MATHEMATICS · GRADES 10-12

Curve sketching

Difficulty level: Advanced

Mathematics: Grades 10-12

This document was made by AI and there may be mistakes. If a question or answer looks wrong, use the Flag a mistake button to let Brett know so he can fix it.

Overview of the concept

This is how you picture what a changing quantity will do before you ever plot a single point. A crowd grows fast at first, then levels off as the room fills, and a sketch shows you that shape in one glance. Engineers and scientists sketch curves to predict what happens next, like how a temperature falls or a population grows. A good sketch tells you the story of the numbers without a single calculation.

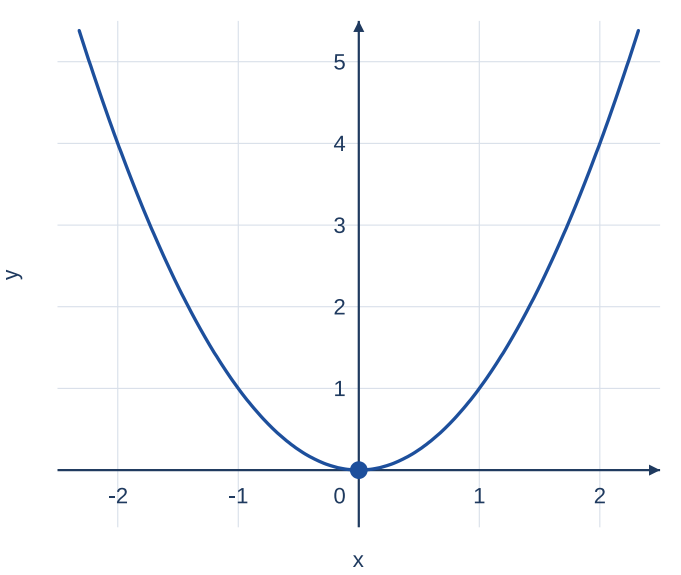


© 2026 Brett Robbins. All Rights Reserved.

Worked examples

EXAMPLE 1

Q Sketch $y = x^2$ using key features.



SOLUTION

Intercepts: the graph passes through (0, 0).

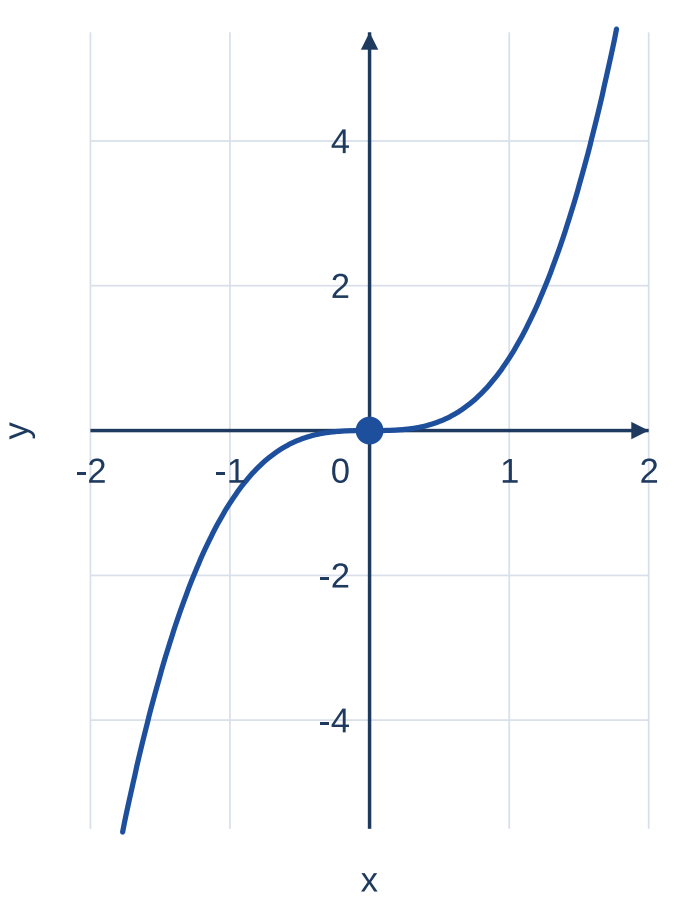
Derivative 2x: decreasing for x less than 0, increasing for x greater than 0.

So it is a U shape with a minimum at (0, 0).

