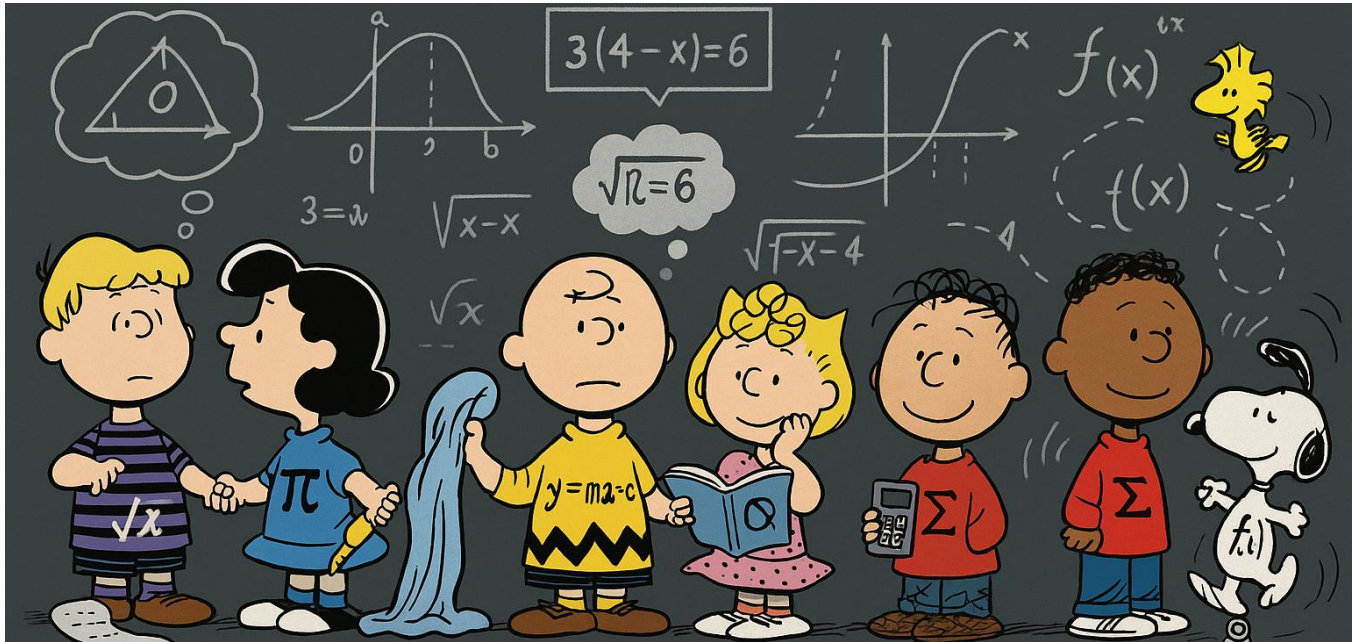




ST PETER'S
COLLEGE

GRADE 12 MATHEMATICS
PRELIMINARY EXAMINATION 2025
PAPER 1



EXAMINERS: O. DIBETSOE, N. LINDSAY

TIME: 3 HOURS

MODERATORS: B. DE BEER, S. DLAMINI, R. OBERMEYER

MARKS: 150

SESSION: ONE

DATE: 28 JULY 2025

NAME:						
TEACHER:	BDB	NLI	ODI	ROB	SDL	

Read the following instructions carefully.

1. This paper consists of 23 pages (including the cover page) and 12 questions as well as a 2-page Information Sheet. Please check that your paper is complete.
2. You may use an approved non-programmable and non-graphical calculator unless otherwise stated.
3. Clearly show **ALL** calculations, diagrams, graphs, etc. that you have used in determining your answers. **Answers only will NOT necessarily be awarded full marks.**
4. Diagrams are not necessarily drawn to scale.
5. If necessary, round off answers to **TWO** decimal places, unless otherwise stated.

