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TOTAL
MARKS

INTERNATIONAL SECONDARY CERTIFICATE EXAMINATION
MAY 2025

MATHEMATICS: PAPER I

EXAMINATION NUMBER

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Time: 3 hours

150 marks

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This question paper consists of 26 pages and an Information Sheet of 2 pages (i–ii). Please check that your question paper is complete.
2. Read the questions carefully.
3. Answer **ALL** the questions.
4. **Answer all the questions on the question paper and hand this in at the end of the examination. Remember to write your examination number in the space provided.**
5. You may use an approved non-programmable and non-graphical calculator unless otherwise stated.
6. Clearly show **ALL** calculations, diagrams, graphs, etc. that you have used in determining your answers.

Answers only will NOT necessarily be awarded full marks.

7. Diagrams are not necessarily drawn to scale.
8. If necessary, round off answers to **ONE** decimal place, unless otherwise stated.
9. It is in your own interest to write legibly and to present your work neatly.
10. Two blank pages (pages 25–26) are included at the end of the paper. If you run out of space for a question, use these pages. Clearly indicate the question number of your answer should you use this extra space.

FOR OFFICE USE ONLY: MARKER TO ENTER MARKS

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	TOTAL
21	12	13	8	10	15	10	11	11	18	8	13	/150

SECTION A**QUESTION 1**

(a) Solve for x in each of the following equations:

$$(1) \quad \frac{1}{4}x^2 - 3x = 0 \quad (3)$$

$$(2) \quad 4 \cdot 3^x - 3^{x+1} = 9 \quad (4)$$

$$(3) \quad 2\log 3 + \log 2x - \log(3x - 1) = 1 \quad (5)$$

- (b) If $\log 3 = p$ and $\log 7 = q$, calculate, in terms of p and q , the value of

$$\log 4\frac{2}{7} \quad (5)$$

- (c) Simplify: $\frac{2^{x+1}.18^{x-2}}{4^x.3^{2x-5}}$ (4)

QUESTION 2

(a) The first term of an arithmetic sequence is 6 and the fifth term is 18.

(1) Determine the common difference of the sequence. (2)

(2) Calculate the sum of the first 20 terms of the sequence. (2)

(b) In a geometric series, the second term is 12 and the fifth term is 1,5.

(1) Find the first term and the common ratio of the series. (6)

(2) Calculate the sum to infinity of the series. (2)

QUESTION 3

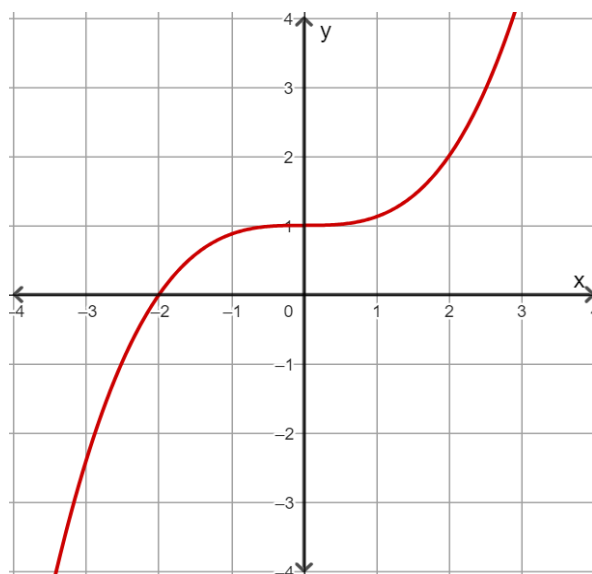
- (a) Using first principles find $f'(x)$ if $f(x) = \frac{1}{2}x^2 + x$. (5)

(b) Determine $\frac{dy}{dx}$ if $y = 2x^5 - \frac{4}{x^3} + \sqrt[5]{x^2}$. (5)

(c) If f is a linear function with $f(3) = 10$ and $f^{-1}(4) = 2$, determine the gradient of f . (3)

