KWAZULU-NATAL PROVINCE

EDUCATION
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

MATHEMATICS P1

JUNE EXAMINATION

2025

MARKS: 150

TIME: 3 hours

This question paper consists of 12 pages and an 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.

3. Number the answers correctly according to the numbering system used in this question paper.

4. Clearly show ALL calculations, diagrams, graphs, etc. which you have used in determining your 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 answers correct to TWO decimal places, unless stated otherwise.

8. Write neatly and legibly.

QUESTION 1

1.1 Solve for x:

1.1.1 $(x+3)(2-5x)=0$ (2)

1.1.2 $7x^2+5x-8=0$ (correct to TWO decimal places) (3)

1.1.3 $\frac{7}{x^2-2x-8}>0$ (4)

1.1.4 $3^{x+2}=42-5.3^x$ (3)

1.1.5 $x-\sqrt{5x-1}=5$ (5)

1.2 Solve for x and y simultaneously:

$x-y=3$
$x^2-xy=2y^2+7$ (6)

1.3 Prove that the roots of $2x^2+px-p^2=0$ are rational for all rational values of p. (3)

[26]

QUESTION 2

2.1 Given the arithmetic series: $6+1-4-9$ ....

2.1.1 Write down the value of the next term of the arithmetic series. (1)

2.1.2 Calculate: $6+1-4-9$ .... -239 (5)

2.2 Consider a quadratic pattern: –9 ; –5 ; x ; 15 ; ...

2.2.1 Calculate the value of x. (3)

2.2.2 If the value of $x=3$, determine the n^{th} term of the number pattern. (4)

2.2.3 Explain why all the terms of this quadratic pattern are odd numbers. (2)

[15]

QUESTION 3

3.1 Given: $\sum_{k=1}^{\infty} 4.p^{1-k} = 6$

3.1.1 Calculate the value of p. (4)

3.1.2 Hence, write down the first three terms of the series. (1)

3.2 On a particular day, a grade 12 learner from Dinaledi High School watched a video about number patterns on YouTube.

- At 1 p.m. he shared the link for the video with 5 of his friends.
- At 2 p.m. each of these 5 friends shared the link with 5 other friends.
- Then at 3 p.m., each of those 5 friends shared it again with 5 different people.

If this pattern continues in the same way:

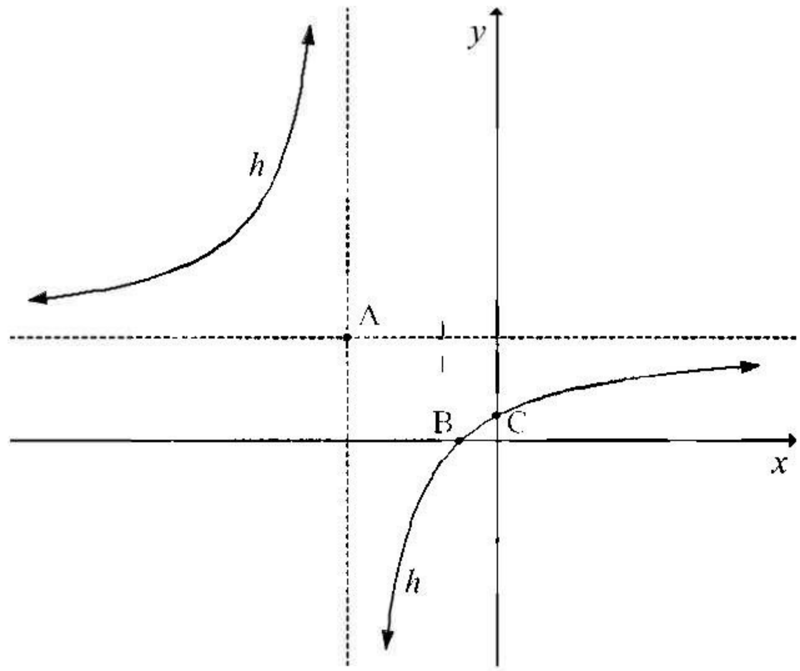
3.2.1 Determine how many people will receive the link at exactly 4 p.m. (2)

3.2.2 Determine the total number of people who would have received the link by 11 p.m. (3)

[10]

QUESTION 4

The sketch below shows the graph of $h(x) = \dfrac{-9}{x+4} + 3$. The asymptotes of h intersect at A. The graph h intersects the x-axis and y-axis at B and C respectively.