	Section A						Section B						
Question	1	2	3	4	5	6	7	8	9	10	11	12	Total
Actual Mark													
Possible Mark	19	7	7	20	14	10	8	14	15	10	11	15	150
Marker's Signature													

SECTION A

Question 1

19 Marks

(a) Solve the following for x :

$$(1) \left(\frac{x}{3} - 1 \right)(x + 6) = 0 \quad (2)$$

$$(2) 243^{x+2} \cdot 9^{2x-1} = 9 \quad (4)$$

$$(3) \dots \dots \dots \quad (2)$$

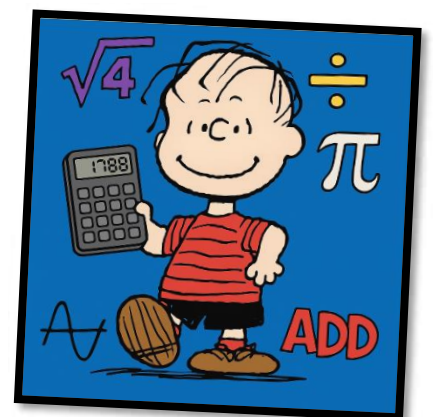
(4) $1 - \sqrt{10 - x} = -2x$

(5)

(b) Solve for x and y if:

(6)

$$4 - 2y = x \text{ and } 2^{x(x-y)} = 4$$



- (a) For which values of k will the equation $x^2 + x + 2 = 3x - k$ have non-real roots? (4)

- (b) Simplify the following, without the use of a calculator: (3)

$$\frac{\log_3 150 - \log_3 50}{\log(150 - 50)}$$

Consider the following arithmetic sequence:

$$(x + 5); (37 - x); (x + 13); \dots$$

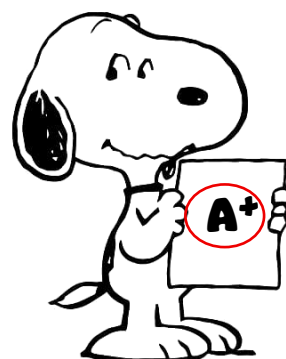
- (a) Show that $x = 14$. (3)

- (b) Hence, find the value of the 38^{th} term of the sequence. (4)

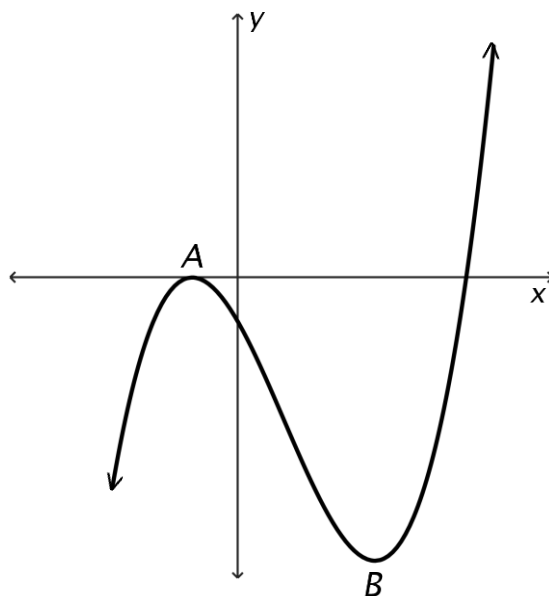


- (a) Using first principles, find $f'(x)$ if $f(x) = x^2 - 5$. (5)

- (b) Find $g'(x)$ if $g(x) = \frac{3}{x^3} + \frac{\sqrt[3]{x^2}}{2}$. (4)



- (c) Sketched below is the graph of $h(x) = x^3 - 3x^2 - 9x - 5$, with turning points at A and B .



- (1) Determine the coordinates of A and B . (5)

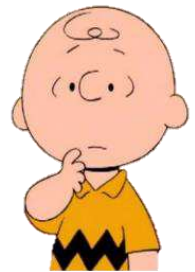
- (2) For which values of x will the gradient of the tangent to $h(x)$ be negative? (1)

- (3) Determine the equation of the tangent to $h(x)$ at $x = 4$. (5)

Charlie Brown buys a small house on auction for R450 000.



- (a) He was given a nominal interest rate of 8% p.a. compounded monthly. Help him to determine the effective annual interest rate. (2)

