KWAZULU-NATAL PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 11

MATHEMATICS P1

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NOVEMBER 2024

MARKS: 150

TIME: 3 hours

This question paper consists of 8 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 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. Diagrams are NOT necessarily drawn to scale.
9. An 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 $x^2 - 7x = -1$ (answers correct to TWO decimal places) (4)

1.1.2 $-x^2 + 2x + 24 \leq 0$ (4)

1.1.3 $(2^x - 1)(2x - 1) = 0$ (3)

1.1.4 $\sqrt{2x+5} = x+3$ (4)

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1.2 Solve for x and y simultaneously:
$y = 2 + 5x$ and $2xy - 7 = -x^2$ (5)

1.3 The roots of a quadratic equation are: $x = \dfrac{m \pm \sqrt{m^2 + 4m}}{2}$.
Calculate the smallest integral value of m for which the roots are non−real. (4)

1.4 Solve for x if $x = \sqrt{x + \sqrt{x + \sqrt{x + \sqrt{x + \sqrt{x + ...}}}}}$ (4)

[28]

QUESTION 2

2.1 Simplify fully, WITHOUT **using a calculator.**

2.1.1 $\dfrac{10^{x+2}.25^x.8^x}{16^{x+1}.125^{x+1}.2}$ (4)

2.1.2 $\dfrac{3^{102}.3^{101}}{3^{204} - 6.3^{201}}$ (3)

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2.2 Solve for x, WITHOUT **using a calculator,** $x^{\frac{2}{3}} - 5x^{\frac{1}{3}} + 6 = 0$ (4)

2.3 Solve for x and y, WITHOUT **using a calculator,** $\dfrac{x.\sqrt{\sqrt{y}}}{2} = \sqrt{\dfrac{3}{2}.\sqrt{\dfrac{9}{2}}}$ (6)

[17]

QUESTION 3

Consider the linear number pattern: 12 ; 9 ; 6 ; ...

3.1 Determine the n^{th} term (general term) of the linear number pattern. (2)

3.2 Calculate the tenth term of the linear number pattern. (2)

3.3 Is -316 a term in the given linear number pattern? Justify your answer with an appropriate calculation. (2)

3.4 The terms of the above linear number pattern are the sequence of first differences of this quadratic sequence: $4x+y\ ;\ -2x-1\ ;\ y+3\ ;\ldots$
Calculate the values of x and y. (5)
[11]

QUESTION 4

Consider the quadratic number pattern: $-13\ ;\ -1\ ;\ 7\ ;\ .....\ ;\ -2101$.

4.1 Write down the FOURTH and FIFTH terms of the quadratic number pattern. (2)

4.2 Show that the general term of the quadratic number pattern is $T_n = -2n^2 + 18n - 29$. (3)

4.3 How many terms are in the above quadratic number pattern? (4)

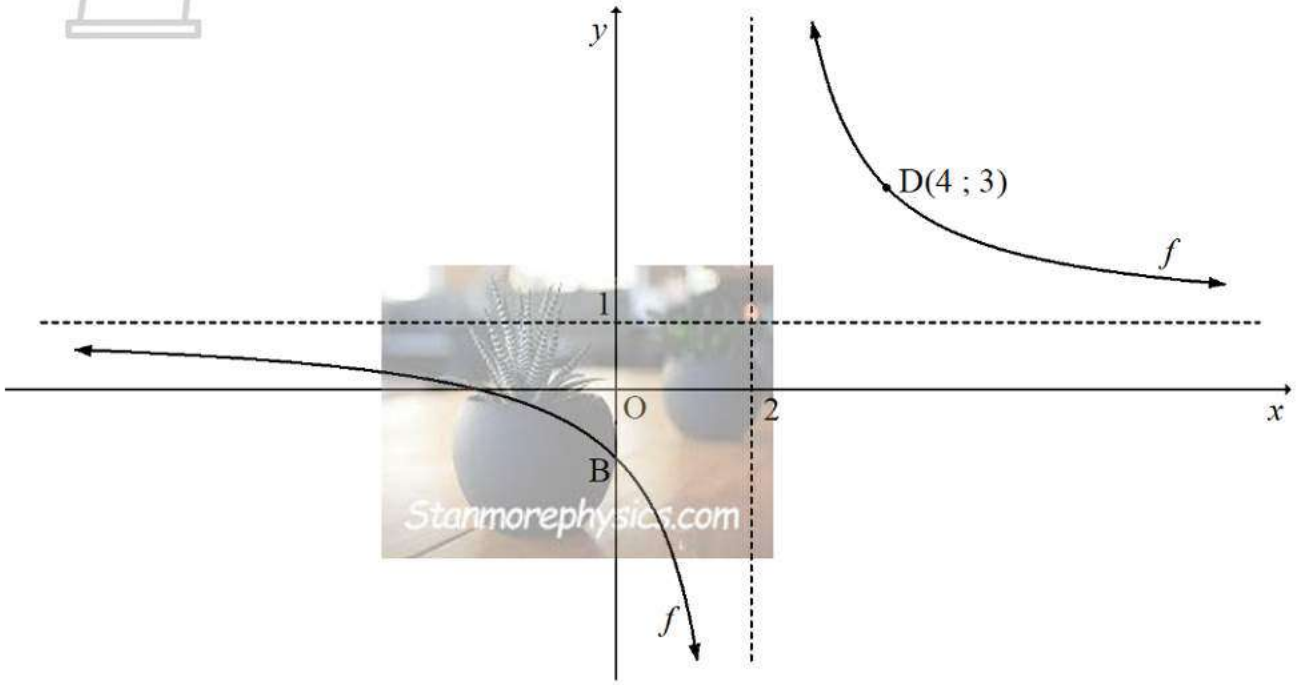
4.4 Determine the maximum value of Q_n if it is given that $Q_n = 2.T_n$ (3)

