BERGVLIET HIGH SCHOOL

MATHEMATICS DEPARTMENT

GRADE 11

MATHEMATICS PAPER 1

November 2023

MARKS: **125**

TIME: **2,5 HOURS**

SET BY: **Z EBERSOHN**

MODERATOR: **S WHITEHORN**

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

$A = P(1 + in)$ $\quad$ $A = P(1 - in)$

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

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of 6 questions and a DIAGRAM sheet. Staple the diagram sheet to your answer sheets.

2. Clearly show ALL calculations, diagrams, graphs, etc that you have used in determining your answers.

3. Answers only will NOT necessarily be awarded full marks.

4. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.

5. If necessary, round off answers to TWO decimal places, unless stated otherwise.

6. Diagrams are NOT necessarily drawn to scale.

7. Number the questions correctly according to the numbering system used in this question paper. Write neatly and legibly.

QUESTION 1

1.1 Solve for x in each of the following equations

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

1.1.2 $3x^2-2x=6$ (correct to TWO decimal places) (4)

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

1.1.4 $\dfrac{x}{x+2}+\dfrac{2}{x^2+5x+6}=\dfrac{5}{x+3}$ (6)

1.1.5 $(x-1)(x+4)\geq 6$ (4)

1.1.6 $3^x+\dfrac{3}{3^x}=4$ (4)

1.1.7 $4^{2x+1}=\sqrt{8^{2x-10}}$ (3)

1.1.8 $(x+\sqrt{m})^2=2x\sqrt{m}+(9+m)$ (2)

1.2 Solve simultaneously for x and y :

$x+2y=3$ and $x^2-y^2=x+y$ (6)

1.3 Given: $f(x)=\dfrac{3x-x^2}{2^x-4}$

Determine the value(s) of x and / or y for which:

1.3.1 $f(x)=0$ (1)

1.3.2 $f(x)$ is undefined (1)

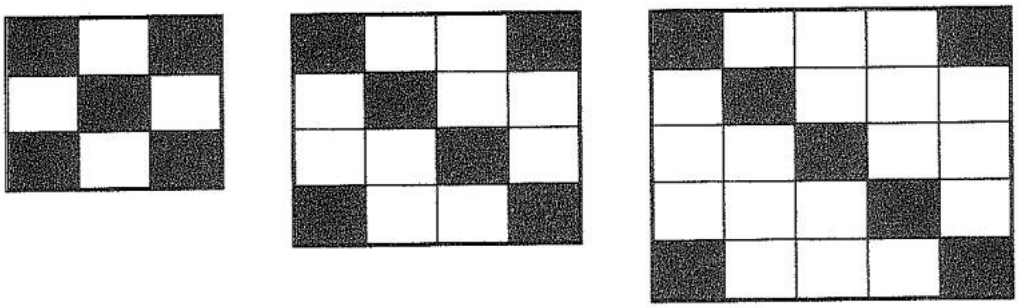
1.3.3 $f(x)\leq 0$ (3)

1.4 Calculate the sum of the digits of $2^{2015}\times 5^{2019}$ (3)

[44]

QUESTION2

2.1 Black and white blocks are used to create patterns. The first three patterns are shown below:



Pattern 1 Pattern 2 Pattern 3

2.1.1 Write down a formula for the number of black blocks that will be used in pattern *n*. (2)

2.1.2 How many black blocks will be used to create pattern hundred and twenty? (2)

2.1.3 Determine the formula for the n^{th} number of white blocks in the pattern. (3)

2.1.4 How many white blocks will there be in the 32^{nd} pattern? (2)

2.2 The number pattern $1\ ;\ 5\ ;\ 11\ ;\ 19\ ;$ ..... is such that the second difference is constant.

2.2.1 Derive a formula for the n^{th} number in the pattern. (4)

2.2.2 Which term in this pattern will have a value of 9 119? (4)

2.3 A certain quadratic pattern has the following characteristics:

- $T_1 = p$
- $T_2 = 18$
- $T_4 = 4T_1$
- $T_4 - T_3 = 10$

Determine the value of *p*. (5)

[22]

