



LIMPOPO

PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF
EDUCATION

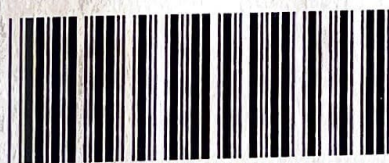
NATIONAL
SENIOR CERTIFICATE

GRADE 12

MATHEMATICS P1
SEPTEMBER 2024

MARKS: 150

TIME: 3 hours



EMATHP1

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 10 Questions.
2. Answer **ALL** the questions.
3. Number your answers correctly according to the numbering system used in this question paper.
4. Clearly show **ALL** calculations, diagrams and graphs that you have used in determining your answers.
5. Answers only will **NOT** necessarily be awarded full marks.
6. An approved scientific calculator (non-programmable and non-graphical) may be used, unless stated otherwise.
7. If necessary, answers should be rounded off to **TWO** decimal places, unless stated otherwise.
8. Diagrams are **NOT** necessarily drawn to scale.
9. Information sheet with formulae is included at the end of the question paper.
10. Write neatly and legibly.

QUESTION 11.1 Solve for x :

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

1.1.2 $3x^2 = -2 - 6x$ (Round off to **TWO** decimal digits) (4)

1.1.3 $2x - 1 = \sqrt{1 - x}$ (4)

1.1.4 $(x + 3)(3 - x) < 0$ (3)

1.2 Solve for x and y simultaneously:

$2x = y + 2$

$y - 2 = x^2 - 3x$ (6)

1.3 An athlete calculated that if he increases his current speed of x km/h by 5 km/h, he can reduce his time (t) by 12 minutes. He will be participating in the City Marathon in Polokwane which is 72 km long.

Determine the value of x . (5)

[25]

QUESTION 2

- 2.1 The 4th term of an arithmetic sequence is 5 and the 14th term is 15.
- 2.1.1 Calculate the common difference. (4)
- 2.1.2 Determine the general term (T_n) of the sequence. (2)
- 2.1.3 Calculate the sum of the first 22 terms. (2)
- 2.2 A quadratic pattern has the following properties:
- $T_1 = x$
- $T_2 = 7$
- $T_4 = 7x$
- $T_3 - T_2 = 6$
- Determine the value of x . (4)

[12]**QUESTION 3**

Given the geometric series: $2 + \frac{2}{3} + \frac{2}{9} + \dots$

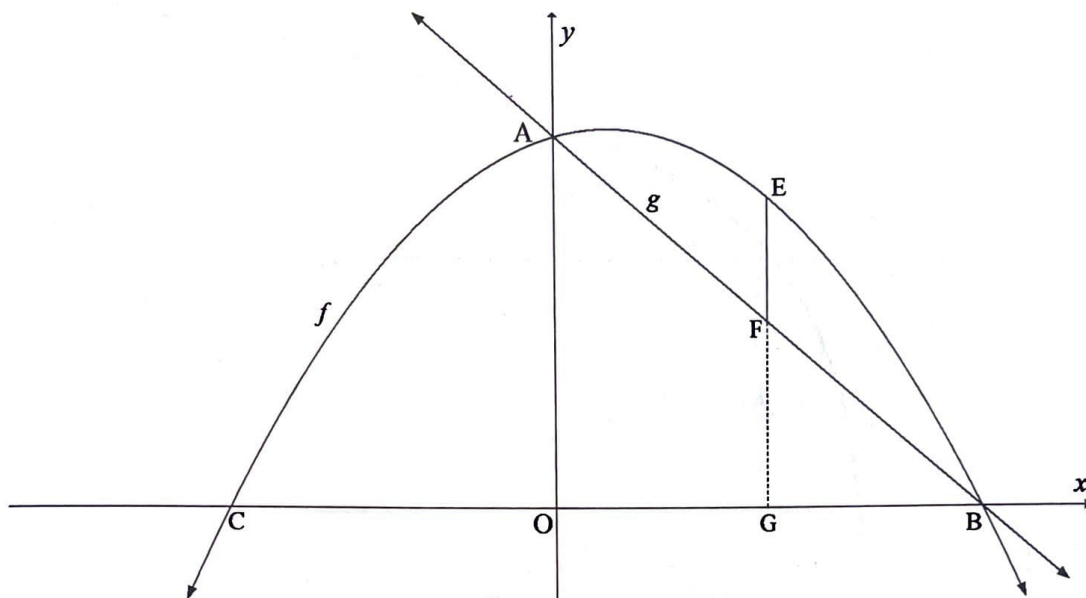
- 3.1 Determine the sum to infinity. (3)
- 3.2 Show that the sum of the first n terms of the series is given by $3 - 3\left(\frac{1}{3}\right)^n$. (3)
- 3.3 Calculate the smallest value of n for which the sum of the first n terms is greater than 2,99. (5)

[11]

QUESTION 4

4.1

The graphs of $f(x) = -x^2 + x + 12$ and $g(x) = mx + k$ are sketched below. B and C are x -intercepts and A is the y -intercept. E is a point on f and F is a point on g . EG is parallel to the y -axis.