© 2026 Brett Robbins. All Rights Reserved.

EXAMPLE 2

Q Sketch $y = x^3$ using key features.



SOLUTION

Intercepts: the graph passes through $(0, 0)$.

Derivative $3x^2$ is never negative, so the graph never decreases.

So it rises through the origin, flattening there but never turning back.

© 2026 Brett Robbins. All Rights Reserved.

Practice questions

1 **Describe the shape of the graph of $y = -x^2$, in words.**

- **A** A U shape with a minimum at the origin
- **B** An upside-down U with a maximum at (0, 1)
- **C** An upside-down U with a maximum at the origin
- **D** A straight line through the origin

Understand It with Pulse | Flag a mistake

© 2026 Brett Robbins. All Rights Reserved.

2 How does the graph of $y = x^2 + 1$ look, in words?

- **A** A U shape shifted down by 1, with a minimum at (0, -1)
- **B** A U shape shifted up by 1, with a minimum at (0, 1)
- **C** An upside-down U with a maximum at (0, 1)
- **D** A U shape with a minimum at the origin

Understand It with Pulse | Flag a mistake

© 2026 Brett Robbins. All Rights Reserved.

3 **Describe the shape of the graph of $y = x^3 - 3x$, in words.**

- **A** Rises to a peak at (-1, 2), falls to a valley at (1, -2), then rises again
- **B** Falls to a valley at (-1, -2), rises to a peak at (1, 2), then falls again
- **C** Rises to a peak at (1, 2), falls to a valley at (-1, -2), then rises again
- **D** Rises steadily without turning back

Understand It with Pulse | Flag a mistake

© 2026 Brett Robbins. All Rights Reserved.

4

A crowd fills a hall quickly at first, then slows down as the hall gets full. What does a sketch of the number of people against time look like?

- **A** A curve that rises slowly at first and then steeply
- **B** A straight line rising steadily
- **C** A curve that falls steeply at first and then flattens out
- **D** A curve that rises steeply at first and then flattens out as it levels off

Understand It with Pulse | Flag a mistake

© 2026 Brett Robbins. All Rights Reserved.

5 **Describe the shape of the graph of $y = (x - 2)^2$, in words.**

- **A** A U shape with a minimum at (2, 0)
- **B** A U shape with a minimum at the origin
- **C** An upside-down U with a maximum at (2, 0)
- **D** A U shape shifted up by 2

Understand It with Pulse | Flag a mistake

© 2026 Brett Robbins. All Rights Reserved.

6 What shape is the graph of $y = -x^3$, in words?

- **A** Falls through the origin, flattening there
- **B** Rises through the origin, flattening there
- **C** Falls through the origin, steepening there
- **D** An upside-down U with a maximum at the origin

Understand It with Pulse | Flag a mistake

7 Where is the minimum of $y = x^2 - 2x + 1$?

- **A** (0, 1)
- **B** (1, 0)
- **C** (-1, 0)
- **D** (1, 1)

Understand It with Pulse | Flag a mistake

© 2026 Brett Robbins. All Rights Reserved.

8 What are the x-intercepts of $y = x^2 - 9$?

- **A** x = 3 and x = -3
- **B** x = 9 and x = -9
- **C** x = 0 and x = 3
- **D** x = 0 and x = -3

Understand It with Pulse | Flag a mistake

9 What are the critical points of $y = x^3 - 3x^2$?

- **A** x = 0 and x = 3
- **B** x = 0 and x = 2
- **C** x = 1 and x = 2
- **D** x = -2 and x = 0

Understand It with Pulse | Flag a mistake

© 2026 Brett Robbins. All Rights Reserved.

10 **Find the y-intercept of the cubic $y = x^3 - 2x + 5$**

Understand It with Pulse | Flag a mistake

© 2026 Brett Robbins. All Rights Reserved.

ANSWER KEY

1. An upside-down U with a maximum at the origin

2. A U shape shifted up by 1, with a minimum at (0, 1)

3. Rises to a peak at (-1, 2), falls to a valley at (1, -2), then rises again

4. A curve that rises steeply at first and then flattens out as it levels off

5. A U shape with a minimum at (2, 0)

6. Falls through the origin, flattening there

7. (1, 0)

8. x = 3 and x = -3

9. x = 0 and x = 2

10. 5

© 2026 Brett Robbins. All Rights Reserved.