QUESTION 3

3.1 A certain amount of money is deposited at 15% interest per annum compounded quarterly.

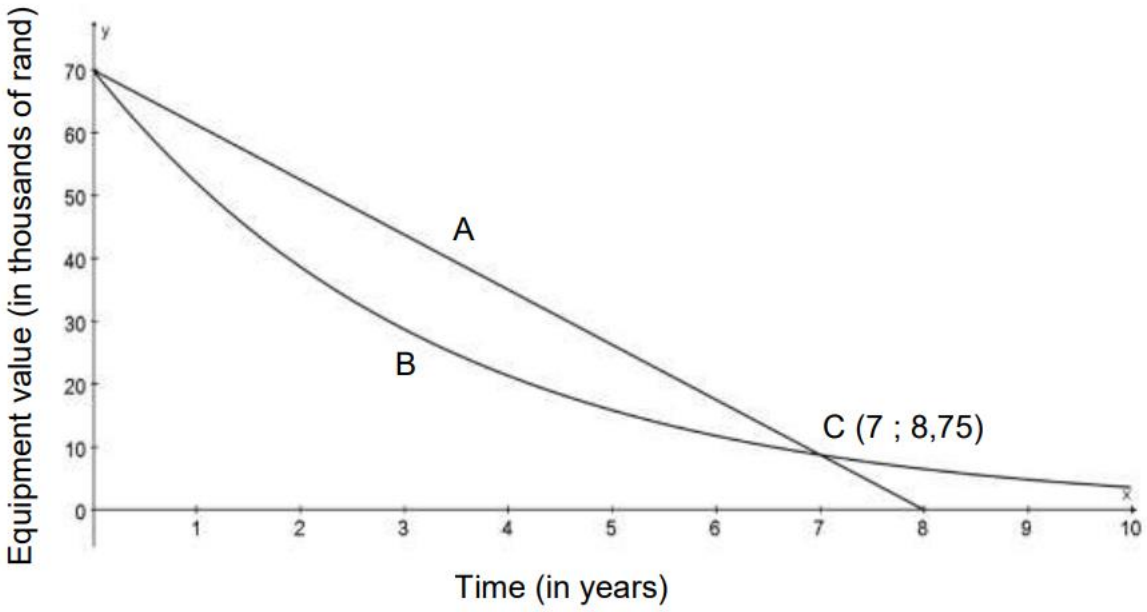
3.1.1 What was the amount deposited if it accumulates to R7 097,78 after 7 years. (3)

3.1.2 Convert the nominal interest rate given to the effective interest rate. (3)

3.2 R14 000 is invested in an account. The account earns interest at a rate of 9% per annum compounded semi-annually for the first 2 years and thereafter 7,5% per annum compounded monthly.
How much money will be in the account exactly 5 years after the initial deposit? (4)

3.3 The diagram below displays two methods of depreciation for office equipment.

Point C (7 ; 8,75) is the intersection of line A and curve B.



3.3.1 What is the initial value of the equipment? (2)

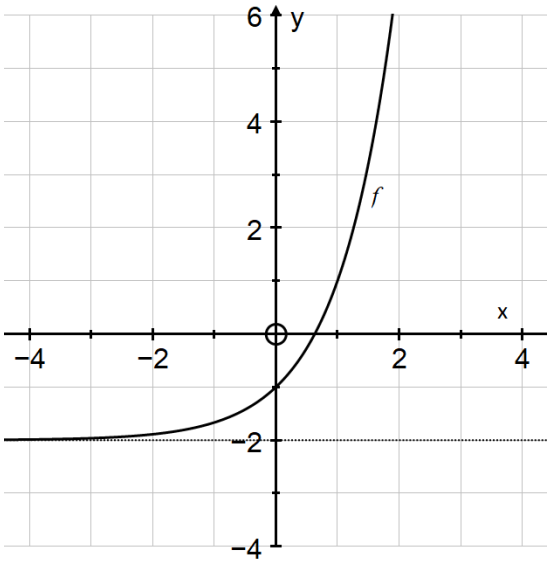
3.3.2 What type of depreciation does method A show? (1)

3.3.3 Use the information on the above graph to determine the annual rate of depreciation for method B, correct to two decimal places. (4)

