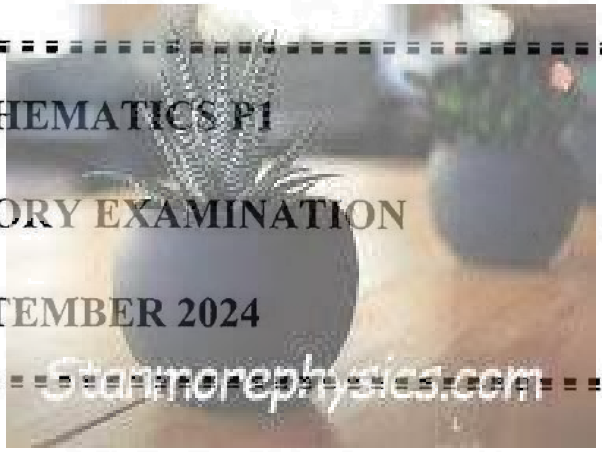
KWAZULU-NATAL PROVINCE

EDUCATION
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12



MATHEMATICS P1

PREPARATORY EXAMINATION

SEPTEMBER 2024

MARKS: 150

TIME: 3 hours

This question paper consists of 10 pages and an 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 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.

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QUESTION 1

1.1 Solve for x:

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

1.1.2 $5x^2 + 2x - 6 = 0$ (answer correct to TWO decimal places) (3)

1.1.3 $2^{x+1} - 3.2^x + 2^x = 12$ (3)

1.1.4 $4x^2 + 12x + 9 > 0$ (3)

1.2 Solve simultaneously for x and y:

$2x - y + 1 = 0$ and $x^2 + xy - y = 3x - 2$ (5)

1.3 Solve for x in terms of y:

$(x+1)(x-3) = (y+1)(y-3)$, where $x \neq y$ (5)

[22]

QUESTION 2

2.1 The first three terms of a quadratic sequence are given:

3; 8; 15; .....

2.1.1 Determine the general term T_n of the sequence. (4)

2.1.2 Is 1700 a term in this sequence? Motivate your answer, using calculations. (4)

2.2 Evaluate:

$1^2 - 2^2 + 3^2 - 4^2 + 5^2 - 6^2 + 7^2 - 8^2 + \text{---------} + 399^2 - 400^2$ (5)

[13]

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QUESTION 3

3.1 The first three terms of a geometric sequence are given: $81;\ m;\ \frac{m}{3};\ \ldots\ldots$

3.1.1 Determine the value of m. (2)

3.1.2 Calculate: $\sum_{t=1}^{9} 81\left(\frac{1}{3}\right)^{t-1}$ (4)

3.2 Given the arithmetic sequence: $\frac{12}{5};\ 3;\ \frac{18}{5};\ \ldots\ldots\ldots\ldots\ldots;\ \frac{333}{5}$

3.2.1 Calculate the number of terms in this sequence. (4)

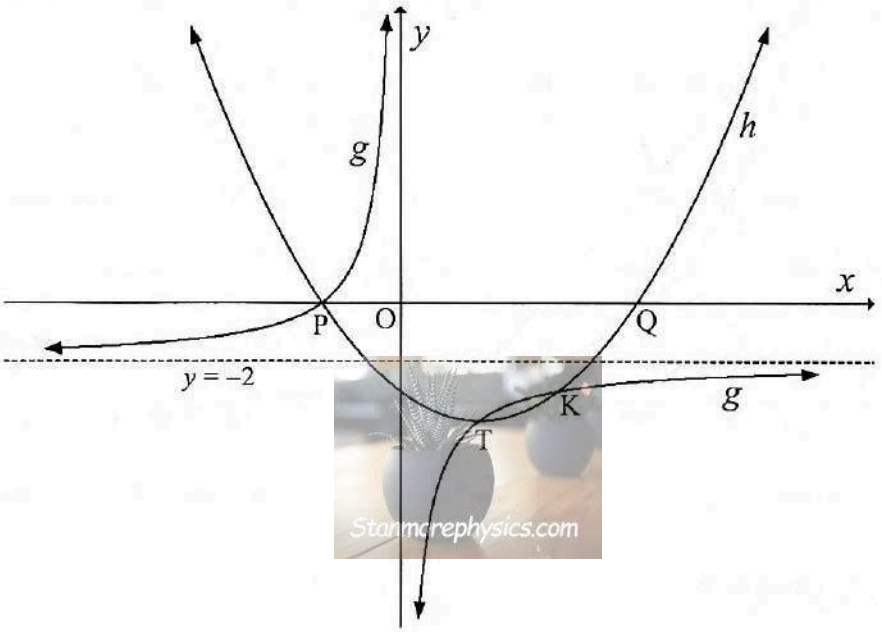
3.2.2 How many terms of this sequence are integers? (4)

[14]

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QUESTION 4

The graphs of $g(x)=\frac{a}{x}+q$ and $h(x)=x^2-2x-3$ are drawn. The graph of h cuts the x-axis at P and Q. The two graphs intersect at points P, T and K. T is the turning point of h. The line $y=-2$ is the asymptote of g.