4.5 Prove that all terms in the sequence of first differences are even numbers. (2)
[14]

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QUESTION 5

In the diagram, the graph of $f(x)=\frac{a}{x+p}+q$ is drawn. $D(4;3)$ is a point on f and B is the y-intercept of f. The asymptotes of f intersect at $(2;1)$.



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5.1 Write down the equations of the asymptotes of f. (2)

5.2 Show that the equation of f is $f(x)=\frac{4}{x-2}+1$ (2)

5.3 Calculate the coordinates of B. (2)

5.4 Determine the equation of the axis of symmetry which has a positive gradient. (2)

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

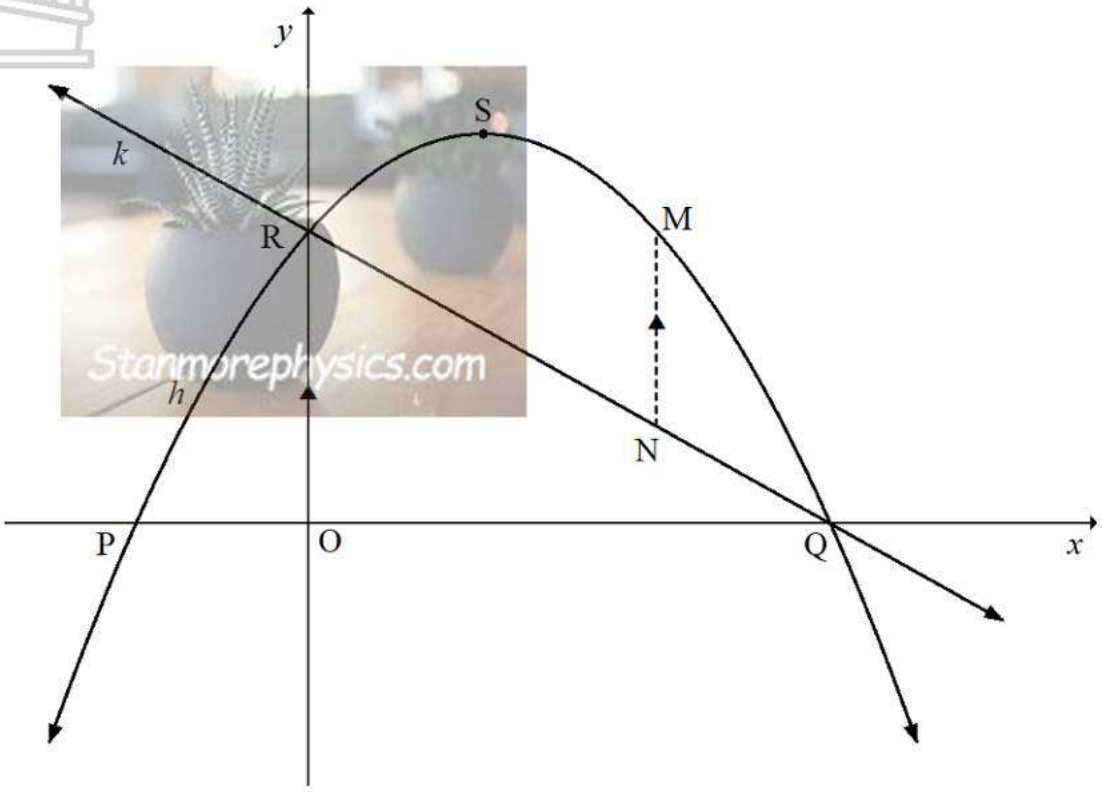
5.6 The graph of f is transformed to obtain the graph of $h(x)=\left(\frac{1}{4}x\right)^{-1}$.