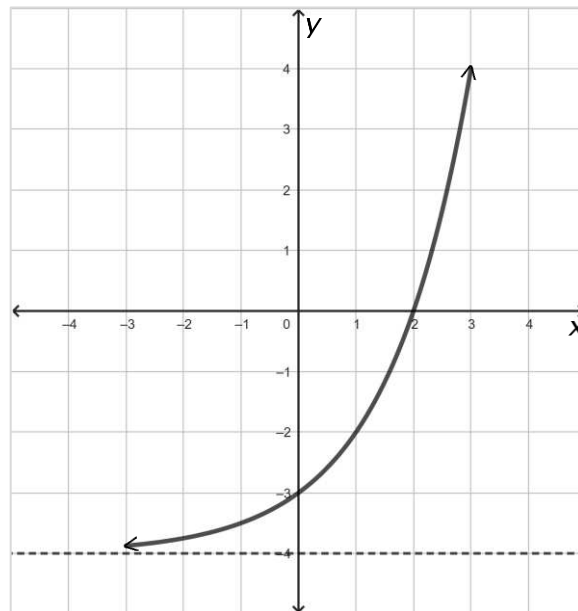


- (b) He decides to pay a 10% deposit and take out a bank loan for the balance. He will repay the loan in equal monthly instalments over a period of 20 years. The first repayment is made one month after the granting of the loan and interest remains constant at 8% p.a. compounded monthly. Calculate the value of his monthly repayment. (5)

- (c) Charlie Brown inherits some money and would like to settle the loan after 17 years. Calculate the balance outstanding on the loan immediately after his last payment at the end of the 17th year. (3)

- (d) Suppose he invests his inheritance in a savings account instead of settling the loan. The account offers 6,5% interest per annum compounded quarterly. If his total inheritance is R120 000, determine how long it will take for the savings account to grow to R200 000. (4)

Sketched below is the graph of $f(x) = 2^x - 4$.



- (a) Determine the inverse of $f(x)$, in the form $f^{-1}(x) = \dots$ (3)
- (b) What is the domain of $f^{-1}(x)$? (2)
- (c) On the axes above, sketch the graph of $f^{-1}(x)$, showing any intercepts with the axes and the asymptote. (3)
- (d) A quadrilateral $ABCD$ is formed by joining the x-intercepts and y-intercepts of both functions. Calculate the area of $ABCD$. (2)

SECTION A: 77 MARKS

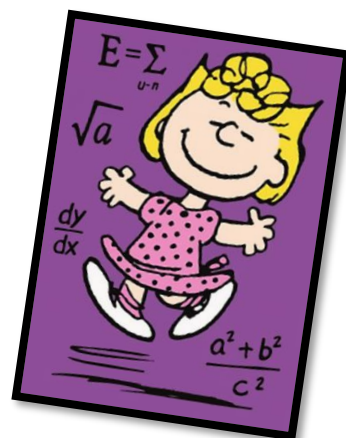
SECTION B

Question 7

8 Marks

Which term of the sequence $-5; 0; 9; 22; 39; \dots$ is equal to 429?

(8)



(a) Given the geometric series: $x + x\left(\frac{x-1}{2}\right) + x\left(\frac{x-1}{2}\right)^2 + \dots$

For which values of x will the series converge if $x \neq 1$? (3)

(b) The sum of the first three terms of a geometric sequence is $31\frac{1}{2}$. The sum of the fourth, fifth and sixth terms of the same sequence is $3\frac{15}{16}$.

(1) Set up an equation for the sum of the first three terms. (1)

(2) Set up an equation for the sum of the fourth, fifth and six terms. (1)

(3) Hence, determine the value(s) of the common ratio (r). (3)

- (c) (1) Patty owns a plant that is infected with bacteria. The number of bacterial cells in the plant, $B(h)$, at the end of every hour (h) is determined by the equation $B(h) = h^2 + 4h - 2$.

Determine the number of bacterial cells in the plant after **2 days**.

(2)



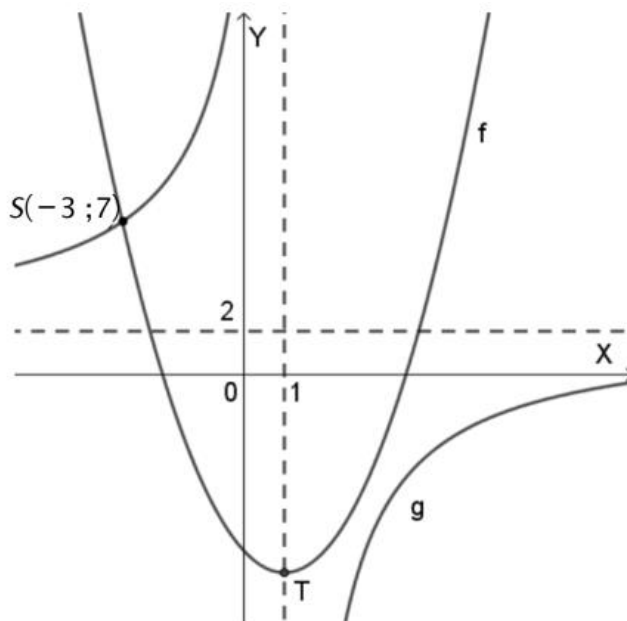
- (2) After some research, Patty discovers that the plant can undergo treatment, which reduces the formation of new bacterial cells. The sequence below represents the number of **new bacterial cells** formed in the plant at the end of every day while undergoing treatment:

670 ; 536 ; 428,8 ; ...