4.1.1 Determine the coordinates of B. (2)

4.1.2 Calculate the values of m and k . (3)

4.1.3 If $OG = 2$ units, calculate : (2)

(a) The length of EF. (2)

(b) The area of AOGF. (3)

4.1.4 Determine the coordinates of the point of intersection of g and the tangent of f at C. (6)

4.1.5 Determine which value(s) of x will $\frac{f(x)}{f'(x)} < 0$? (3)

4.2 Given: $f(x) = \frac{2}{x+2} + 2$

4.2.1 Draw a sketch graph of f clearly showing the intercepts and the asymptotes. (4)

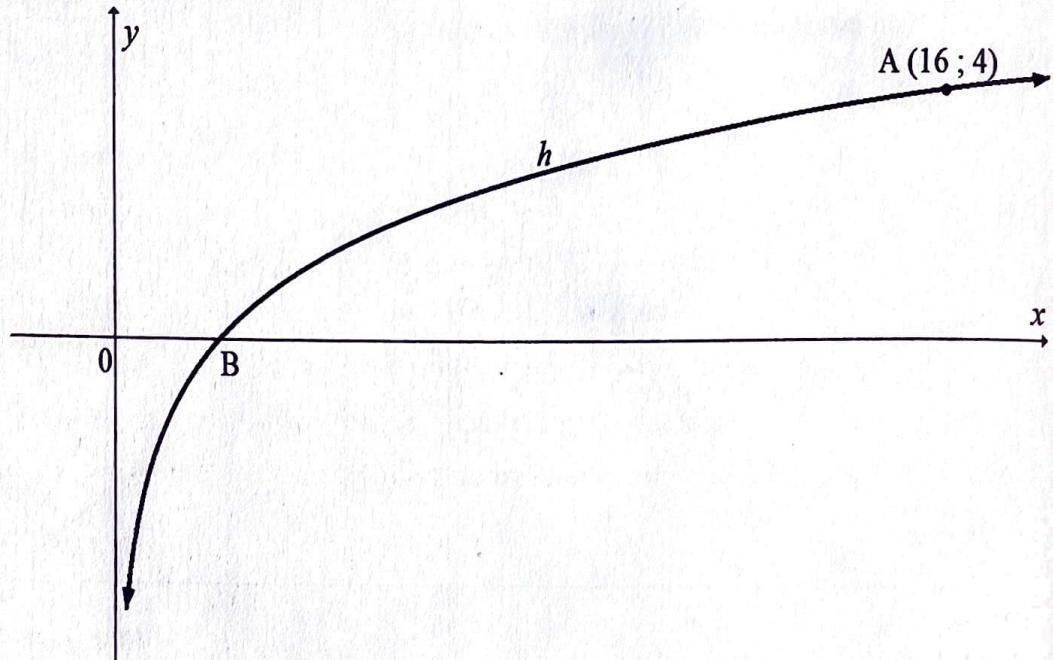
4.2.2 Determine for which values of x will: $\frac{2}{x+2} \geq -2$ (2)

4.2.3 Determine the equation of the axes of symmetry for which the gradient is negative. (2)

[27]

QUESTION 5

The figure below shows the graph of $h(x) = \log_a x$. Point $A(16; 4)$ lies on the curve and B is the x -intercept of h .



- | | | |
|-----|--------------------------------------------------------------------------------|-----|
| 5.1 | Calculate the value of a . | (3) |
| 5.2 | Write down the coordinates of B . | (1) |
| 5.3 | Determine the equation of h^{-1} , in the form $h^{-1}(x) = \dots\dots\dots$ | (2) |
| 5.4 | Write down the range of h^{-1} . | (1) |

[7]

QUESTION 6

Thapelo and Mahlatse invest their inheritance of R200 000 at 11, 5% p.a compounded quarterly. After 10 years, they use their return on their investment to build a house at a cost of R1 850 000. They borrow the balance needed to build the house from a bank. The bank grants them a loan at an interest rate of 12% p.a compounded monthly. They must repay the loan back over a period of 25 years.