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QUESTION 4

4.1 The graph of $f(x) = 3^x - 2$ has been drawn on the set of axes given below.



4.1.1 Write down the range of *f*. (2)

4.1.2 If *g* is the reflection of f in the x – axis write down the equation of $g(x)$. (2)

4.1.3 Determine the values of *x* for which $f(x) - 1 < 0$. (2)

4.2 Given: $h(x) = -2^x + 4$

4.2.1 Determine the equation of the new graph if $h(x)$ is reflected in the y – axis. Write your answer in the format $y =$ …… (2)

4.2.2 Determine the values of *p* for which $h(x + p)$ will have a negative root. (2)

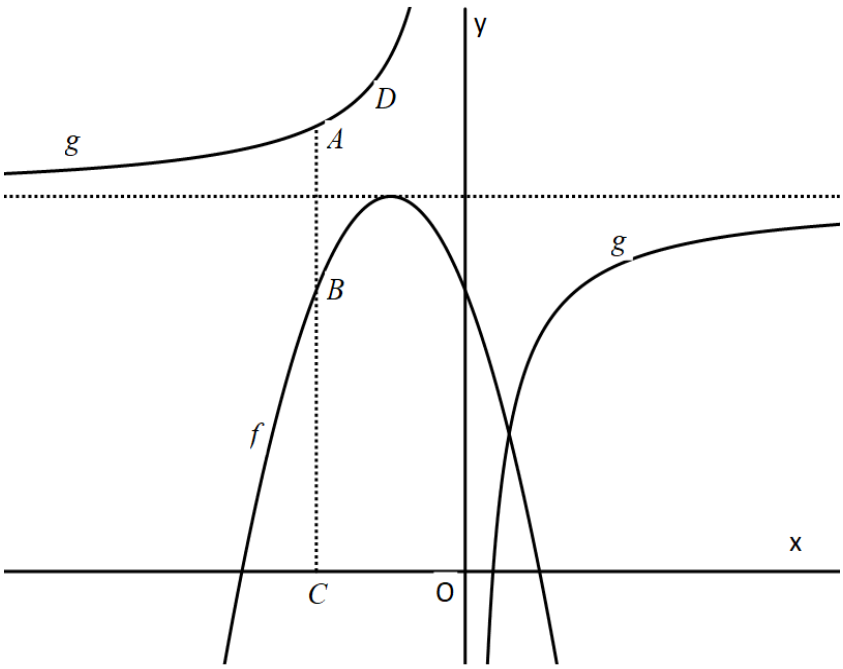
4.2.3 Sketch the graph of *h* on the diagram sheet clearly indicating the asymptote(s) and intercepts with the axes. (2)

4.2.4 Indicate on your graph where you would read off the solution to $3^x + 2^x = 6$. (2)

[14]

QUESTION 5

Given the graphs of $f(x) = -2(x+1)^2 + 8$ and $g(x) = -\frac{3}{x} + q$.