QUESTION 4

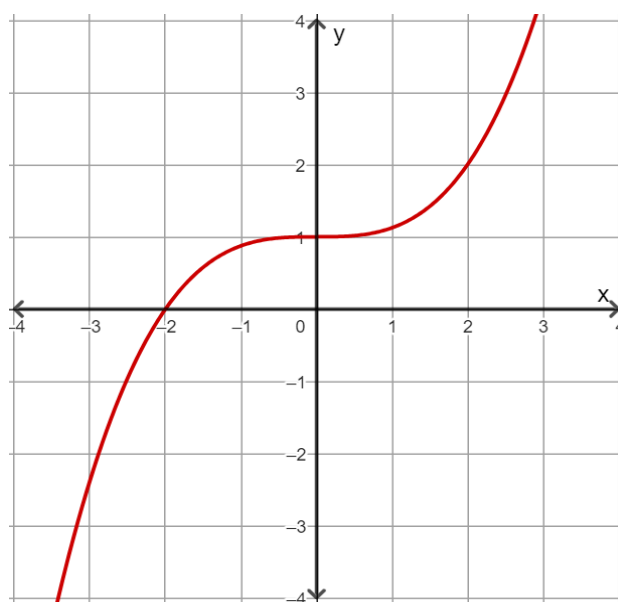
Sketched is the graph of $y = f(x)$.



On the sets of axes provided below, draw a sketch of the following graphs:

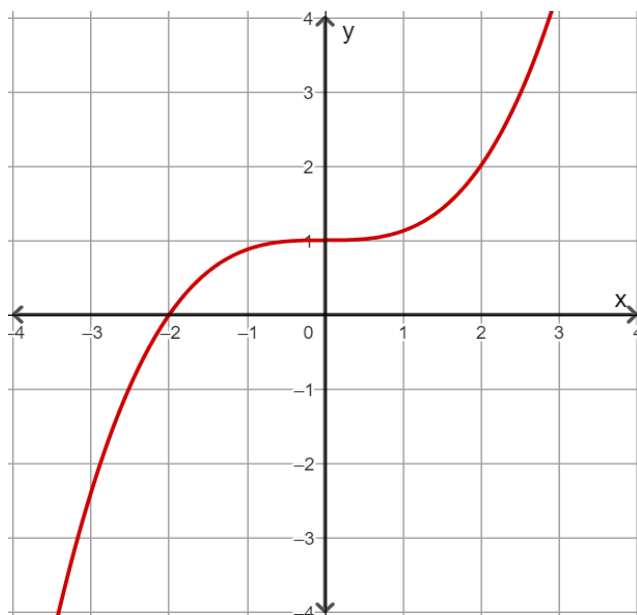
(a) $y = -f(x)$

(2)



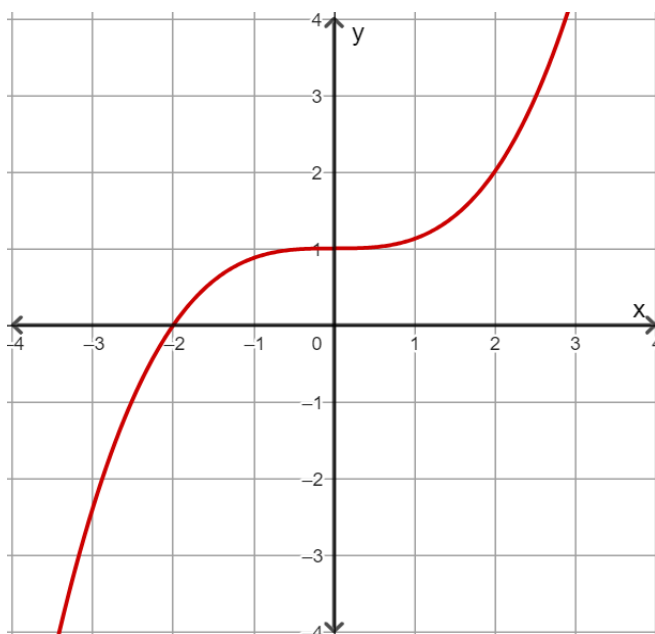
(b) $y = f(-x)$

(2)



