KWAZULU-NATAL PROVINCE

EDUCATION
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 11

MATHEMATICS PAPER 1

NOVEMBER 2023

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 9 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. that 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 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 $(2x+1)(5-x)=0$ (2)

1.1.2 $x^2-\frac{2}{3}x-5=0$ (correct to TWO decimal places) (3)

1.1.3 $2x\left(x-\frac{1}{2}\right)\leq 6$ (4)

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

1.2 Solve for x and y simultaneously:

$3x-y=1$ and $2xy-3y^2=-x^2-7$ (6)

1.3 The roots of a quadratic equation are $x=\frac{-10\pm\sqrt{100-4k^2}}{2k}$.

Calculate the values of k for which the roots are:

1.3.1 equal (3)

1.3.2 non-real (3)

[26]

QUESTION 2

2.1 Simplify the following expressions completely, WITHOUT using a calculator:

2.1.1 $\frac{\left(9x^2\right)^{-\frac{1}{2}}}{9x^{-2}}$ (3)

2.1.2 $\frac{\sqrt{8k^4}-\sqrt{98k^4}}{\sqrt{25}k^2}$ (3)

2.2 Solve for x WITHOUT using a calculator:

2.2.1 $x^{-\frac{3}{2}}=125$ (3)

2.2.2 $\frac{p^x.p^{\frac{2}{x}}}{p^{5-x}}=1$ (4)

2.2.3 $\frac{x-4}{\sqrt{x}-2}=5a^0$ (4)

[17]

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QUESTION 3

Consider the following linear number pattern: $3x+8\ ;\ x-2\ ;\ \ldots\ ;\ -141\ ;\ -145$.

3.1 Is the above linear number pattern finite or infinite? (1)

3.2 Show that $x=-3$. (2)

3.3 Determine T_n, the general term of this number pattern, in the form $T_n=bn+c$. (3)

3.4 Calculate the value of T_{15}, the 15^{th} term of this number pattern. (2)

3.5 How many terms are in this number pattern? (2)

[10]

QUESTION 4

Given a quadratic sequence: $3\ ;\ 17\ ;\ 35\ ;\ 57\ ;\ \ldots$

4.1 Write down the next two terms of the sequence. (2)

4.2 Determine the general term of the sequence in the form $T_n=an^2+bn+c$. (4)

4.3 Which term in the sequence is the second term greater than 826? (4)

4.4 Which TWO consecutive terms in the quadratic sequence have a first difference of 122? (4)

4.5 The given quadratic sequence is multiplied by a constant to obtain a new quadratic sequence: $-6\ ;\ 8p-2\ ;\ -70\ ;\ 18q\ ;\ \ldots$

Write down the values of p and q. (2)

[16]

QUESTION 5

5.1 Given: $h(x) = \dfrac{-3}{x - \frac{3}{2}} - 2$

5.1.1 Write down the equations of asymptotes of h. (2)

5.1.2 Write down the coordinates of the y-intercept of h. (2)

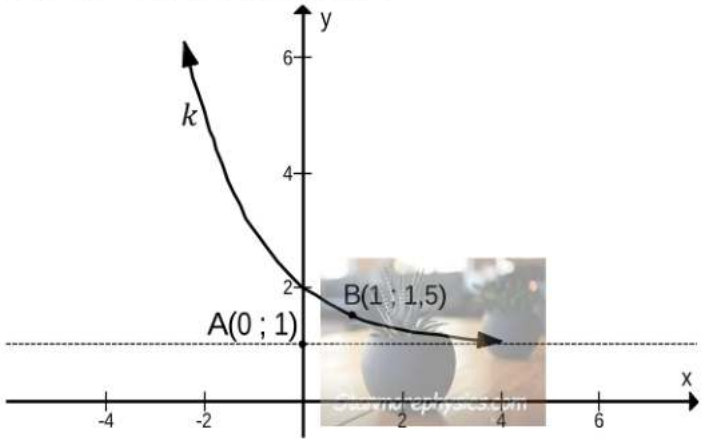
5.1.3 Calculate the coordinates of the x-intercept of h. (3)

5.1.4 Draw the graph of h. Clearly show the asymptotes and the intercepts with the axes. (3)

5.1.5 Determine the equation of the axis of symmetry of h that has a negative gradient. (2)

5.1.6 Calculate the coordinates of the points of intersection of h and the axis of symmetry determined in QUESTION 5.1.5. (5)

5.2 The graph of $k(x) = b^x + q$ is drawn in the sketch below. The point A(0 ; 1) lies on the asymptote of k and B(1 ; 1,5) lies on k.