The plant will perish if it is infected by more than 3500 bacterial cells. Determine whether the plant will survive. Justify your answer.

(4)

The graphs of $f(x) = ax^2 + bx + c$ and $g(x) = \frac{a}{x+p} + q$ are shown on the sketch below. T is the turning point of f . The minimum value of f is -9 . The dotted lines are the asymptotes of g . $S(-3; 7)$ is a common point on f and g .



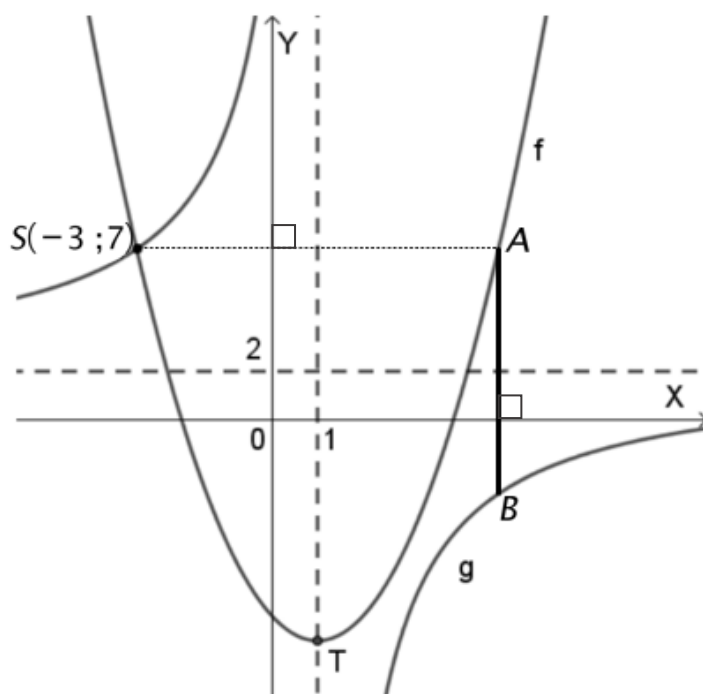
(a) Write down the coordinates of T . (1)

(b) Determine the equations of f and g . (8)

f	g

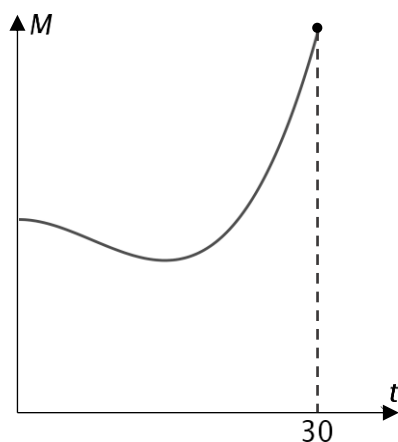
(c) For which values of x is $f(x) > g(x)$? (2)

(d) Determine the length of the vertical line segment AB , where A is a point on f such that SA is a horizontal line, and B is on g . (4)



Question 10**10 Marks**

Snoopy's mass in the first 30 days of his life is given by $M(t) = t^3 - 9t^2 + 3000$ for $0 \leq t \leq 30$, where t is the time in days and M is the mass of Snoopy in grams.



- (a) A puppy's mass usually decreases after the first few days of birth. On which day will Snoopy's mass return to his birth mass? (4)
- (b) On which day will Snoopy have a minimum mass? (3)
- (c) On which day will Snoopy's mass be decreasing the fastest? (3)

