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GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

PROVINCIAL EXAMINATION

NOVEMBER 2023

GRADE 11

MATHEMATICS

PAPER 1

TIME: 3 hours

MARKS: 150

11 pages

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INSTRUCTIONS AND INFORMATION

1. Answer ALL the questions.
2. This question paper consists of 10 questions.
3. Present your answers according to the instructions of each question.
4. Clearly show ALL calculations, diagrams, graphs, et cetera which were used in determining the 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. Number the questions according to the numbering system used in the question paper.
10. Write neatly and legibly.

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QUESTION 1

1.1 Given: $K = \sqrt{\frac{5}{p+2}} + \frac{p}{3}$

1.1.1 Show that K is rational if $p = 3$. (2)

1.1.2 For which value(s) of p will K be real? (1)

1.2 Solve for x:

1.2.1 $3x^2 = 4x + 2$ (correct to TWO decimal places) (2)

1.2.2 $x^2 + 10x > -21$ (4)

1.2.3 $\sqrt{x^2 - 5} = 2\sqrt{x}$ (5)

1.2.4 $3^{x+1} + 3^{x-1} = \frac{10}{9}$ (4)

1.3 Given: $x + y = 2$ and $y + 1 = \frac{-3}{x-1}$

1.3.1 Solve for x and y. (5)

1.3.2 Hence or otherwise, determine the value of: $\left(\frac{1}{x} + \frac{1}{y}\right)$. (2)

1.4 Given: $2mx^2 - (m - 2)x + m + 1 = 0$, where $m \neq 0$, determine the value(s) of m for which the equation has:

1.4.1 Real roots (6)

1.4.2 Two real roots that are opposite in sign if $m < 0$. (2)

[33]

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QUESTION 2

2.1 Simplify **WITHOUT** the use of a calculator.

2.1.1 $\left\{\frac{512x^3}{64x^{-3}}\right\}^{-\frac{1}{3}}$ (3)

2.1.2 $\frac{x^{n+2}+x^{n+1}-x^n-x^{n-1}}{x^2-1}$ (3)

2.1.3 $\sqrt{a+\sqrt{2a-1}}.\sqrt{a-\sqrt{2a-1}}$ (4)

2.2 Given: $(1-\sqrt{2})(x+y\sqrt{z})=-3+\sqrt{2}$

Determine **WITHOUT** the use of a calculator the values of x, y en z. (4)
[14]

QUESTION 3

3.1 Given the pattern:

tan x; sin x; sin x.cos x, …

3.1.1 Explain how each term is found from the previous term. (1)

3.1.2 Write down the fourth term (T_4) of the pattern. (1)

3.2 Given the pattern:

–1; 2; 5; 8; …

3.2.1 Determine an expression for the n^{th} term of this pattern. (4)

3.2.2 Which term of the pattern will be equal to 161? (2)
[8]

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QUESTION 4

4.1 In the diagram below, the first three figures in a pattern that Mary is investigating are shown.

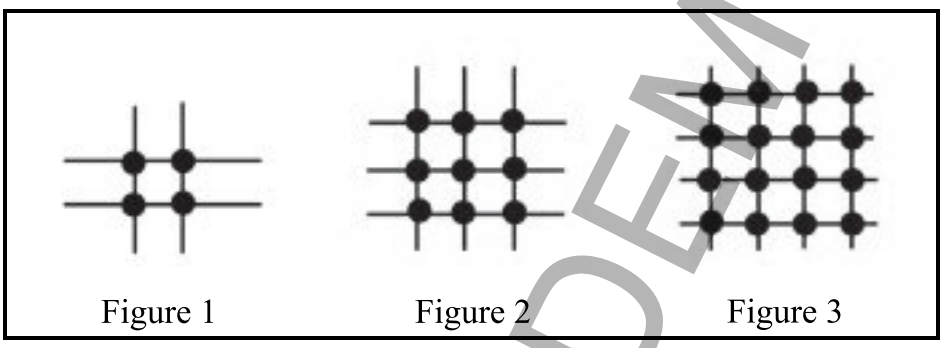


Figure 1 Figure 2 Figure 3

4.1.1 Determine the total number of squares for Figure 5. (1)

4.1.2 How many dots will there be in Figure 7? (1)

4.1.3 Considering the n^{th} figure, show that an expression for the number of dots can be written as $(n + 1)^2$. (4)

4.2 An athlete runs along a straight road. His distance d from a fixed point P on the road is measured at different times, n, and has the form $d(n) = an^2 + bn + c$.

The distances are recorded in the table below.

