BERGVLIET HIGH SCHOOL

MATHEMATICS DEPARTMENT

NOVEMBER EXAMINATION

GRADE 11

MATHEMATICS PAPER 1

13 NOVEMBER 2024

MARKS: 125

TIME: 2½ HOURS

SET BY: B Jorge

MODERATOR: Z Ebersohn

NAME & SURNAME: ..... CLASS: .....

TEACHER (Circle ONLY your teacher): LE JO VI WH EB

QUESTION	Q1 (32)	Q2 (14)	Q3 (12)	Q4 (14)	Q5 (12)	Q6 (13)	Q7 (17)	Q8 (11)	TOTAL (125)
MARK									
MODERATED MARK									

PLEASE DETATCH AND ATTACH TO ANSWER SHEET!!!

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of 8 questions and 7 pages. Answer ALL the questions on lined paper, except **6.3.3** below.

2. An information sheet with formulae is included at the end of the question paper.

3. Clearly show ALL calculations, diagrams, graphs, et cetera that you have used to determine your answers.

4. Answers only will not necessarily be awarded full marks.

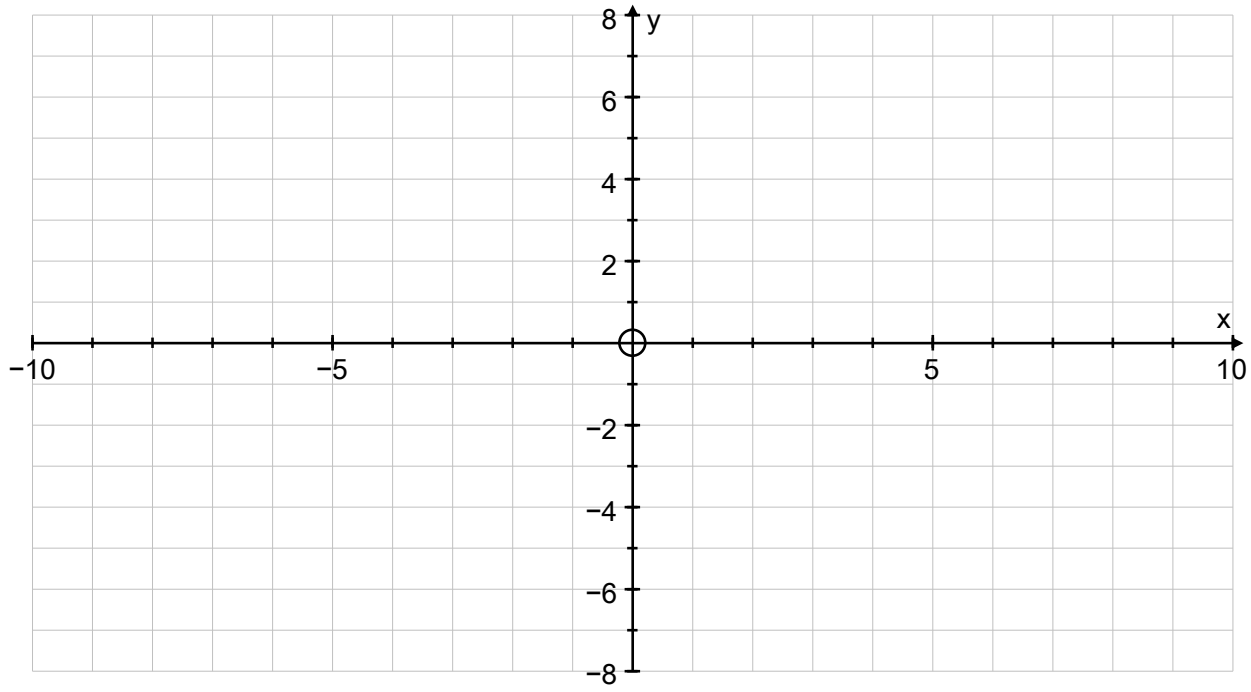
5. You may use an approved scientific calculator (non-programmable and non-graphical), for all questions unless otherwise instructed.

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

7. Diagrams are NOT necessarily drawn to scale.

8. Write neatly and legibly.

Question 6.3.3



(4)

[2]

QUESTION 1

1.1 Solve for x in the following algebraic equations:

1.1.1 $3x^2 - 5x - 1 = 0$ (correct to 2 decimal places) (3)

1.1.2 $(2x+1)^2 - 4 = 0$ (3)

1.1.3 $x^2 - 6x < -8$ (4)

1.1.4 $\sqrt{x-1} + \dfrac{3}{\sqrt{x-1}} = 4$ (5)

1.1.5 $2^{2x+1} - 3(2^{2x-1}) + 4^x = 12$ (4)

1.2 1.2.1 Solve for x and y:

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

1.2.2 Hence, or otherwise, determine the value(s) of : $\left(\dfrac{1}{x} - \dfrac{1}{y}\right)$. (4)

1.3 Given: $P = (1-a)$ and $Q = (1+a)(1+a^2)(1+a^4).....(1+a^{256})$

Determine the value of $P \times Q$ in terms of a. (3)