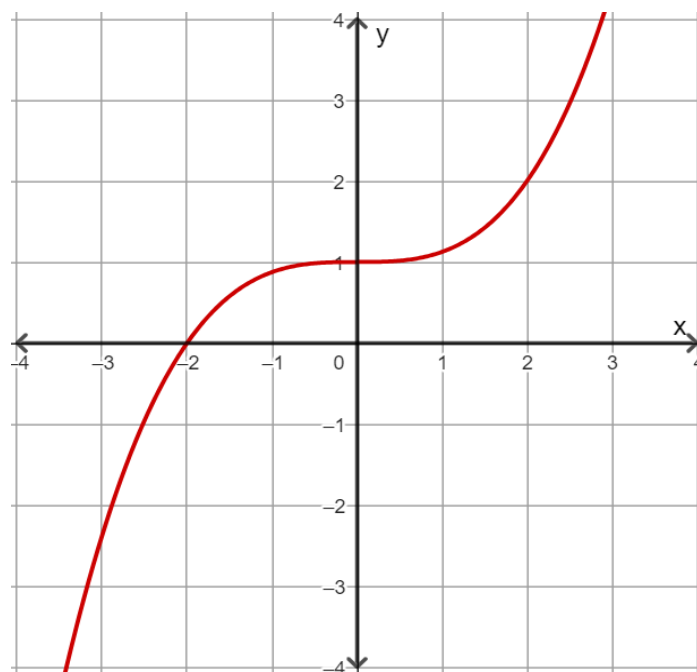
(c) $y = f^{-1}(x)$

(2)



(d) $y = f(x - 1)$

(2)



QUESTION 5

A motorcycle costing R350 000 now, rises with inflation at 6,9% per annum. The interest on investments is 8% p.a. effective.

(a) Calculate the cost of the motorcycle in 5 years' time. (3)

(b) Calculate the nominal interest rate with monthly compounding. (2)

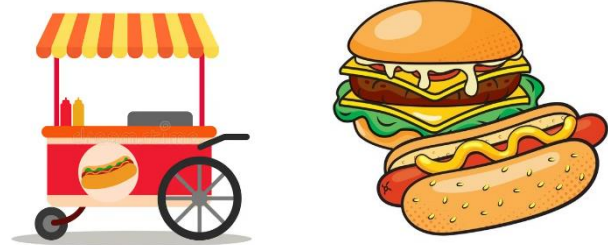
(c) How much must I invest on a monthly basis, starting immediately and finishing in **5 years' time**, if I have to be able to purchase the motorcycle? (5)

[10]

QUESTION 6

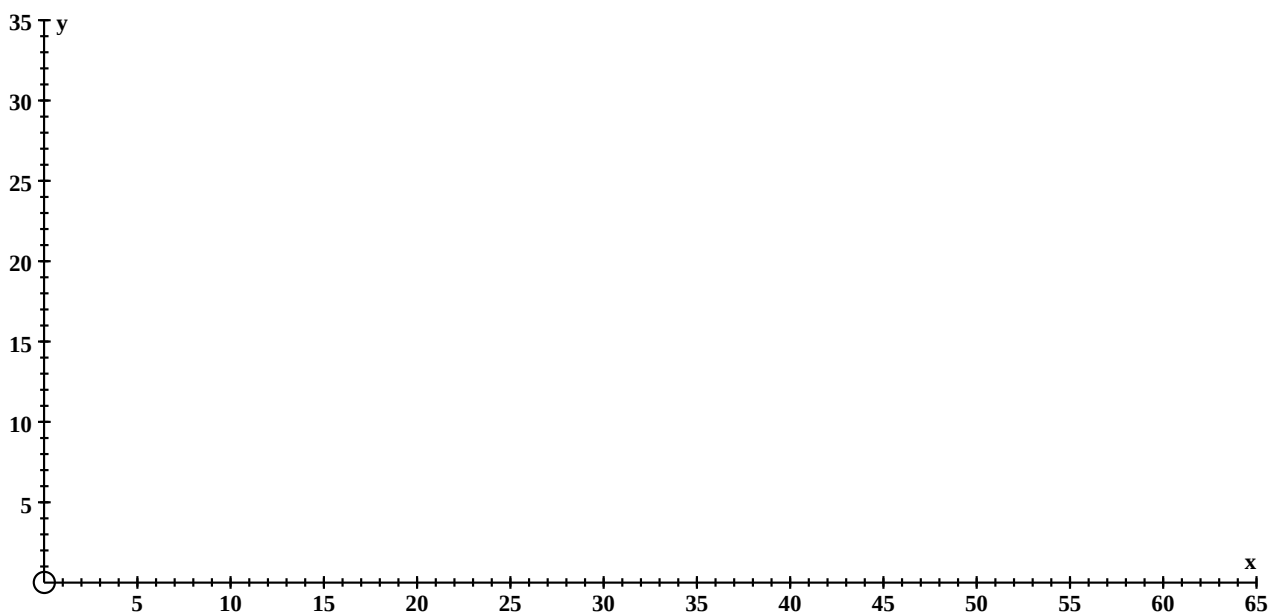
A food stand sells x hot-dogs and y burgers per day subject to the following constraints:

- The number of hot-dogs must be at least 15.
- The number of burgers must be at most in the ratio of 2 : 3 to the number of hot-dogs.
- $5 \leq y \leq 15$.
- $y \leq -\frac{1}{2}x + 30$.
- $2y + x \geq 30$.



