LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF
EDUCATION

NATIONAL
SENIOR CERTIFICATE

GRADE 12

MATHEMATICS P1

SEPTEMBER 2020

EMATHP1

MARKS: 150

TIME: 3 Hours

This question paper consists of 11 pages, an answer sheet 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 11 questions.
2. Answer ALL the questions.
3. Clearly show ALL calculations, diagrams, graphs, etc. that you have used to determine your answers.
4. Answer only will not necessarily be awarded full marks.
5. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
6. Answer QUESTION 6.2 and 6.5 on the DIAGRAM SHEET provided
7. If necessary, round off answers to TWO decimal places, unless stated otherwise.
8. Diagrams are NOT necessarily drawn to scale.
9. Number the answers correctly according to the numbering system used in this question paper.
10. Write neatly and legibly.
11. Use black or blue pen only.

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QUESTION 1

1.1 Solve for x

1.1.1 $-(x-2)(x+1)=0$ (2)

1.1.2 $x^2-x=-5$ (4)

1.1.3 $3\sqrt{x-2}+6=x$ (5)

1.1.4 $-3x^2+5x\geq -2$ (4)

1.2 Show that the roots of $x^2+p=(p+1)x$ are rational for all rational values of p. (4)

1.3 Solve for x and y simultaneously if :

$$\frac{1}{x}+\frac{1}{y}=3 \quad \text{and} \quad x-y=\frac{1}{2}$$ (6)

[25]

QUESTION 2

The following quadratic sequence is given: $-6\ ;\ 2-x\ ;\ 4\ ;\ 2x+5$

2.1 Solve for x (3)

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

[7]

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QUESTION 3

3.1 The first two terms of an arithmetic series A and the infinite geometric series B, are the same: A: $-2+a+\ldots$ and B: $-2+a+\ldots$

Write down in terms of a:

3.1.1 the third term of the geometric series B. (2)

3.1.2 the third term of the arithmetic series, A. (2)

3.2 The sum of the first three terms in the arithmetic series A is equal to the third term of the geometric series B. Write down an equation and determine the value of a. (5)

3.3 If $a=-6$, does the geometric series B converge? Show calculations to support your answer. (3)

[12]

QUESTION 4

4.1 Determine: $\sum_{p=1}^{\infty}(x+2)^p$, if it exits, when $x=-5$ (2)

4.2 The powers of 2 are removed from the set of positive integers:

1 ; 2 ; 3 ; 4 ; 5 ; … ; 1998 ; 1999 ; 2000.

Find the sum of the remaining integers. (5)

[7]

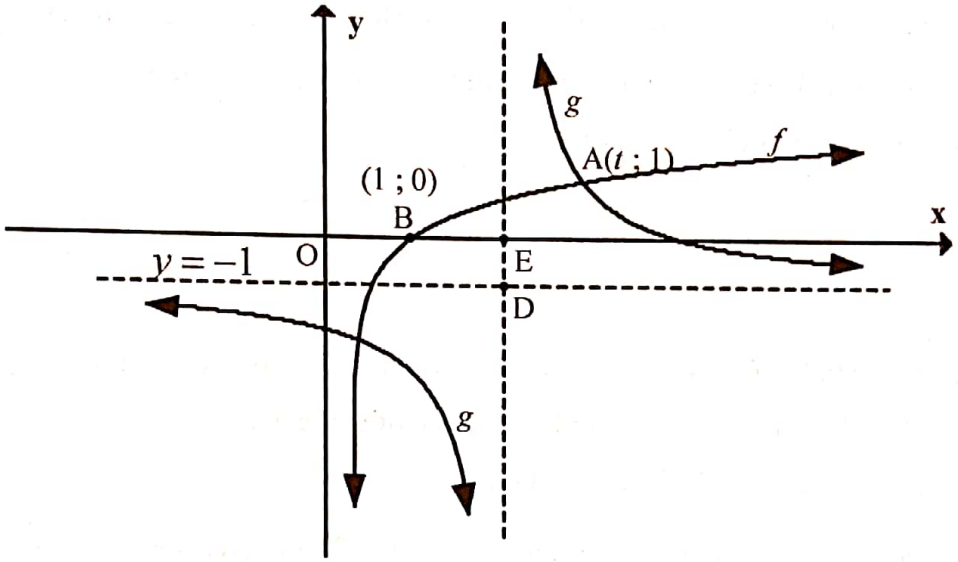
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QUESTION 5

