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.

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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.

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QUESTION 1

1.1 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: $2 + \frac{2}{3} + \frac{2}{9} + \ldots\ldots\ldots\ldots$

3.1 Determine the sum to infinity. (3)

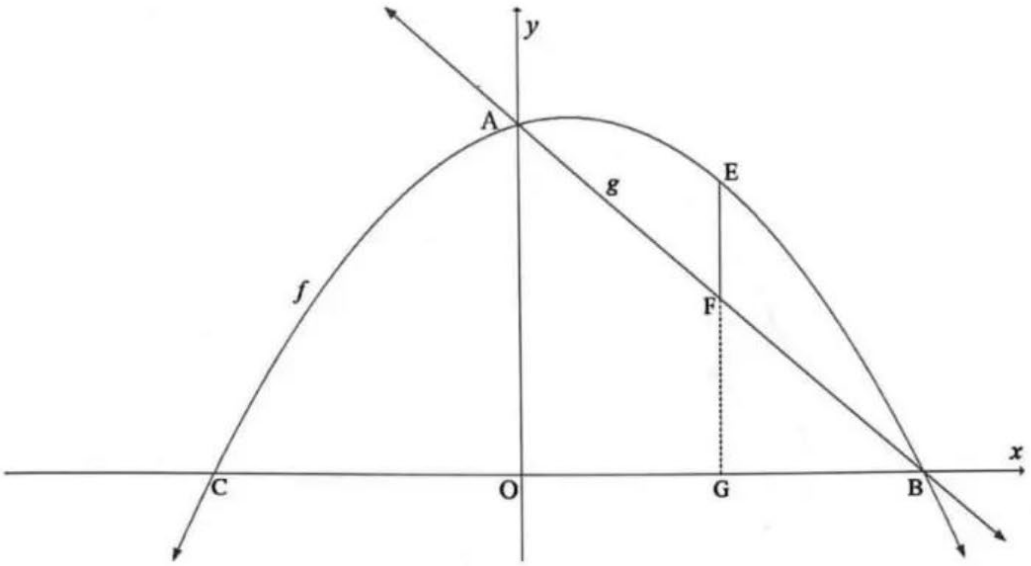
3.2 Show that the sum of the first n terms of the series is given by $3 - 3\left(\frac{1}{3}\right)^n$. (3)

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 :

(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)

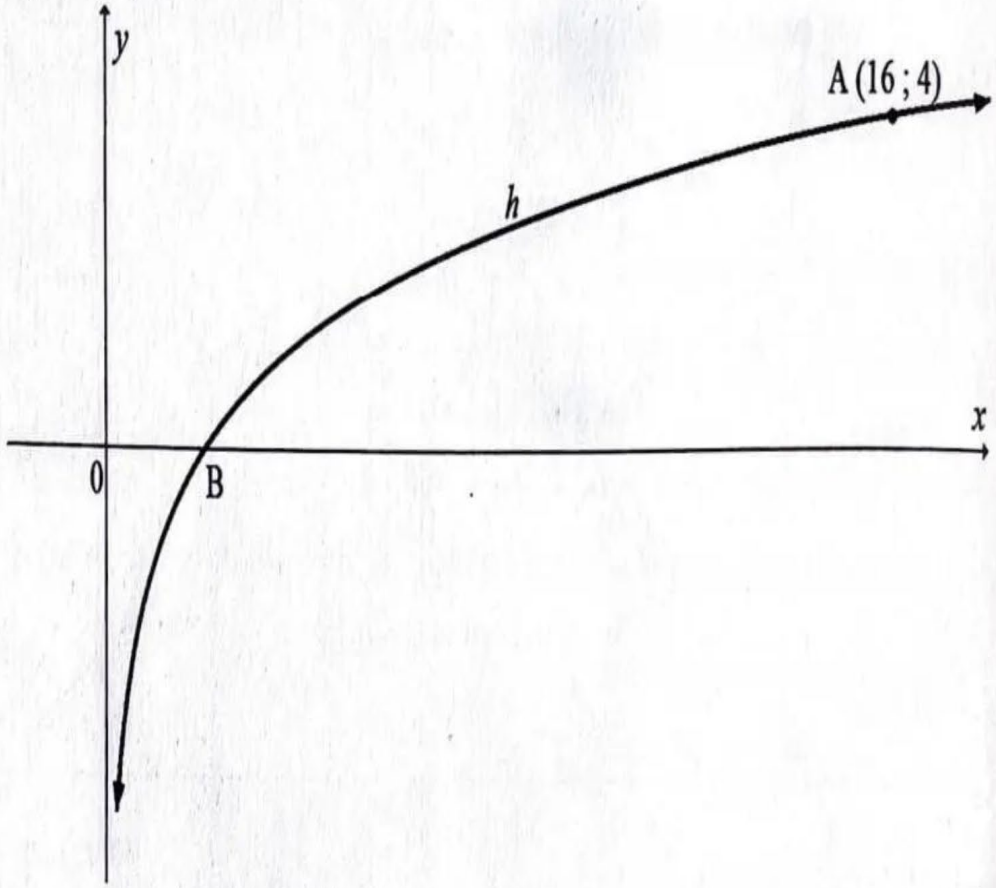
4.2.2 Determine for which values of x will: $\frac{2}{x+2} \geq -2$ (2)

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 $h^{-1}(x) = ...$ (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 $D_x\left[\dfrac{x^3+2x^2+x}{x+1}\right]$ (4)

7.2.3 $\dfrac{dy}{dx}$ if $y=\sqrt[3]{x}-\dfrac{1}{3x}$ (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)

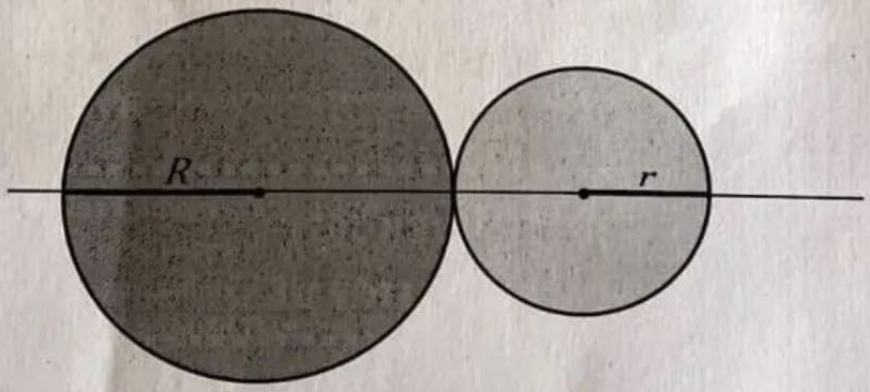
8.4 Determine the value(s) of k for which $2x(x^2-9x+24)=k$ has three unequal roots. (2)

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]

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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

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

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

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

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

$$F = \frac{x\left[(1+i)^n - 1\right]}{i} \qquad P = \frac{x[1-(1+i)^{-n}]}{i} \qquad f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

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

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

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

In ΔABC:

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

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

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

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

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

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

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

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

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