Time (seconds)	1	2	3	4	5	6
Distance (metres)	17	10	5	2	r	s

4.2.1 Determine the values of r and s. (2)

4.2.2 Determine the values of a, b, and c. (4)

4.2.3 How far is the athlete from P when $n = 8$? (2)

4.2.4 Mikayla claims that the pattern WILL have a minimum value. Jack claims that the pattern will NOT have a minimum value.
Who is correct? Support your answer with an appropriate calculation. (3)
[17]

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QUESTION 5

5.1 After 2 years a phone is worth $\frac{1}{3}$ of its original value. Use the reducing balance method to calculate the annual rate of depreciation of the phone. (2)

5.2 Carl's Car Wash is saving for new equipment. Carl invests R10 000 at 7,5% p.a., compounded monthly.

5.2.1 Calculate the effective interest rate. (3)

5.2.2 Carl deposited R10 000. At the end of the first year the interest rate changes to 7,8%, compounded quarterly. Six months later Carl deposited a further R5 000. If Carl requires R17 000 for the new equipment, will he have sufficient funds for this purchase after 3 years? (5)

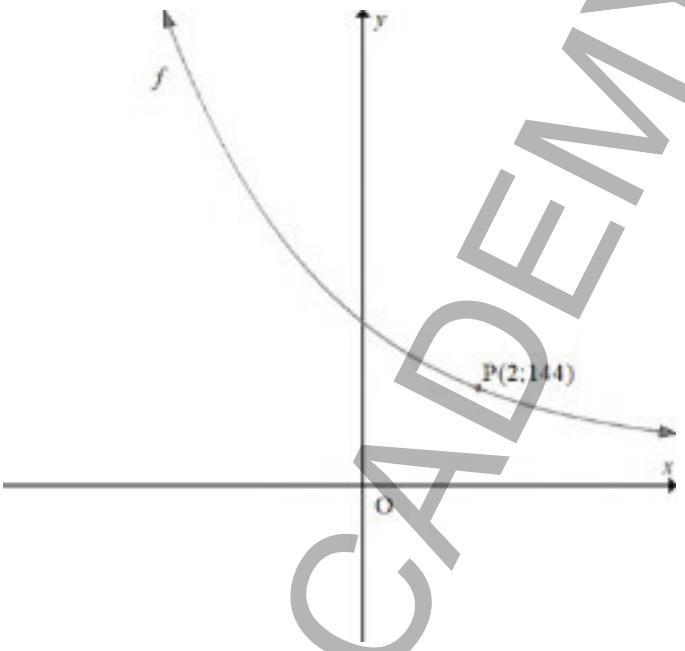
5.3 Two friends receive an amount of R6 000 each to invest for a period of 5 years. They invest the money as follows:
Mervin: 8,5% p.a. simple interest. At the end of the 5 years, Mervin will receive a bonus of exactly 5% of the principal amount.
Haley: 8% p.a. compounded quarterly.
Who will have a larger investment after 5 years?
Justify your answer with appropriate calculations. (6)
[16]

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QUESTION 6

Given: $f(x) = a.b^x$, $a \neq 0$. P(2 ; 144) is a point on f.



6.1 Write down the domain of f. (1)

6.2 Write down the equation of the asymptote of f. (1)

6.3 If $b = \frac{3}{4}$, calculate the value of a. (2)

6.4 The graph of g is obtained by reflecting the graph of f in the y-axis.
Write down the equation of g. (1)

6.5 Is g an increasing or decreasing function?
Give a reason for your answer. (2)

6.6 Prove that:

$[f(x)]^2 - [f(-x)]^2 = a.f(2x) - a.f(-2x)$ for ALL values of x. (3)

[10]

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QUESTION 7

Given: $f(x) = \frac{2}{x+4} - 1$

7.1 Write down the equation of the asymptotes of f. (2)

7.2 Calculate the intercepts of the graph of f with the axes. (3)

7.3 Sketch the graph of f, showing clearly the asymptotes and intercepts with the axes. (3)

7.4 Write down the coordinates of the image of the x-intercept if it is reflected about the axis of symmetry $y = \quad x \quad 5$. (2)

7.5 Write down the range of $y = -f(x)$. (1)

7.6 Describe in words, the transformation of f to g if $g(x) = \frac{-2}{x-4} - 1$. (1)

[12]

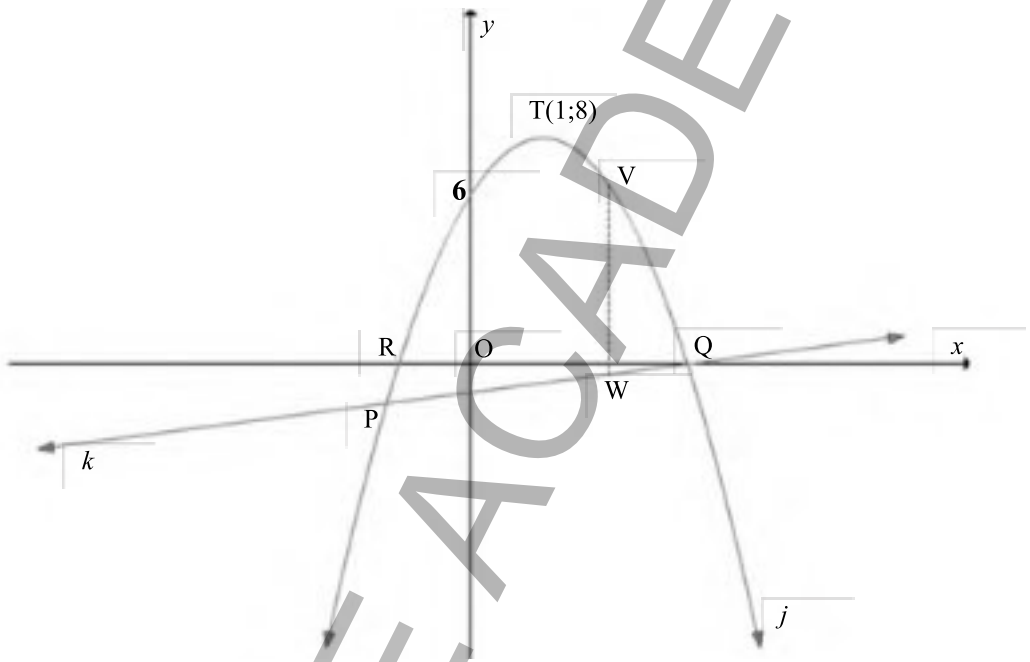
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QUESTION 8

