O Level Maths

Topic: Linear, Quadratic, and Cubic Graphs

> **Instructions**
>
> Answer all questions. Show working where necessary. Sketch the graphs for the given functions and solve the problems related to linear, quadratic, and cubic graphs.

Practice Problems

Linear Graphs:

1. Sketch the graph of $y = 2x + 3$.

2. Plot the graph for $y = -x + 4$, and find the x-intercept.

3. For the equation $3x - 2y = 6$, find the slope and y-intercept. Then, sketch the graph.

4. Plot the graph of $y = 4x - 5$ and find the slope and y-intercept.

Quadratic Graphs:

1. Sketch the graph of $y = x^2 - 4x + 3$.

2. For the quadratic equation $y = x^2 + 2x - 8$, find the vertex and axis of symmetry. Sketch the graph.

3. Find the x-intercepts of the quadratic equation $y = x^2 - 6x + 9$ and sketch the graph.

4. Plot the graph of $y = -x^2 + 2x + 3$ and identify the vertex and direction of the parabola.

Cubic Graphs:

1. Sketch the graph of $y = x^3 - 3x$.

2. Plot the graph of $y = x^3 + 2x^2 - x$ and find the inflection point.

3. For the cubic equation $y = -x^3 + 4x$, find the roots and sketch the graph.

4. Sketch the graph of $y = 2x^3 - 4x^2 + 3x$, and identify the turning points.

Word Problems

1. A company's profit function is given by $P(x) = -x^2 + 6x - 8$, where x is the number of units sold. Find the number of units sold that will maximize the profit and sketch the profit function.

2. A car's speed s in kilometers per hour is modeled by the equation $s = 2x^3 - 3x^2 + 5$, where x is the time in hours. Find the speed at $x = 2$ hours.

3. A parabola models the path of a ball thrown into the air, given by the equation $h(t) = -5t^2 + 20t + 10$, where t is time in seconds and $h(t)$ is height in meters. Find the maximum height of the ball.

Multiple-Choice Questions

1. What is the vertex of the quadratic function $y = x^2 - 6x + 8$?

   A. $(3, -1)$
   B. $(-3, 8)$
   C. $(3, 8)$
   D. $(-3, -1)$

2. What is the x-intercept of the graph of $y = 2x + 4$?

   A. $x = -2$
   B. $x = 2$
   C. $x = 0$
   D. $x = -4$

3. Which of the following is the equation of the cubic function that passes through the origin and has an inflection point at $x = 1$?

   A. $y = x^3 - 3x$
   B. $y = x^3 + 2x^2 - x$
   C. $y = 2x^3 - 4x$
   D. $y = -x^3 + 4x$

4. What is the turning point of the cubic equation $y = x^3 - 3x^2 - 4x + 12$?

    A. $(2, -4)$

    B. $(-2, 4)$

    C. $(0, 12)$

    D. $(1, 7)$

5. What is the general shape of the cubic graph of $y = -x^3 + 3x^2$?

    A. An upward-opening parabola

    B. A downward-opening parabola

    C. A symmetric curve with one turning point

    D. A curve with two turning points and an inflection point

6. Which of the following is the correct form of the quadratic equation for a parabola with a vertex at $(2, 5)$?

    A. $y = (x - 2)^2 + 5$

    B. $y = x^2 + 2x + 5$

    C. $y = x^2 - 4x + 5$

    D. $y = x^2 + 4x - 5$

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