The diagram below shows the graph of $g(x)=\frac{2}{x+p}+q$ and $f(x)=\log_3 x$. The horizontal asymptote of g is: $y=-1$

B$(1;0)$ is the $x-$intercept of f. A$(t;1)$ is a point of intersection between f and g. The vertical asymptote of g intersects the $x-$axis at E and the horizontal asymptote at D. OB = BE



5.1 Write down the range of g. (2)

5.2 Determine the equation of g. (2)

5.3 Determine the x and y intercept of g (2)

5.4 Calculate the value of t. (3)

5.5 Write down the equation of f^{-1}, the inverse of f, in the form $y=\ldots$ (2)

5.6 For which values of x will $f^{-1}(x)<3$? (2)

5.7 Determine the point of intersection of the graph of f and the axis of symmetry of g that has a negative gradient. (3)

[16]

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QUESTION 6

Given: $f(x) = -2(x-3)^2 + 8$

6.1 Write down the coordinates of the turning point of f. (2)

6.2 Draw a sketch graph of f on the DIAGRAM sheet provided. (4)

6.3 For which values of x is $x.f(x) > 0$? (2)

6.4 Determine the average gradient of f between $x = -2$ and $x = 0$. (3)

6.5 Without any further calculations, sketch the graph of $g = f(x-2)$, on the same DIAGRAM sheet as Question 6.2. Indicate intercepts and the coordinates of the turning point of g. (4)

[15]

QUESTION 7

7.1 A business bought 16 computers at R11 500 each. If each of the computers is worth R1 000 after 3 years, calculate the rate of depreciation if it is calculated according to the linear method. (3)

7.2 Mpho requires a loan to buy a house for R 950 000. The interest charged on the loan is 10% p.a. compounded monthly. If the loan is repaid over a period of 9 years.

7.2.1 Calculate the monthly repayments. (4)

7.2.2 Calculate the balance of the loan at the end of 8 years. (3)

7.2.3 What percentage of the 96th payment will be used to repay interest? (5)

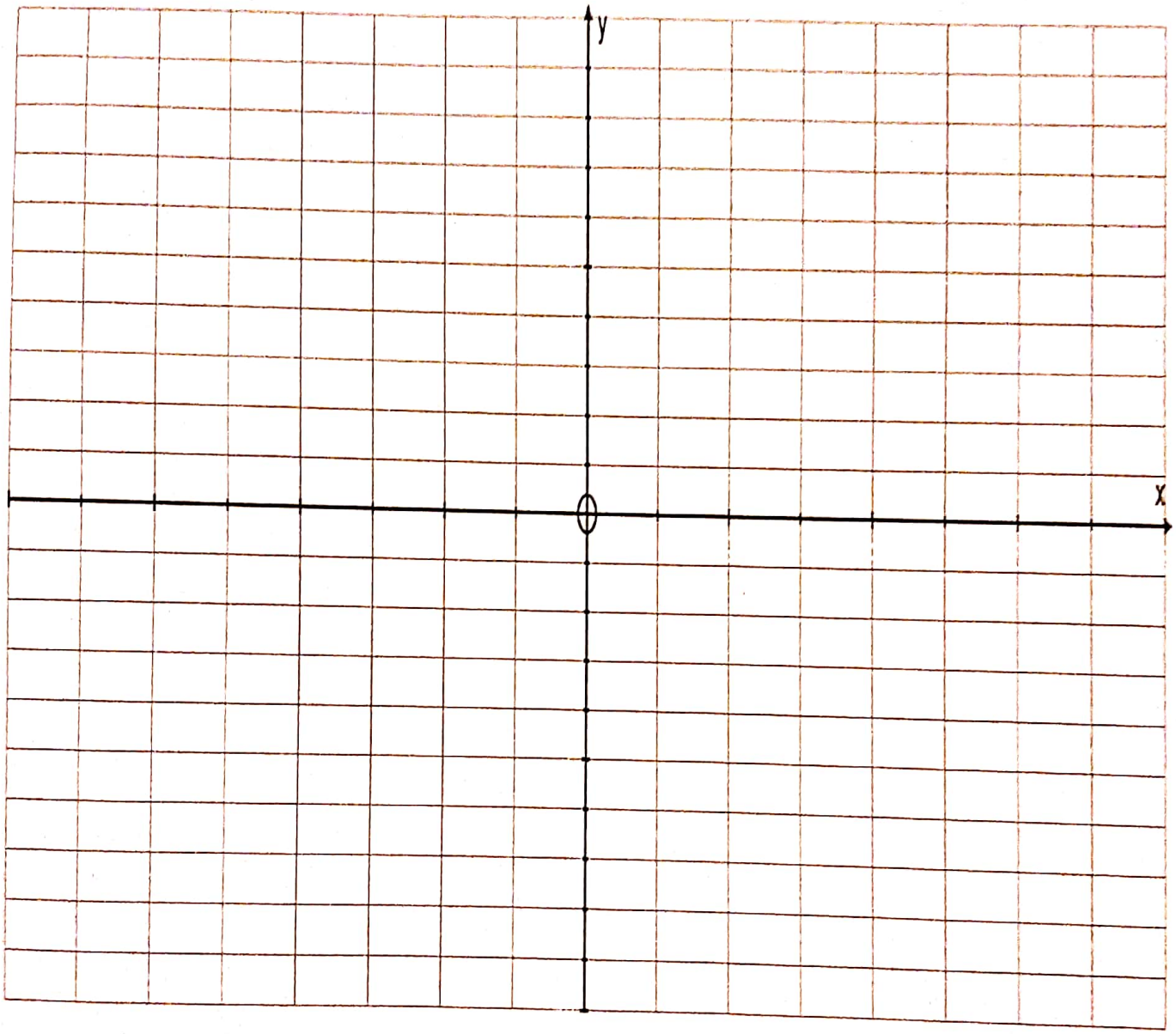
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ANSWER SHEET **NAME/NAAM:**_____