[32]

QUESTION 2

2.1 Simplify fully without using a calculator, leave answers in positive exponential form:

2.1.1 $\dfrac{5^{x-2}.2^{x+2}}{10^x - 10^{x-1}.2}$ (3)

2.1.2 $\left[\dfrac{16x^2}{81x^{-2}}\right]^{\frac{-1}{2}}$ (4)

2.1.3 $\left(\sqrt{p} - 2\sqrt{m}\right)^2$ (3)

2.2 Without the use of a calculator, show that: $\dfrac{2}{1+\sqrt{2}} - \dfrac{8}{\sqrt{8}} = -2$ (4)

[14]

QUESTION 3

3.1 The first term of a linear number pattern is 92 and the constant difference is -4.

3.1.1 Write down the values of the second and third terms. (2)

3.1.2 Determine an expression for the nth term of the pattern. (2)

3.1.3 If $T_m + T_n = 3$, determine the value of $(m+n)$. (4)

3.2 The first 3 terms of a linear number pattern are:

$2x^2+5x+5$; $2x^2+5x+2$; $3x^2+4x-3$ (4)

Determine the possible value(s) of x.

[12]

QUESTION 4

The first four terms of a quadratic number pattern are:

$$-1\ ;\ x\ ;\ 3\ ;\ x+8\ ;.....$$

4.1 Calculate the value(s) of x. (4)

4.2 Show that the nth term of the pattern is $T_n = (n-1)^2 - 1$. (4)

4.3 Calculate the value of the 70^{th} term. (2)

4.4 What is the value of the first TERM in the pattern that is greater than 8 800? (4)

[14]

QUESTION 5

5.1 A laptop computer costs R25 000. Calculate the value of the machine after 4 years if it depreciates at 11% p.a. according to the reducing balance method. (2)

5.2 The nominal interest rate of an investment is 12,45% p.a., compounded monthly. Calculate the effective interest rate. (4)

5.3 Keanu made an initial deposit of R10 000 into an account that paid interest at 9,6% p.a., compounded semi-annually. Six months later he had to withdraw R5 000. Two years after the initial deposit he deposited R13 500 into this account. If the interest rate changed to 5,2% p.a., compounded quarterly after two years, what was his account balance 3 years after his initial deposit? (6)

[12]

QUESTION 6

Given $f(x) = \frac{3}{x}$,

6.1 Write down the equation(s) of the asymptote(s) of f. (2)

6.2 Determine the equation of g, if f is shifted 4 units up. (1)

6.3 6.3.1 Write down $h(x) = f(x+2) - 3$ (2)

6.3.2 Calculate the equation of the axis of symmetry with a positive gradient, for h. (2)

6.3.3 Sketch h on the axes provided behind the cover page. (3)

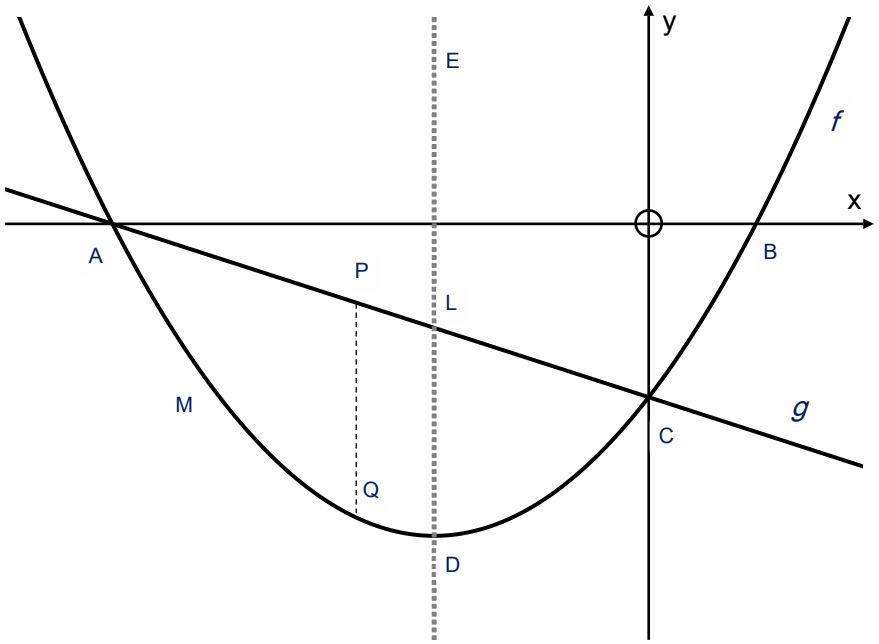
6.4 Describe the transformations applied to f to produce $p(x) = \frac{-3}{x-1}$ (2)

[12]

QUESTION 7

The graphs of $f(x)=x^2+4x-5$ and $g(x)=-x+q$ are sketched below and display the following properties:

- Points A and B are the $x-$intercepts of f
- Point C is the $y-$intercept and D is the turning point of f
- The dotted line DE is the axis of symmetry of f
- A and C are the intersections of f and g
- Point L is where g intersects the axis of symmetry of f
- M and C are symmetrical with respect to the axis of symmetry of f



7.1 Determine the equation of g in the form $g(x)=$ (1)

7.2 Calculate the length of AB. (3)

7.3 Determine the coordinates of D. (2)

7.4 Determine the coordinates of M. (1)

7.5 Determine the maximum length of the line PQ, which is between A and the origin and PQ is parallel to the y-axis. (4)

7.6 For which value(s) of x is: $\dfrac{f(x)}{g(x)}\geq 0$ (2)

7.7 For which value(s) of k will $f(x)=kx-6$ have one real root? (4)

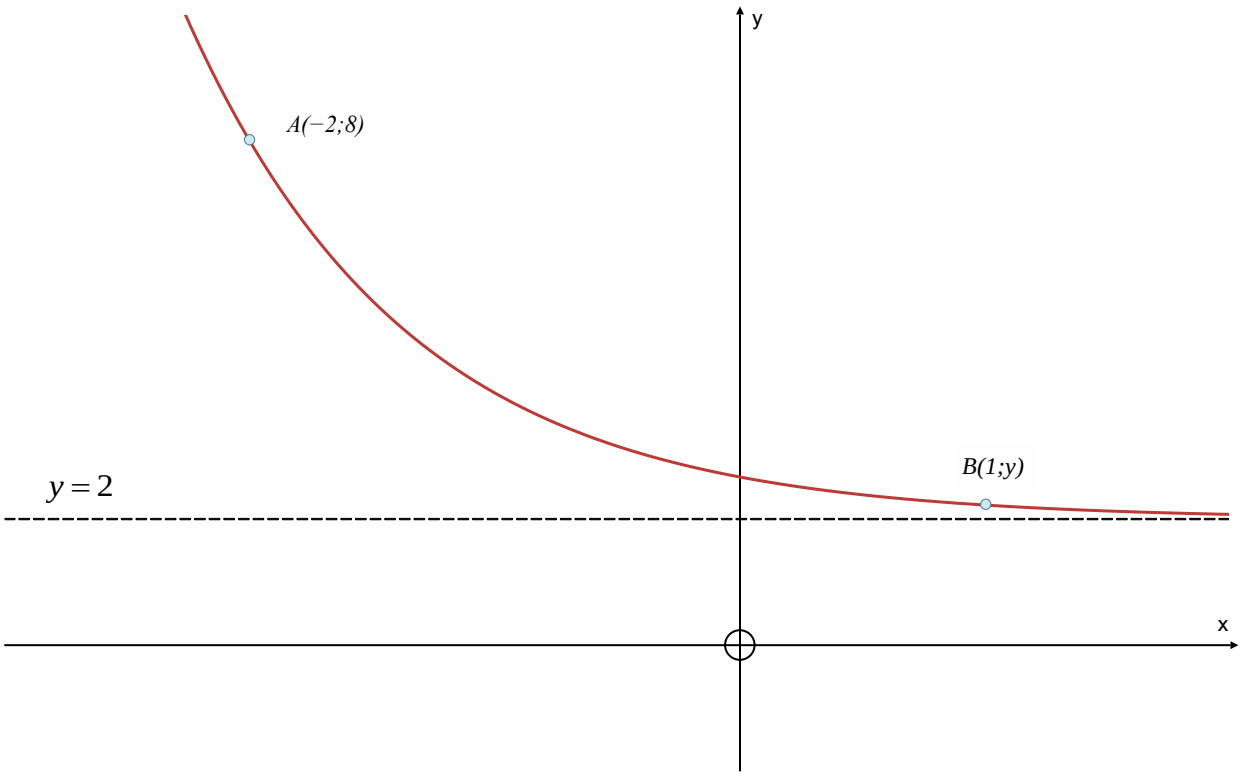
[17]

QUESTION 8

The sketch below is the graph of $f(x) = 2.b^{x+1} + q.$

The graph of f passes through the points $A(-2;8)$ and $B(1;y)$.

The line $y = 2$ is an asymptote of f.



8.1 Show that the equation of f is $f(x) = 2(3)^{-x-1} + 2.$ (3)

8.2 Calculate the $y-$coordinate of the point B. (2)

8.3 Determine the average gradient of the curve between the point A and B. (2)

8.4 A new function h is obtained when f is reflected about it's asymptote.
Determine the equation of h. (2)

8.5 For the domain of h where $x \leq -1,$ determine the corresponding range of h. (2)

[11]

INFORMATION SHEET: MATHEMATICS

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

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

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

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

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

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

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

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

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

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} \qquad a^2 = b^2 + c^2 - 2bc.\cos A \qquad area\,\Delta ABC = \frac{1}{2}ab.\sin C$$

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

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

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