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4.1 Calculate the coordinates of P and Q. (3)

4.2 Calculate the coordinates of T. (3)

4.3 Write down the equation of the vertical asymptote of g. (1)

4.4 Determine the equation of g. (3)

4.5 Is g a function? Motivate your answer. (2)

4.6 Calculate the coordinates of K. (5)

4.7 For which values of x will $g(x)>h(x)$? (3)

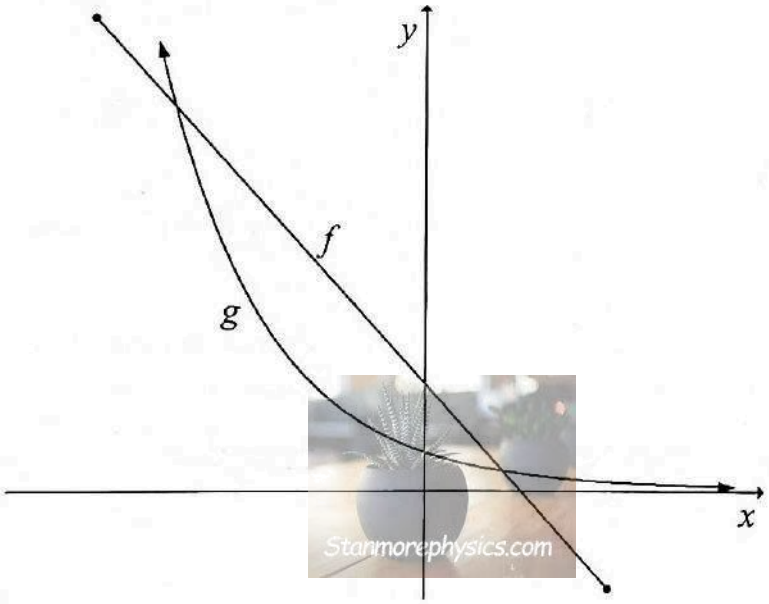
[20]

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QUESTION 5

The following graphs are drawn below:

- $f(x) = -2x + 3$ for $-4 \leq x \leq 3$; and
- $g(x) = 2^{-x}$.



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5.1 Calculate the x-intercept of f. (2)

5.2 For which values of x is $-2^{-x+1}.x + 6.2^{-x-1} < 0$? (4)

5.3 A new graph p is formed by reflecting g in the line $y = x$. Write down the equation of p in the form $y = ...$ (2)

5.4 Write down the range of f^{-1}, the inverse of f. (2)

5.5 Determine the coordinates of the point of intersection between f and f^{-1}. (3)

[13]

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QUESTION 6

6.1 Siphokazi invested R6 500 for 4 years at an interest rate of r % p.a., compounded quarterly. At the end of this period, she received R13 460. Calculate r, correct to ONE decimal place. (4)

6.2 Terence has been planning to go on an overseas tour during December 2024. He needs R65 000 for this tour. Starting from 31 July 2023, he has been depositing Rx in a savings account at the end of each month. He will continue doing this until 30 November 2024, at which time there will be enough money in the account.

Terence will withdraw all the money in the savings account on 30 November 2024, immediately after depositing the last Rx.

Calculate the value of x, if interest was calculated at 8% p.a., compounded monthly. (3)

6.3 Mrs Naidoo plans to buy a house. She will need a bank loan for R650 000. The bank charges interest at 11% p.a., compounded monthly, and will require her to pay a monthly instalment of R7 000.

6.3.1 How many instalments of R7 000 will Mrs Naidoo have to pay? (4)

6.3.2 Calculate the final payment that Mrs Naidoo will have to pay to settle the loan. (4)

[15]

QUESTION 7

7.1 Given: $f(x) = -x^2 + x$. Determine $f'(x)$ from first principles. (5)

7.2 Determine the derivatives of the following:

7.2.1 $y = x^3\left(4 - x^{-3}\right)$ (2)

7.2.2 $f(x) = \dfrac{2x^2 + 3}{\sqrt{x}}$ (4)