[<<https://www.dreamstime.com/illustration/hot-dog-stand.html>>]

- (a) Represent the constraints graphically and shade the feasible region on the axes below. (8)



(b) The profit on a hot-dog is R15 and on a burger is R60.

- (1) Determine how many hot-dogs and burgers must be sold per day to obtain a maximum profit. (5)

- (2) Hence, calculate the maximum profit. (2)

[15]

79 marks

SECTION B**QUESTION 7**

A loan is to be repaid over 10 years by means of equal monthly instalments starting after one month. After 3 years, the outstanding balance is R289 985,16. Interest is calculated at 14% per annum compounded monthly. Determine:

(a) The monthly payment (5)

(b) The original loan (5)

[10]

QUESTION 8

- (a) The first 4 terms of a quadratic sequence are: -26 ; p ; p^2 ; 34

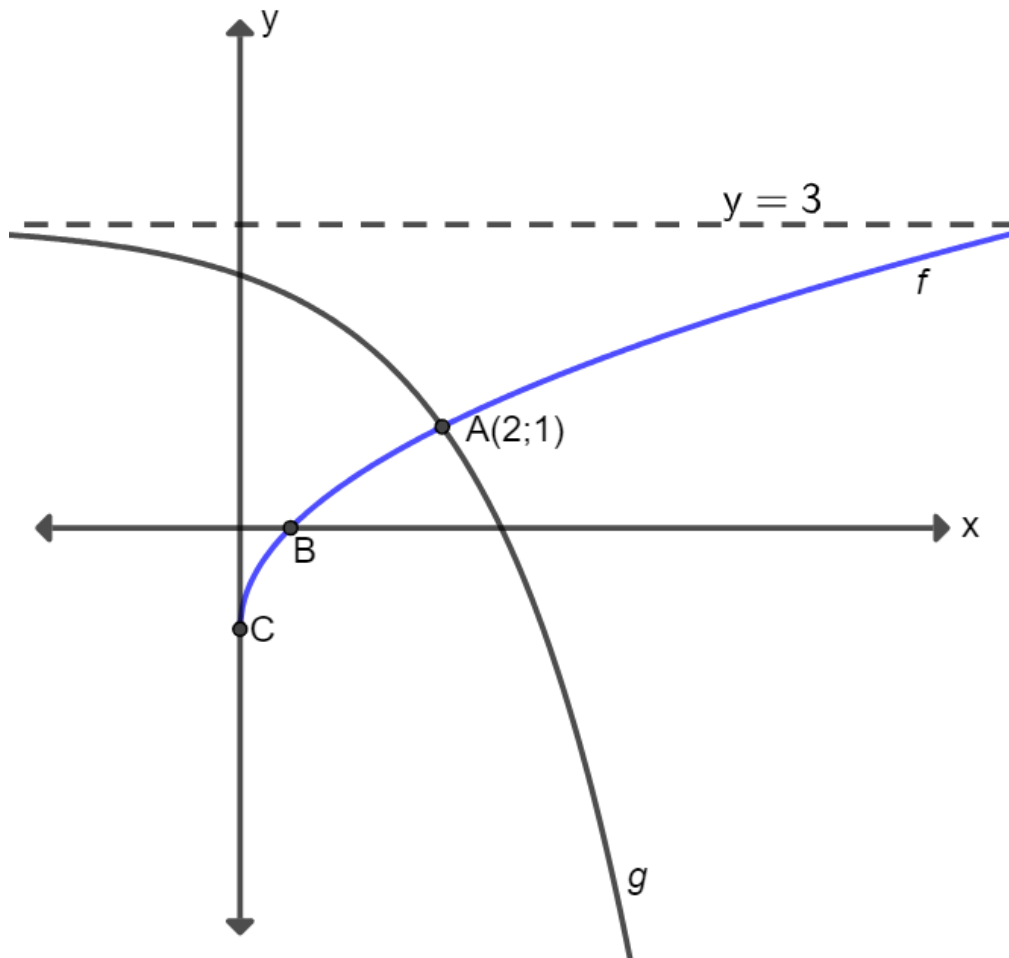
Determine the value(s) of p .