5.2.1 Determine the equation of k. (3)

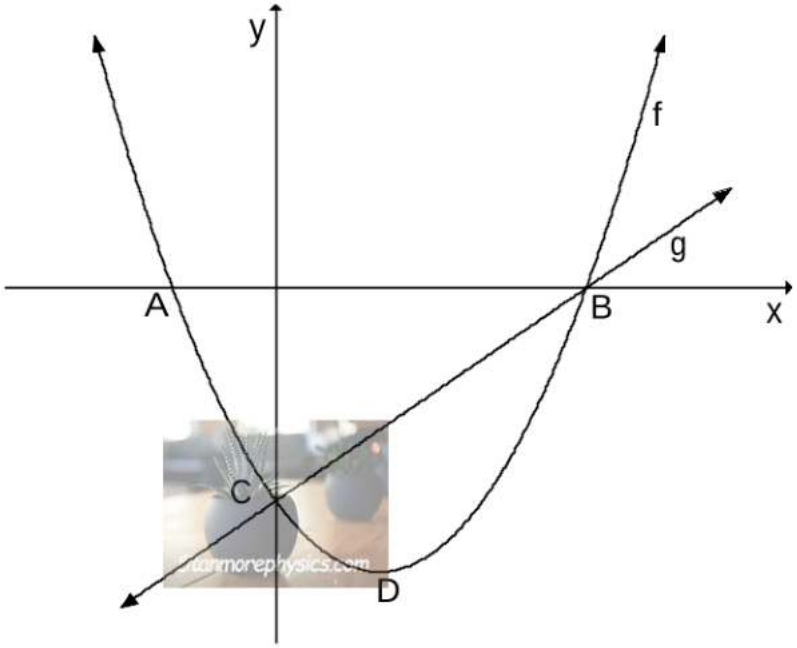
5.2.2 Describe, in words, the transformation from k to $j(x) = 2^x$. (2)

[22]

QUESTION 6

The sketch below shows the graphs of $f(x)=\frac{1}{2}(x-2)^2-8$ and $g(x)=x-6$.

- A and B are the x-intercepts of f.
- D is the turning point of f.
- C is the y-intercept of both graphs.
- Graphs f and g intersect at B and C.



6.1 Calculate the length of AB. (4)

6.2 Write down the coordinates of D. (1)

6.3 Write down the range of f. (1)

6.4 Calculate the average gradient between points A and C. (3)

6.5 For which values of k will $\frac{1}{2}x^2-2x-6-k=0$ have two positive roots? (2)

6.6 Use the graphs to determine the values of x for which:

6.6.1 $f(x)\geq 0$ (2)

6.6.2 $\frac{g(x)}{f(x)}>0$ (2)

6.7 Determine the maximum value of h if $h(x)=\sqrt{2}^{2-f(x)}$. (3)

6.8 Calculate the value(s) of k for which $y=-3x+k$ will NOT be a tangent to f. (5)

[23]

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QUESTION 7

7.1 A construction vehicle was bought for R625 000. The value of the vehicle depreciates annually at a rate of 10,25% p.a. on the reducing-balance method. Calculate the book value of the vehicle 6 years after it was bought. (2)

7.2 Calculate the effective interest rate if an investment earns interest at the rate of 8% p.a., compounded half-yearly. (3)

7.3 A house was bought $4\frac{1}{2}$ years ago. The value of the house increased at 14% p.a., compounded quarterly. If the value of the house is now R1 671 650,74, calculate the purchase price of the house. (3)

7.4 Mr Nsele invested R x into a savings account. He withdrew R15 000 from the account two years after making the initial deposit. Four years after making the initial deposit, the accumulated amount in the savings account was R75 000.
The account earned interest at the rate of 12% p.a., compounded monthly for the first three years. Thereafter the interest rate changed to 8% p.a., compounded half-yearly.

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7.4.1 Calculate the amount that Mr Nsele had in the account three years after making the initial deposit. (3)

7.4.2 Calculate the value of x, the amount Mr Nsele initially deposited into the account. (4)
[15]

QUESTION 8

8.1 For events A and B, it is given that $P(A) = 0,35$ and $P(B) = 0,4$.

8.1.1 Calculate $P(A \text{ or } B)$ if A and B are mutually exclusive. (2)

8.1.2 Calculate $P(A \text{ or } B)$ if A and B are independent. (3)

8.2 A survey was conducted among 150 Grade 11 learners about the genre of music that they listen to mostly. The results are shown in the table below.

	Classical	**Pop**	**Hip hop**	**Total**
Girls	35	k	27	80
Boys	32	15	23	70
Total	67		50	**150**

8.2.1 Write down the value of k. (1)

8.2.2 If a learner is selected at random from the group, what is the probability that the learner is a boy and does not listen to Pop music? (2)

8.2.3 Are the events: "being a girl" and "listening to Pop music" independent? Show all necessary calculations. (4)

[12]

QUESTION 9

9.1 The probability that South Africa (SA) will reach the finals in the 2027 Rugby World Cup is 0,35 and the probability that New Zealand (NZ) will reach the finals is 0,60. The probability that neither South Africa nor New Zealand will reach the final is 0,08.

Calculate the probability that only New Zealand will reach the finals. (4)

9.2 A picnic basket contains x apples and 8 bananas. A fruit is selected at random and eaten. Thereafter, another fruit is selected at random and eaten. The probability of selecting two different fruits, in any order, in the first two selections is $\frac{48}{95}$.

Calculate the total number of apples in the basket. (5)

[9]

TOTAL: 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:

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

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

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

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

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

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

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

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

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

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