Sketched below is a parabola j and a straight line k, with equation $k(x) = \frac{1}{3}x - 1$.

- T(1 ; 8) is the turning point of j.
- j cuts the y-axis at $y = 6$ and the x-axis at R(–1;0) and Q.
- j and the straight line intersect at P and Q.
- V is a point on j and W is a point on k such that VW is parallel to the y-axis.



8.1 Show that the equation of j can be written as $j(x) = -2x^2 + 4x + 6$. (3)

8.2 Calculate the average gradient of j between $x = 1$ and $x = 3$. (3)

8.3 Calculate the coordinates of P, the intersection of j and k. (5)

8.4 Calculate the MAXIMUM length of VW. (4)

8.5 Use the graphs to determine the value(s) of x for which:

8.5.1 j increases. (1)

8.5.2 $-\frac{j(x)}{k(x)} \leq 0$ (2)

8.6 For which values of k will $j(x) - k = 0$ have two distinct roots? (2)

[20]

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QUESTION 9

Jeremy enters the quiz show, "WHO WANTS TO BE A MILLIONAIRE? "
The objective is to answer consecutive questions correctly in order to win one million rand. A contestant's turn ends when a question is answered INCORRECTLY. Contestants may choose to answer the questions themselves or use a lifeline for assistance. A lifeline may only be used ONCE and it must be used within the first 3 rounds of questions.

On the first attempt:

- The probability that Jeremy answers the question Correctly (C) on his own is 0,7.
- The probability that Jeremy answers the question Incorrectly (I) is 0,1.
- The probability that Jeremy uses a Lifeline (L) is 0,2.
- If Jeremy uses a lifeline, the probability that the lifeline produces the correct answer is 0,9.

9.1 Draw tree diagrams to represent the given information for 2 rounds of questions. (2)

9.2 Determine the probability that Jeremy will, unassisted, answer the first TWO questions correctly. (2)

9.3 Determine the probability that Jeremy answers the FIRST question correctly. (3)
[7]

QUESTION 10

10.1 The events A, B and C are such:

- A and B are independent.
- B and C are independent.
- A and C are mutually exclusive.
- Their probabilities are P(A) = 0,3 , P(B) = 0,4 and P(C) = 0,2.

Calculate the probability of the following events occurring:

10.1.1 Both A and C occur. (1)

10.1.2 Both B and C occur. (2)

10.1.3 At least ONE of A or B occurs. (4)

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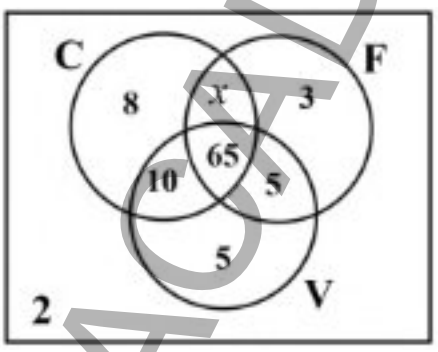
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10.2 A leadership camp organised for 103 Grade 11 learners were asked to indicate their meal preferences. They could choose from Chicken (C), Fish (F) or Vegetables (V).

The following information was collected:

- 2 learners do not eat chicken, fish or vegetables.
- 5 learners eat only vegetables.
- 8 learners eat only chicken.
- 23 learners do not eat fish.
- 3 learners eat only fish.

Let the number of learners who eat chicken or fish be x.



10.2.1 Calculate the value for x. (1)

10.2.2 Calculate the probability that a learner chosen at random eats any TWO of the given food choices. (2)

10.3 The length of 80 worms, in centimetres, is recorded in the table below.

Length (cm)	(0 ; 5]	(5 ; 10]	(10 ; 15]	(15 ; 20]	(20 ; 25]
Frequency	9	21	25	17	8

Determine the probability that ONE worm is 5 cm or shorter and the OTHER is longer than 15 cm. (3)

[13]

TOTAL: 150

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