- 6.1 Calculate the effective interest rate. (3)
- 6.2 Calculate the value of the investment after 10 years. (2)
- 6.3 Determine the loan amount needed to finish building the house. (2)
- 6.4 Calculate their monthly payment on the loan. (4)
- 6.5 Calculate the balance on the loan after 15 years. (3)
- 6.6 Determine how much interest they will pay on the loan in the 25 years' time. (2)

[16]**QUESTION 7**

- 7.1 Determine $f'(x)$ from first principles if it given that $f(x) = 3x^2$. (5)
- 7.2 Determine:
- 7.2.1 $f'(x)$ if $f(x) = (x-1)(x^6 + x^5 + x^4 + x^3 + x^2 + x + 1)$ (3)
- 7.2.2 $D_x \left[\frac{x^3 + 2x^2 + x}{x+1} \right]$ (4)
- 7.2.3 $\frac{dy}{dx}$ if $y = \sqrt[3]{x} - \frac{1}{3x}$ (4)

[16]

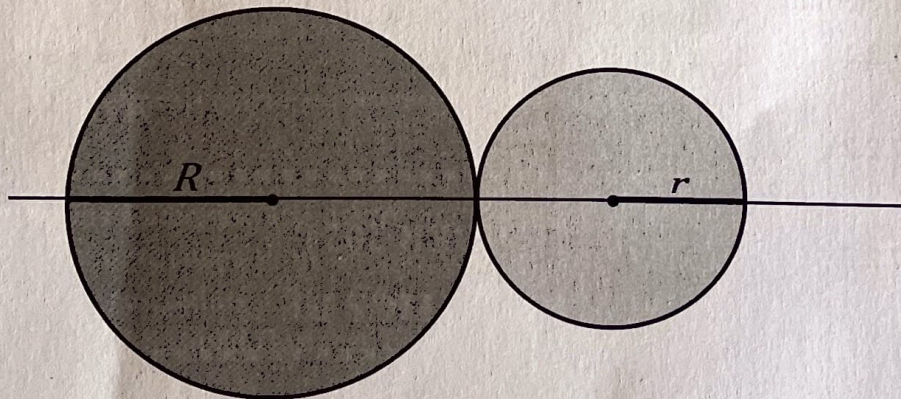
QUESTION 8

Given: $f(x) = 2x(x^2 - 9x + 24)$

- 8.1 Show that $P(3 ; 36)$ is a point on the graph of f . (2)
- 8.2 Calculate the coordinates of the turning points of the graph of f . (4)
- 8.3 Draw a neat sketch graph of f . Indicate the coordinates of any intercepts with the axes and of the turning points (3)
- 8.4 Determine the value(s) of k for which $2x(x^2 - 9x + 24) = k$ has three unequal roots. (2)
- 8.5 Determine the maximum value of $f(x)$ if $x \in [0 ; 5]$. (1)
- [12]**

QUESTION 9

Mashudu Business Enterprise has asked you to design an advertising disc that consists of two circles and has the shape shown in the figure below. The larger circle has radius R and the smaller circle has radius r . The values of R and r must vary, and $R + r = 200$ mm. To minimise costs, Mashudu Business Enterprise has also stated that the area of the shape must be a minimum.



- 9.1 Show that the area(A), of the figure is given by:
 $A = 2\pi(R^2 - 200R + 20\,000)$ (3)
- 9.2 Determine the values of R and r if the area, of the figure is a minimum. (4)
- 9.3 Hence, explain why the shape suggested by the company is not possible if you want to maintain a minimum area. (2)
- [9]**

QUESTION 10

- 10.1 Given $P(A) = 0,45$ and $P(B) = 0,25$.
Determine $P(A \text{ or } B)$ if A and B are mutually exclusive events. (2)
- 10.2 A survey was conducted in one of the schools in Limpopo province with a population of 50 educators. 30 of the educators indicated that they each own a car. Two educators were randomly selected one after the other without repetition.
- 10.2.1 Represent the given information on a tree diagram. Clearly indicate the possible outcomes of the event. (3)
- 10.2.2 Find the probability that only one of the educators selected owns a car. (3)
- 10.2.3 Find the probability that the two educators selected, each owns a car. (2)
- 10.3 You require a password for an online account. The password must have 3 numerical values, followed by 2 vowels.
- 10.3.1 How many passwords are possible if repetitions are allowed? (2)
- 10.3.2 Determine the number of possible passwords with the following conditions:
- If repetitions are not allowed,
 - The password does not start with a zero and
 - It ends with a vowel a .
- (3)
- [15]**

INFORMATION SHEET

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

$$A = P(1 + ni)$$

$$A = P(1 - ni)$$

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

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

$$T_n = a + (n - 1)d$$

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

$$T_n = ar^{n-1}$$

$$S_n = \frac{a(r^n - 1)}{r - 1}; \quad r \neq 1$$

$$S_\infty = \frac{a}{1 - r}; \quad -1 < r < 1$$

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

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

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

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$M\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$$

$$y = mx + c$$

$$y - y_1 = m(x - x_1)$$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m = \tan \theta$$

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

In $\triangle ABC$:

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

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

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

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

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

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

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

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

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

$$\bar{x} = \frac{\sum fx}{n}$$

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

$$P(A) = \frac{n(A)}{n(S)}$$

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

$$\hat{y} = a + bx$$

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