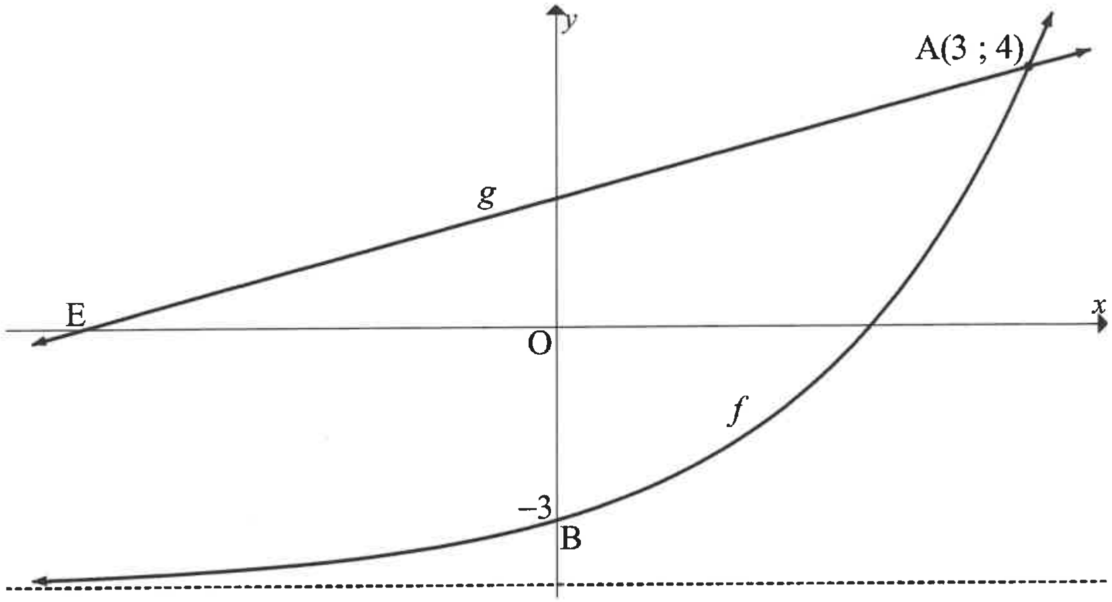
5.1 Show that $f(x) = -2x^2 - 4x + 2$. (3)

5.2 Determine the values of k for which $h(x) = f(x) + k$ will have no real roots. (2)

5.3 The graph of $y = g'(x)$, where g' is the derivative of g, is obtained when f is reflected over the line $y = 4$. Draw a sketch graph of g if $g(0) < 0$. Clearly indicate any stationary points on your graph. (4)
[9]

QUESTION 6

The graphs of $f(x) = p^x + q$ and $g(x) = mx + c$ are drawn below. A(3 ; 4) is the point of intersection of f and g. B(0 ; – 3) is the y-intercept of f. E is the x-intercept of g.



6.1 Calculate the values of p and q. (4)

6.2 Write down the range of f. (1)

6.3 The graph of g^{-1}, the inverse of g, also passes through B. Determine the equation of g in the form $y = \ldots$ (4)

6.4 Write down the equation of g^{-1} in the form $y = \ldots$ (2)

[11]

QUESTION 7

7.1 John invests an amount of money in an account paying interest at a rate of 15% p.a., compounded monthly. Calculate the annual effective interest rate of this investment. (2)

7.2 Tino invests R500 000 in an account earning interest at the rate of 6% p.a., compounded quarterly. Tino decides to withdraw R11 250 at the end of every 3 months. Tino will continue making these regular withdrawals until there is no money in the account. How many withdrawals of R11 250 will Tino be able to make? (5)

7.3 On **1 March 2021**, Abby made a once-off deposit of R12 000 into an account earning interest at a rate of 9,5% p.a., compounded monthly. She deposited R500 into the same account on **1 April 2023** and continues to make these monthly deposits of R500 on the first day of each month thereafter.

Calculate how much money was in the account immediately after the deposit of R500 is made on **1 March 2025**, exactly four full years after her initial deposit. (6)

[13]

QUESTION 8

8.1 Determine $f'(x)$ from first principles if it is given that $f(x) = x^2 - 2$ (5)

8.2 Determine:

8.2.1 $\frac{d}{dx}\left[3x^2 - 4x\right]$ (2)

8.2.2 $g'(x)$ if $g(x) = -2\sqrt{x}(x-1)^2$ (4)

8.3 Given that $y = 4x - 14$ is a common tangent to $f(x) = 2x^2 - 4x - 6$ and $g(x) = ax^2 + bx - 18$, calculate the values of a and b. (6)

[17]

QUESTION 9

Given: $f(x) = x^3 - 6x^2 + 9x - 4 = (x-4)(x-k)^2$

9.1 Show that $k = 1$. (2)

9.2 Calculate the coordinates of the turning points of f. (4)

9.3 Describe the concavity of f at $x = -3$. (2)

9.4 Draw the graph of f. Label ALL turning points and intercepts with the axes. (4)

9.5 Calculate the maximum vertical distance between f and h for $1 < x < 3$, if $h(x) = -2f'(x)$. (6)

[18]

QUESTION 10

10.1 A and B are mutually exclusive events.
If P(A) = 0,42 and P(A or B) = 0,79, calculate P(B). (2)

10.2 A game at a fun park requires a player to roll a six-sided dice and pick a card from a deck of 52 cards.

A player wins if an odd number appears on the uppermost face of the dice and the player also draws a picture card from the deck.

- A deck of cards has 4 suites (hearts, diamonds, spades and clubs).
- There are 4 picture cards (king, queen, jack and ace) in every suite.

A player pays R10 to play a game and in an hour, 260 people can each play one game. If the owner wants to make a 70% profit per hour, calculate the maximum amount that the owner must pay out to each winner. (6)

[8]

QUESTION 11

Consider the three-digit numbers from 501 up to 999.

11.1 How many of these three-digit numbers have exactly one 5 in them? (4)

11.2 Calculate the probability of a three-digit number not satisfying the condition given in QUESTION 11.1. (3)

[7]

TOTAL: 150

INFORMATION SHEET

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

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

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

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

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

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

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

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

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

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

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

$area\ \ \Delta ABC = \frac{1}{2} ab.\sin C$

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

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

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

$\sin 2\alpha = 2\sin\alpha.\cos\alpha$

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

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

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