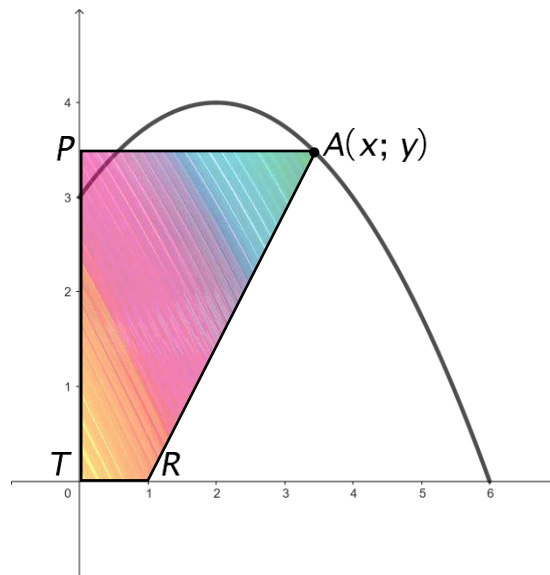
- (a) Two curves are defined by the following equations: (5)

$$y = 7^x \text{ and } y = 2 \cdot 5^x$$

Show that the x coordinate of the point of intersection of the two curves is given by:

$$\frac{1}{\log_2(7) - \log_2(5)}$$

- (b) A trapezium is drawn where T is fixed at the origin and R is fixed at $(1; 0)$.
 A can move along a path defined by the parabola $y = -\frac{x^2}{4} + x + 3$ for $0 < x < 6$.
 P moves up and down the y -axis so that PA is always parallel to TR .



The area for a trapezium is calculated using the formula $A = \frac{a+b}{2} \times h$, where a and b are the lengths of the parallel sides.

Calculate the x coordinate of A for which the area of $TRAP$ will be a maximum. (6)

(a) Let G and H be two events in a sample space such that:

- $P(G) = 0,4$
- $P(H) = h$
- $P(G \text{ or } H) = 0,7$

Determine the value of h for which G and H are independent.

(5)

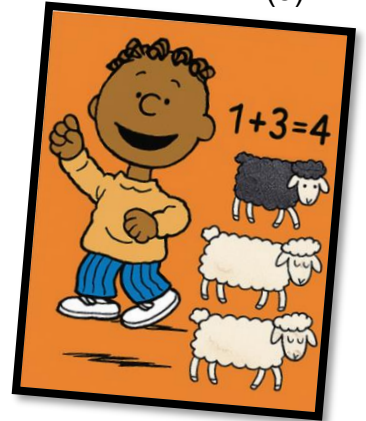
- (b) Franklin goes to visit his uncle on a sheep farm, to help with shearing season (where they remove the sheep's wool coat). His uncle has 15 black sheep, and the rest are white. While shearing, Franklin takes note of the colour of each of the sheep he is shearing before he releases it to the field.

Franklin's uncle says the probability of shearing 2 black sheep in a row is $\frac{1}{6}$.

Determine the number of sheep on the farm.

Hint: a tree diagram may be helpful.

(5)

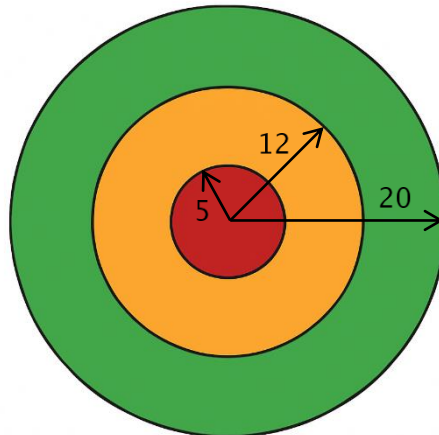
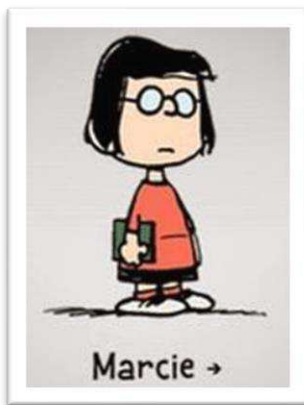


(c) A circular dartboard has a radius of 20 cm. It is divided into three concentric scoring zones:

- Inner circle (bullseye) with radius 5 cm – worth **100 points**
- Middle ring, from 5 cm to 12 cm – worth **50 points**
- Outer ring, from 12 cm to 20 cm – worth **20 points**

Marcie has **3 darts** left and needs exactly **170 points** to beat Peppermint Patty. Calculate the probability that Marcie will win. (Give your answer as a percentage, correct to 2 decimal places)

(5)



SECTION B: 73 MARKS

TOTAL: 150 MARKS

EXTRA SPACE – PLEASE LABEL WORK CAREFULLY