QUESTION 6.2 and 6.5



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QUESTION 8

8.1 Differentiate $f(x) = -x^2 - 3x$ from first principles. (4)

8.2 Calculate $D_x\left[x + \frac{1}{x}\right]^2$ (4)

8.3 Determine $\frac{dy}{dx}$ if $y = -3x^2 - \frac{3}{\sqrt[3]{x}} + 3^{-1}$ (4)

8.4 The tangent to the curve of $y = -2x^2 - x$ is perpendicular to the line $y = -2x + 1$. Determine the $x-$ coordinate of the point of tangency (the point where the tangent touches the curve). (4)

8.5 Given the functions $f(x) = 2x^3 - 16$ and $g(x) = x^2 + 2x + 4$

If $p(x) = \frac{f(x)}{g(x)}$ determine $p'(3)$ (4)

[20]

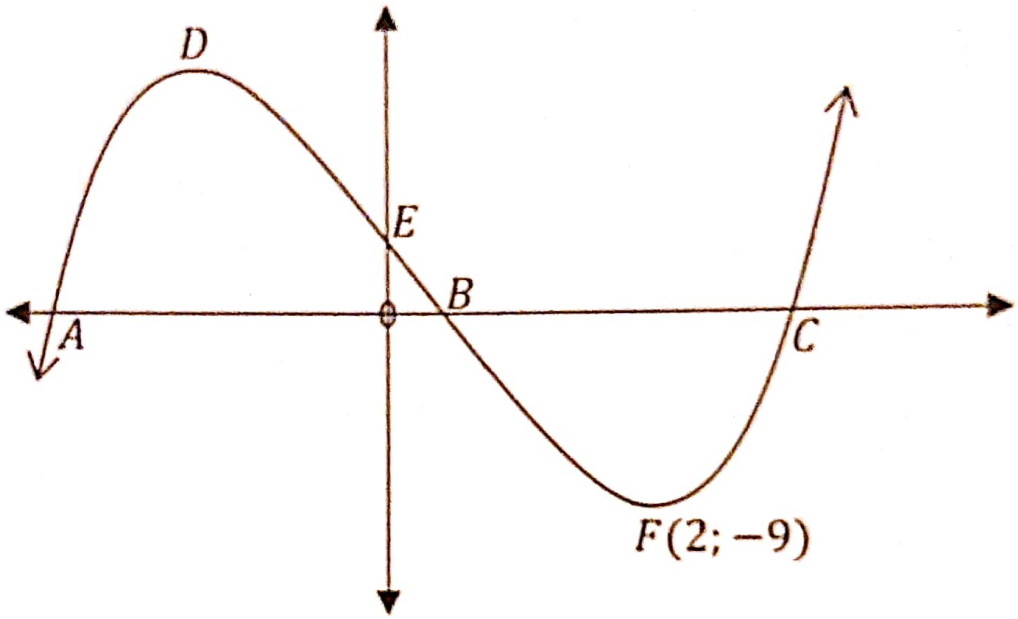
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QUESTION 9

The figure represents the graph of $y = 2x^3 + px^2 + qx + 3$. D and F $(2;-9)$ are the turning points. A, B and C are the x-intercepts and E is the y-intercept.