(5)

- (b) Determine the greatest value for m for which $\sum_{k=1}^m \frac{1}{25} (5)^{k-1} < 6$. (6)

QUESTION 9

In the diagram below, the graphs of $f(x) = \sqrt{ax} - 1$ and $g(x) = b \cdot 2^x + c$ are given. The graphs of f and g intersect at the point $A(2;1)$.



- (a) Determine the value(s) of x , represented on this sketch, for which $f(x) > g(x)$. (1)

(b) Determine the values of a , b and c in the functions given. (6)

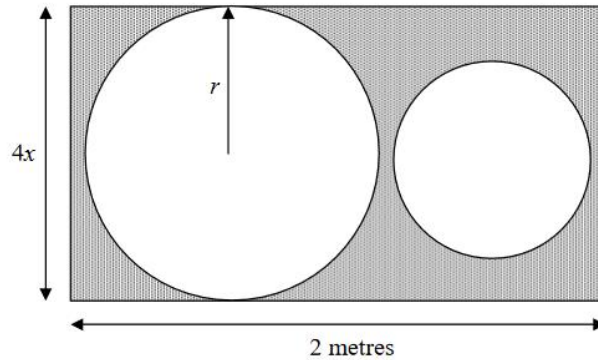
(c) Assuming that the equation of g is $g(x) = -\frac{1}{2} \cdot 2^x + 3$.
Determine the $g^{-1}(x)$, the inverse of $g(x)$. (4)

QUESTION 10

- (a) Find the value of x for which the tangent to the curve $y = -x^2 + 3x$ is parallel to the tangent of the curve $y = 2x^2 - 3x$. (4)

- (b) The function $y = px^3 + qx^2 + 9x + 1$, has a local maximum at the point (1; 5).
Determine the coordinates of the local minimum point. (8)

- (c) Two circles are cut out of a rectangular cardboard of 2 metres long and $4x$ metres wide.
The radius of the larger circle is half the width of the cardboard, and the smaller circle has a radius that is $\frac{2}{3}$ the radius of the bigger circle.



- (1) Show that the area of the shaded region is $A(x) = 8x - \frac{52\pi}{9}x^2$. (3)

- (2) Determine the value of x that maximises the shaded region. (3)

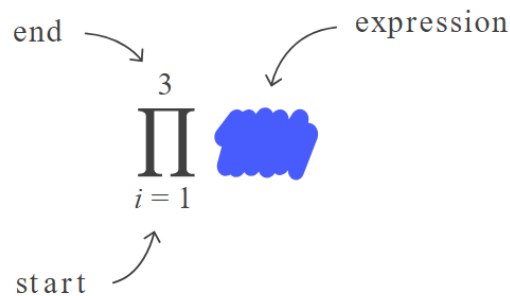
QUESTION 11

Given the equation $x^2 + 2x = k(x^2 - 2x + 2) + 2$, where k is constant such that $k \neq 1$.

Determine the range of values of k such that the equation has distinct real roots. (8)

QUESTION 12

- (a) Here is an operation and symbol you may not have seen before. It is called the product operator $\prod$.



The product operator is represented by the $\prod$ (product) symbol and is used to represent the operation of multiplying a sequence of expressions together. For example, the statement below represents the product of a sequence of three numbers.

$$\begin{aligned}\prod_{i=1}^3 (i+1) &= (1+1)(2+1)(3+1) \\ &= (2)(3)(4) \\ &= 24\end{aligned}$$

Now using the Product Operator evaluate the following:

$$\prod_{k=2}^{100} \left(1 - \frac{1}{k}\right)$$

(6)

- (b) A student chooses four numbers. When each number is added to the mean (average) of the other three numbers, the following sums are obtained: 25; 37; 43 and 51.

Determine the mean of the four numbers the student chose. (7)

[13]

71 marks

Total: 150 marks

ADDITIONAL SPACE (ALL QUESTIONS)

**REMEMBER TO CLEARLY INDICATE AT THE QUESTION THAT YOU HAVE USED THE
ADDITIONAL SPACE TO ENSURE ALL ANSWERS ARE MARKED.**