4.1 Write down the coordinates of A. (1)

4.2 Calculate the coordinates of B. (2)

4.3 Calculate the coordinates of C. (2)

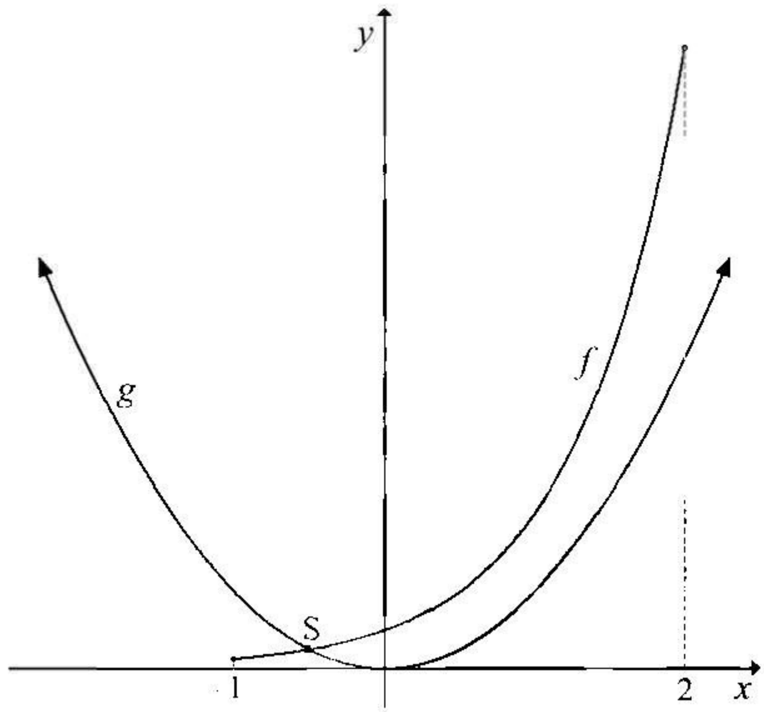
4.4 Describe the translation from h to $j(x) = \dfrac{-9}{x}$. (2)

4.5 Determine the coordinates of the points on j that are closest to the origin. (4)

[11]

QUESTION 5

The diagram below shows the graphs of $f(x) = a^x$, for $x \in [-1\ ;\ 2]$, and $g(x) = bx^2$.
$S\left(-\frac{1}{2}\ ;\ \frac{1}{2}\right)$ is a point of intersection of f and g.



5.1 Determine the values of a and b. (4)

5.2 Draw a sketch graph of the inverse of g. Indicate the coordinates of one point on the graph. (2)

5.3 Is the inverse of g a function? (1)

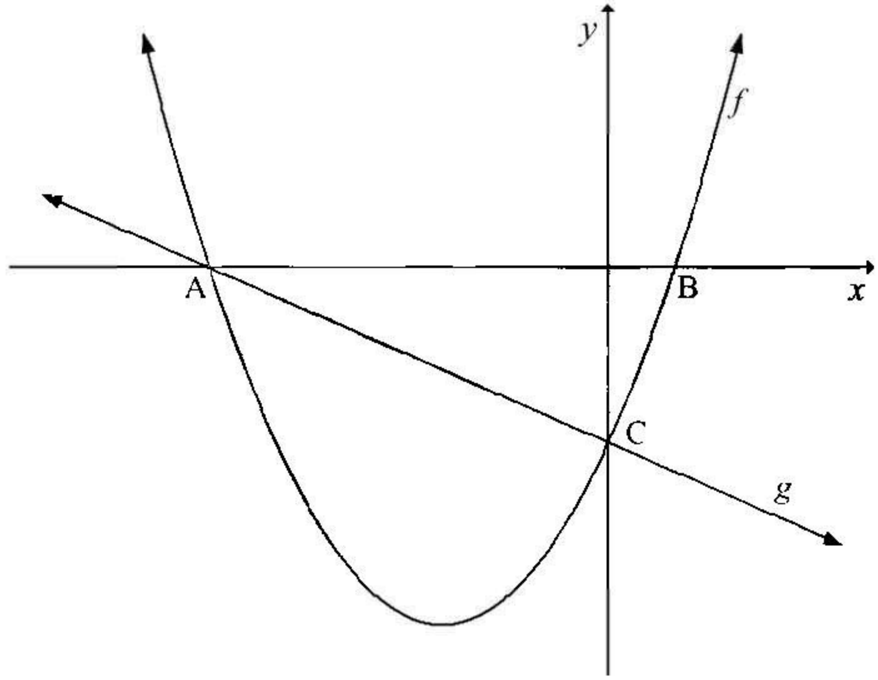
5.4 Determine the equation of f^{-1} in the form of $y = ...$
Also state the restriction on the domain. (4)