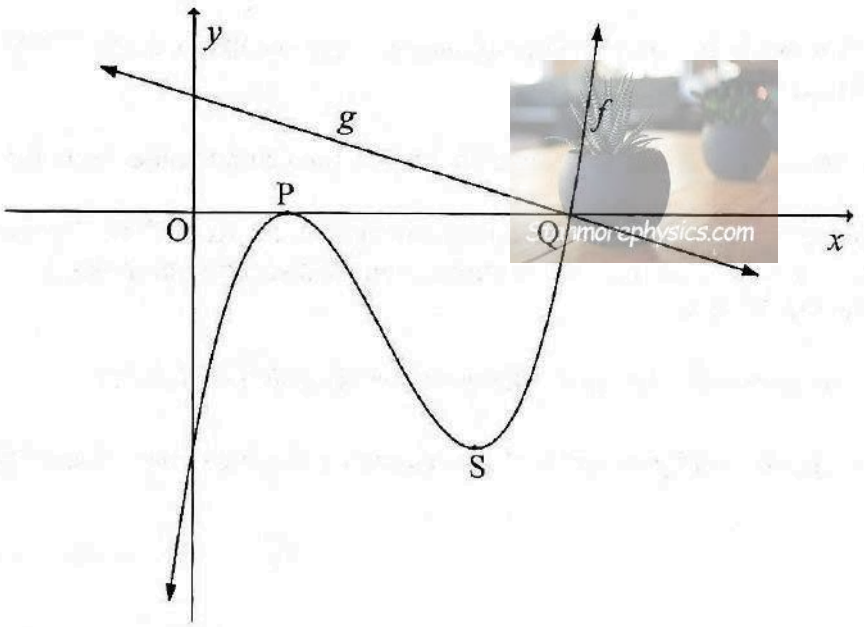
[11]

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QUESTION 8

The graphs of $f(x)=(x-1)^2(x+n)$ and $g(x)=-\frac{1}{2}x+2$ are drawn below.

- P and Q are the x-intercepts of f.
- P and S are the turning points of f.
- g passes through Q.



8.1 Calculate the coordinates of Q. (2)

8.2 Hence, write down the value of n. (1)

8.3 Calculate the length of PQ. (2)

8.4 Calculate the coordinates of S. (5)

8.5 Describe the concavity of f at $x=0$. (1)

8.6 Given: $h(x)=-\frac{1}{2}x+k$.

For which values of x will h be a tangent to f? (5)

[16]

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QUESTION 9

In February 2024, Bafana Bafana played in the semi-finals of the AFCON tournament. During the match, their striker Tebogo Mokoena kicked the soccer ball vertically upwards into the air and its motion was represented by the equation: $h(t) = 1 + 20t - 5t^2$, where h is the height of the ball above the ground in metres, and t is the time in seconds after the ball was kicked.

9.1 Determine the maximum height of the ball above the ground. (5)

9.2 How long will it take for the ball to hit the ground? (3)

9.3 Determine the velocity of the ball 1,5 seconds after he has kicked it. (2)

[10]

QUESTION 10

10.1 During the Covid-19 pandemic, researchers conducted many studies to test the effectiveness of various vaccines. The table below shows data of one of those studies.

	TESTED COVID-19 POSITIVE	TESTED COVID-19 NEGATIVE	TOTAL
MALE	27	189	216
FEMALE	81	567	648
TOTAL	108	756	864

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10.1.1 Calculate the probability that a randomly selected participant is female. (1)

10.1.2 Is the probability of testing positive for Covid-19 independent of gender? Show ALL calculations to motivate your answer. (4)

10.2 Towards the end of 2023, the KZN Traffic Department introduced a new number plate system for cars in the province.

Each new number plate consists of:

- two letters of the alphabet;
- followed by two digits;
- followed by two letters of the alphabet; and
- ending with the letters ZN.

One example of such a number plate is: **RR 23 GB ZN**

All 26 letters of the alphabet, excluding Q and the 5 vowels, may be used.
Any two digits from 0 to 9 may be used.

10.2.1 How many different number plates can be made if letters and digits may be repeated? (2)

10.2.2 How many different number plates can be made if letters and digits may not be repeated? (2)

10.2.3 If letters and digits may not be repeated, what is the probability that a number plate of this form will start with the letters B and C in any order? (3)

10.3 Tracey has 10 sweets in a bag. Some are green and some are red. She picks a sweet from the bag, takes note of the colour, and then puts it back into the bag. She does this four times.
How many green sweets are there in the bag, if the probability that she picks at least one green sweet is 97,44%? (4)

[16]

TOTAL: 150

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INFORMATION SHEET: MATHEMATICS

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

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

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

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

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

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

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

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

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

In ΔABC:

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

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

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

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

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

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

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

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

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

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