Sino Bright School Chongqing

Monthly Exam, 2025-2026 T1

Subject:	Pure Mathematics 1
Date:	Oct 2025
Time:	90 Minutes
Teacher:	Shi Feng

Mark Breakdown:	
Part I: Multiple Choice Questions 2 Marks × 15	Student Name:
Part II: Short Answer Questions 2 Marks × 15	
Part III: Long Answer Questions 40 Marks	
Total Score: 100	Score: _____

Special Instructions/Materials Allowed:

- Pen

Part I: Multiple Choice Questions (30 marks)

Choose the correct answer. Each question carries 2 marks.

1. Simplify $(3x^2y^{-3})^2$:

   (a) $6x^4y^{-6}$
   (b) $9x^4y^{-6}$
   (c) $9x^4y^{-5}$
   (d) $6x^4y^{-5}$

2. Find the value of k if $x^2 - 4x + k = 0$ has discriminant 0:

   (a) 2
   (b) 4
   (c) 6
   (d) 8

3. Solve $x^2 - 5x - 14 > 0$:

   (a) $x < -2$ or $x > 7$
   (b) $x < -7$ or $x > 2$
   (c) $-2 < x < 7$
   (d) $-7 < x < 2$

4. The graph of $y = \frac{1}{x}$ is translated by $\begin{pmatrix} 2 \\ -3 \end{pmatrix}$. What is the new equation?

   (a) $y = \frac{1}{x-2} - 3$
   (b) $y = \frac{1}{x+2} + 3$
   (c) $y = \frac{1}{x-2} + 3$
   (d) $y = \frac{1}{x+2} - 3$

5. Which is a factor of $x^3 - 4x$?

   (a) $x - 2$
   (b) $x + 1$
   (c) $x^2 + 4$
   (d) $x - 4$

6. Simplify $\sqrt{12} + \sqrt{27}$:

   (a) $5\sqrt{3}$
   (b) $6\sqrt{3}$
   (c) $7\sqrt{3}$
   (d) $8\sqrt{3}$

7. Evaluate $8^{-\frac{2}{3}}$:

   (a) $\frac{1}{4}$
   (b) $\frac{1}{2}$
   (c) 2
   (d) 4

8. The function $f(x) = x^2 + 2x + 3$ has:

   (a) Two distinct real roots
   (b) One repeated real root
   (c) No real roots
   (d) A maximum point at $(-1, 2)$

9. Complete the square: $x^2 + 8x + 1$

   (a) $(x + 4)^2 - 15$
   (b) $(x + 4)^2 + 15$
   (c) $(x + 8)^2 - 63$
   (d) $(x + 8)^2 + 1$

10. Solve $x^2 - 6x + 9 = 0$:

    (a) $x = 3$ only
    (b) $x = -3$ only
    (c) $x = 3$ and $x = -3$
    (d) No real solutions

11. Simplify $\frac{\sqrt{50} + \sqrt{18}}{\sqrt{2}}$:

(a) 4   (b) $4\sqrt{2}$ (c) 8   (d) $2\sqrt{2}$

12. Evaluate $27^{-\frac{2}{3}}$:

    (a) 9   (b) $\frac{1}{9}$ (c) $\frac{1}{3}$ (d) 3

13. Rationalize: $\frac{-3}{2+\sqrt{5}}$

    (a) $6+3\sqrt{5}$ (b) $2-\sqrt{5}$ (c) $6-3\sqrt{5}$ (d) $\frac{3\sqrt{5}-6}{3}$

14. Complete the square: $x^2 + 6x + 5$

    (a) $(x+3)^2 - 4$ (b) $(x+3)^2 + 4$ (c) $(x+6)^2 - 31$ (d) $(x+6)^2 + 5$

15. The graph of $y = x^2$ is translated by $\begin{pmatrix} -2 \\ 3 \end{pmatrix}$. What is the new equation?

    (a) $y = (x-2)^2 + 3$ (b) $y = (x+2)^2 + 3$ (c) $y = (x-2)^2 - 3$ (d) $y = (x+2)^2 - 3$

Part II: Short Answer Questions (30 marks)

True/False Questions (10 marks)

State whether each statement is True or False. Each question carries 2 marks.

1. **True/False:** The function $f(x) = x^2 + 2x + 3$ has no real roots.

2. **True/False:** The graph of $y = (x-2)^2 + 3$ has a minimum point at $(2,3)$.

3. **True/False:** $\sqrt{12} + \sqrt{27} = 5\sqrt{3}$.

4. **True/False:** The inequality $\frac{1}{x} > 2$ holds for all $x > 0$.

5. **True/False:** The equations $y = x^2$ and $y = 2x - 1$ have exactly one solution.

Fill in the Blanks (20 marks)

Complete each statement. Each blank carries 2 marks.

1. Simplify $\frac{6x^3y^2}{2xy}$: _____

2. Solve $x^2 - 6x + 9 = 0$: _____

3. Complete the square: $x^2 + 8x + 1 = $ _____

4. Solve $\frac{x+1}{x-2} < 0$: _____

5. Asymptotes of $y = \frac{3}{x-4} + 2$: _____ and _____

6. Discriminant of $3x^2 - 2x + 5 = 0$: _____

7. Roots of $2x^2 + 5x - 3 = 0$: _____ and _____

8. The inequality $x^2 + 4x + 4 \geq 0$ holds for _____

9. Translation vector mapping $y = x^2$ to $y = (x+3)^2 - 5$: _____

10. For $f(x) = (2x-3)(x+1)$, find $f(2x)$: _____

Part III: Long Answer Questions (40 marks)

Show all working. Each question carries 10 marks.

1. **Quadratic Equations and Inequalities**

    (a) Solve $x^2 - 10x + 16 = 0$ by factorisation. (3 marks)

    (b) Hence, solve $x^2 - 10x + 16 \leq 0$. (3 marks)

    (c) Sketch the graph of $y = x^2 - 10x + 16$, indicating key points. (4 marks)

2. **Algebraic Manipulation**

    (a) Simplify $\frac{2x^2 - 8}{x^2 - 4x + 4}$. (3 marks)

    (b) Express $\frac{3}{\sqrt{5} - 1}$ in the form $a + b\sqrt{5}$, where a, b are rational. (3 marks)

    (c) Factorise completely: $x^3 - 3x^2 - 4x + 12$. (4 marks)

3. **Graphs and Transformations**

    (a) Sketch $y = x^2 - 4x + 3$, labeling intercepts and turning point. (4 marks)

    (b) On the same axes, sketch $y = x(x - 1)(x + 1)$, labeling intercepts. (3 marks)

    (c) Find the translation vector mapping $y = x^2$ to $y = (x - 1)^2 + 2$. (3 marks)

4. **Advanced Problems**

    (a) Sketch these functions, labeling intercepts: (4 marks)

$$f(x) = (2 + x)^2(2 - x), \quad g(x) = \frac{-4}{x^2}$$

    (b) State the number of solutions to $f(x) = g(x)$ and explain why. (3 marks)

    (c) Shade the region satisfying $y \geq f(x)$ and $y \leq g(x)$. (3 marks)