5.5 If $x < 0$, write down the values of x for which $f(x) > g(x)$. (2)

[13]

QUESTION 6

The graphs of $f(x) = x^2 + 5x - 6$ and $g(x) = mx + c$ are drawn below.
A and B are the x-intercepts of f and C, the y-intercept. g passes through A and C.



6.1 Calculate the coordinates of A and B. (3)

6.2 Determine the equation of g. (3)

6.3 If $h(x) = f(x) + k$, determine the values of k for which g and h will not intersect. (5)

[11]

QUESTION 7

7.1 Nelisiwe received her yearly bonus and decided to invest the full amount.

- Bank A offers an interest rate of 8,5% p.a., compounded half-yearly.
- Bank B also offers an interest rate of 8,5% p.a., but compounded monthly.

7.1.1 With which bank should she invest? Give a reason for your answer. (2)

7.1.2 Convert 8,5% p.a. compounded monthly to an effective interest rate. (3)

7.2 Calculate the price at which Bongiwe bought her car if its depreciated value after three years is R230 476,05. Depreciation is calculated at a rate of 13% p.a., using the reducing balance method. (2)

7.3 Andries deposited R x into a savings account with an interest rate of 8,7% p.a. compounded quarterly.

- 3½ years after the initial deposit, the interest rate charged changed to 9.2% p.a., compounded monthly.
- 4 years after the initial deposit, he withdrew R1 750.
- His pay-out amount after 6 years of investment is R8 944,97.

Calculate x. (5)

[12]

QUESTION 8

8.1 Given: $f(x) = -7x^2 - 3$

8.1.1 Determine $f'(x)$ from first principles. (5)

8.1.2 Calculate the gradient of the tangent to f at $x = -\frac{1}{2}$. (2)

8.2 Determine:

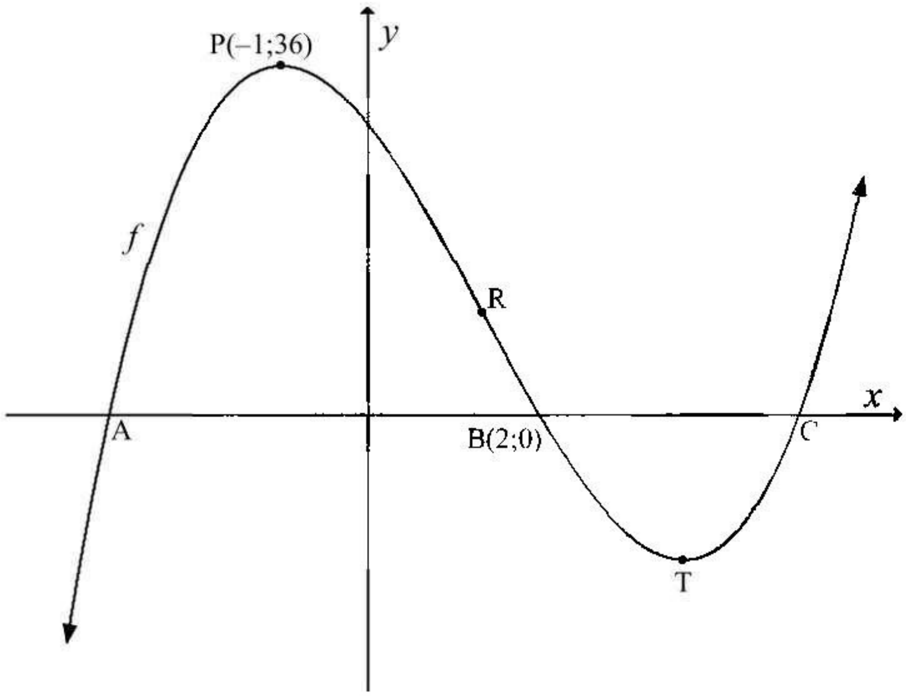
8.2.1 $\frac{dy}{dx}$ if $y = 3x(x^2 - 2)$ (3)