Describe the transformation, in words, from f to h. (3)

[15]

QUESTION 6

The graphs of $h(x) = ax^2 + bx + c$ and $k(x) = -x + 6$ are drawn below. P and Q(6;0) are the x-intercepts of h and S is the turning point of h. Graphs h and k have a common y-intercept, R . M lies on h and N lies on k such that MN is parallel to the y-axis.



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6.1 Write down the coordinates of R. (1)

6.2 It is further given that PQ is 8 units. Write down the x-coordinate of P. (1)

6.3 Prove that $a = -\frac{1}{2}$, $b = 2$ and $c = 6$ (4)

6.4 Calculate the coordinates of S. (3)

6.5 Write down the range of h. (1)

6.6 Determine the values of x for which $\frac{x}{h(x)} \geq 0$ (3)

6.7 If $g(x) = h(x) + d$, determine the values of d for which $g(x)$ will always intersect the x-axis. (2)

6.8 Determine the maximum length of line MN when $h(x) > k(x)$ (4)

[19]

QUESTION 7

Given the function $g(x) = 2x + 6$.

The function of $f(x) = b^x + q$ is defined by the following properties:

- $0 < b < 1$
- $f(0) = 3$
- range is $y \in \mathbb{R}, y > 2$

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7.1 Draw a neat sketch of f and g on same set of axes. Clearly show all intercepts with the axes, and asymptotes, if any. (5)

7.2 The coordinates of the point of intersection of f and g are $(-1\ ;\ 4)$.

7.2.1 If f and g are reflected along the line $x = 1$, write down the coordinates of the point of intersection of the images of f and g under this transformation. (2)

7.2.2 Determine the values of x for which $0 \leq g(x) \leq 4$ (2)

7.2.3 Determine the values of k for which the roots of $-2.f(x) = k$ are negative. (2)

[11]

QUESTION 8

8.1 Miss Gwala invested R30 000 at an interest rate of 12% p.a., simple interest. After n years, the accumulated value of her investment was R51 600. Calculate the value of n. (2)

8.2 The total number of bees in an apiary are declining each year at the rate of 2,5% of the total number of the previous year. There are currently 20 416 bees in the apiary. How many bees in total were in the apiary 8 years ago? (Round off your answer to the nearest whole number). (3)

8.3 Mrs Howard invested R10 050 on 1 January 2020 in an account that paid interest at the rate of x % p.a., compounded quarterly. The accumulated amount in the account on 1 January 2024 was R13 867. Calculate the value of x. (4)

8.4 Mr Mnqayi invested R50 000 in a savings account for 7 years. The investment earned interest at the rate of 14% p.a., compounded monthly for the first three years. The rate of interest changed to 13% p.a., compounded half-yearly, for the remaining four years. Mr Mnqayi withdrew R6 032 from the account 5 years after making the initial deposit.

8.4.1 Calculate the accumulated amount in the account three years after making the initial deposit. (3)

8.4.2 Calculate the accumulated amount in the savings account at the end of the seven-year period. (4)

[16]

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QUESTION 9

9.1 A and B are events such that P(A) = 0,38 , P(not B) = 0,77 and P(A or B) = 0,425. Calculate:

9.1.1 P(B) (2)

9.1.2 P(A and B) (2)

9.2 There are y learners in Grade 11 at a certain high school. The principal observed the attendance and punctuality on a certain day. The results are summarised in the table below.

	Arrived on time	Arrived late	Absent	Total
Boys	a	b	c	30
Girls	d	10	e	m
Total	40	n	h	y

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9.2.1 Are the events 'being a girl' and 'arrived late' mutually exclusive? Give a reason for your answer. (2)

9.2.2 The events 'being a boy' and 'arrived on time' are independent. It is also given that P(being a boy and arrived on time) = $\frac{3}{16}$.

Calculate the value of y. (4)

[10]

QUESTION 10

10.1 A survey was conducted among 165 Grade 12 learners. These learners were asked which car brand they preferred among BMW, Audi and VW.
The results of the survey are summarised below.

- 42 learners preferred a BMW.
- 85 learners preferred an Audi.
- 106 learners preferred a VW.
- 18 learners preferred a BMW and an Audi, but not a VW.
- 40 learners preferred a VW and an Audi, but not a BMW.
- x learners preferred a BMW and a VW.
- 13 learners preferred all three car brands.
- 20 learners did not prefer any of these three car brands.

Draw a Venn diagram to represent the above information. (4)

10.2 A Grade 11 teacher collected the mathematics workbook from each of the 25 learners in her class. Some of the learners in her class are boys and the remainder are girls. The teacher randomly selected the first book from the pile and marked it. The teacher again randomly selected the second book from the pile and marked it.
The probability that the first two books selected belonged to boys is $\frac{7}{20}$.

Calculate the number of girls in the class. (5)

[9]

TOTAL MARK [150]

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INFORMATION SHEET

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

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

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

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

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

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

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

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

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

In ΔABC:

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

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

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

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

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

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

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$$

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

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

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

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

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