5.1 Write down the domain of *g*. (1)

5.2 Write down the value of *q* if the horizontal asymptote of *g* is a tangent to f. (1)

5.3 Write down the axis of symmetry of f. (1)

5.4 If D lies on the axis of symmetry of f, determine the coordinates of D. (2)

5.5 Determine the axis of symmetry of *g* that has a positive gradient. (2)

5.6 Determine the *x* – intercepts of *g* and *f*. (4)

5.7 For which values of *x* will $f(x).g(x) \leq 0$? (3)

5.8 Determine the value(s) of *k* for which $f(x) = k$ will have equal roots. (2)

5.9 If ABC is perpendicular to the *x* – axis and $OC = 2$, determine the length of AB. (4)

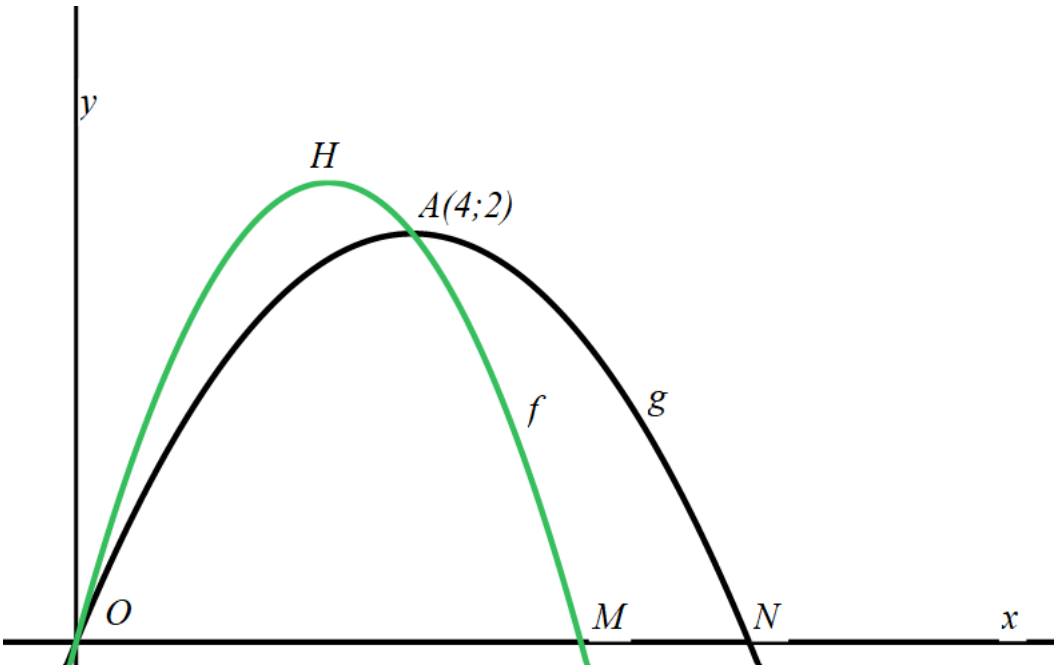
[20]

QUESTION 6

6.1 A sports scientist is looking at ways to throw a heavy object further.

The diagram below looks at two throws and models them with parabolas.

- The first throw starts at the origin, O, it reaches its maximum height at H and lands at M. The throw is represented by the graph *f*.
- The second throw starts at O, reaches its maximum height at point A and lands at N. This is graph *g*.
- The graph of *f* also goes through A.



If the second throw is **two metres further** than the first throw, determine the coordinates of H. (5)

6.2 A quadratic function, $f(x) = ax^2 + bx + c$ has the following properties:

- $f(6-p) = f(6+p)$ for all values of p
- $f\left(\frac{-b}{2a}\right) = 2$
- $b^2 < 4ac$

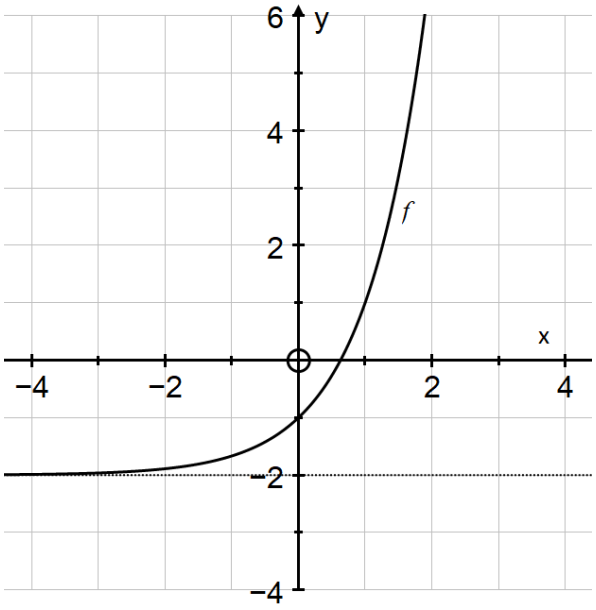
Draw a rough sketch graph of f, clearly showing all of the above information. (3)

[8]

DIAGRAM SHEET

NAME: _____

QUESTION 4.2.1



	Total	Learner Mark
1	**44**	
2	**22**	
3	**17**	
4	**14**	
5	**20**	
6	**8**	
	125	