8.2.2 $D_x\left[\frac{\sqrt[3]{x^2} - 8x}{x}\right]$ (3)

[13]

QUESTION 9

The diagram below shows the graph of $f(x) = x^3 + px^2 + qx + 30$.
A, $B(2;0)$ and C are the x-intercepts of f, and $P(-1;36)$ and T are the turning points.
R is the point of inflection.



9.1 Show that $p = -4$ and $q = -11$. (5)

9.2 Calculate the coordinates of point T. (4)

9.3 Determine the length of AC. (4)

9.4 Determine the x-coordinate of point R. (2)

9.5 For which values of x is:

9.5.1 $f'(x) > 0$ (2)

9.5.2 $\frac{f''(x)}{x} < 0$ (2)

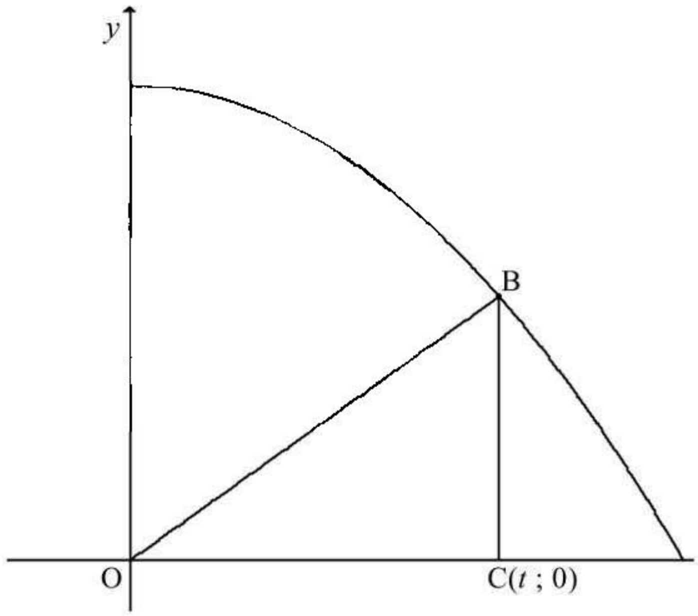
[19]

QUESTION 10

The diagram shows the graph of the parabola with equation $f(x)=9-\frac{x^2}{9};\ x\in[0\ ;\ 9]$.

BC is a line parallel to the y-axis, with $C(t;0)$ a point on the x-axis and B on the graph of f.

OB is drawn.



10.1 Write down the coordinates of B in terms of t. (2)

10.2 Show that the area of ΔOBC can be given by: $A(t)=\frac{9}{2}t-\frac{t^3}{18}$. (2)

10.3 Determine the maximum area of ΔOBC. (5)

[9]

QUESTION 11

11.1 A bag of balls contains 7 green balls and 5 yellow balls. Sihle randomly selects two balls from the bag, one at a time, and without replacing the first one.

11.1.1 Draw a tree diagram to illustrate all possible outcomes. (3)

11.1.2 Determine the probability that she selects one yellow and one green ball, in any order. (3)

11.2 A smoke detector system in a large warehouse uses two devices: A and B.
If smoke is present, the probability that it will be detected by device A is 0,71.
The probability that it will be detected by device B is 0,83, and the probability that it will be detected by both devices is 0.58.

11.2.1 Are the two events, namely that device A will detect the smoke and that device B will detect the smoke, mutually exclusive?
Give a reason for your answer. (2)

11.2.2 If smoke is present, what is the probability that it will **not** be detected? (3)

[11]

TOTAL: 150

INFORMATION SHEET: MATHEMATICS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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