9.1 Show that $p = -5$ and $q = -4$ (5)

9.2 If A is the point $(-1;0)$. Calculate the co-ordinates of B and C, the $x-$intercepts of the graph. (3)

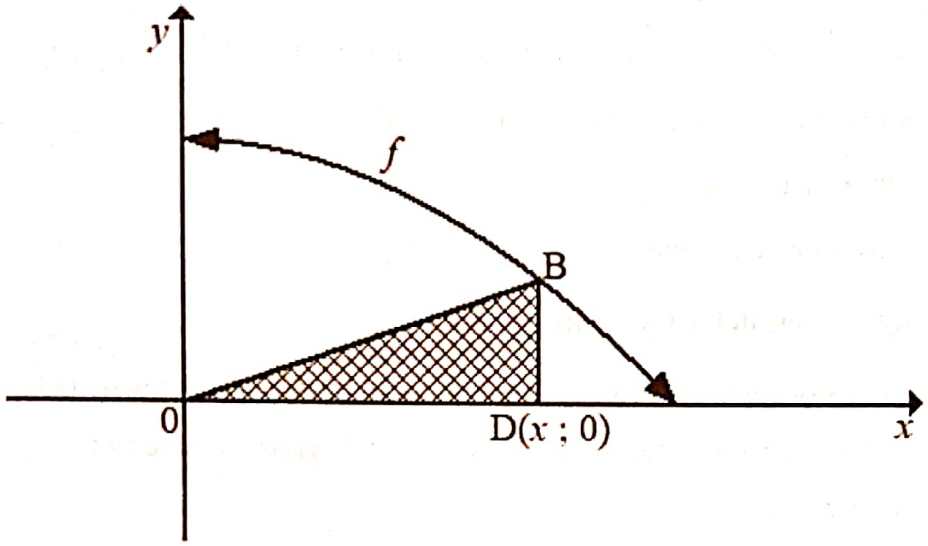
9.3 Determine the co-ordinates of D, the local maximum point. (3)

[11]

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QUESTION 10

Refer to the figure showing the parabola given by $f(x)=4-\frac{x^2}{4}$ with $0\le x\le 4$. D is the point $(x;0)$ and DB is parallel to the $y-$axis, with B on the graph of f.



10.1 Write down the coordinates of B in terms of x. (1)

10.2 Show that area A of ΔOBD is given by: $A=2x-\frac{x^3}{8}$ (2)

10.3 Determine how far D should be from O to give the maximum area of Δ OBD. (4)

[7]

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QUESTION 11

11.1 A survey of 80 students at a local library indicated the reading preferences below.

44 read the *National Geographic* magazine

33 read the *Getaway* magazine

39 read the *Leadership* magazine

23 read both *National Geographic* and *Leadership* magazines

19 read both *Getaway* and *Leadership* magazines.

9 read all three magazines

69 read at least one magazine.

11.1.1 How many students did not read any magazine (1)

11.1.2 Let the number of students who read *National Geographic* and *Getaway* but not Leadership, be represented by x. Draw a Venn diagram to represent reading preferences. (3)

11.1.3 Hence show that $x = 5$. (2)

11.1.4 What is the probability that a student selected at random will read at least two of the three magazines? (correct to THREE decimal places) (2)

11.2 A smoke detector system in a large warehouse use two devices, A and B. If smoke is present, the probability that it will be detected by device A is 0,95. The probability that it will be detected by B is 0,98 and the probability that it will be detected by both devices simultaneously is 0,94.

11.2.1 If smoke is present, what is the probability that it will be detected by device A or B? (2)

11.2.2 What is the probability that the smoke will not be detected? (1)

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11.3 There are 15 girls in a mixed class. If two pupils from the class are selected at random to represent the class on the school council, then the probability that both are girls is 0,35. How many boys are in the class? (4)

[15]

TOTAL: 150

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