MATHEMATICS · GRADES 10-12

Normal lines

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 engineers work out the angle a signal bounces off a curved satellite dish or a car headlight reflector. The dish has to catch a signal and send it to one exact point, and the headlight has to throw light forward instead of scattering it everywhere. A solar concentrator uses the same idea to focus sunlight onto one spot to make heat. Get the angle wrong and the signal misses, the light spreads, or the heat never arrives.



Rule

The normal line is perpendicular to the tangent, so its slope is the negative reciprocal of the tangent slope.

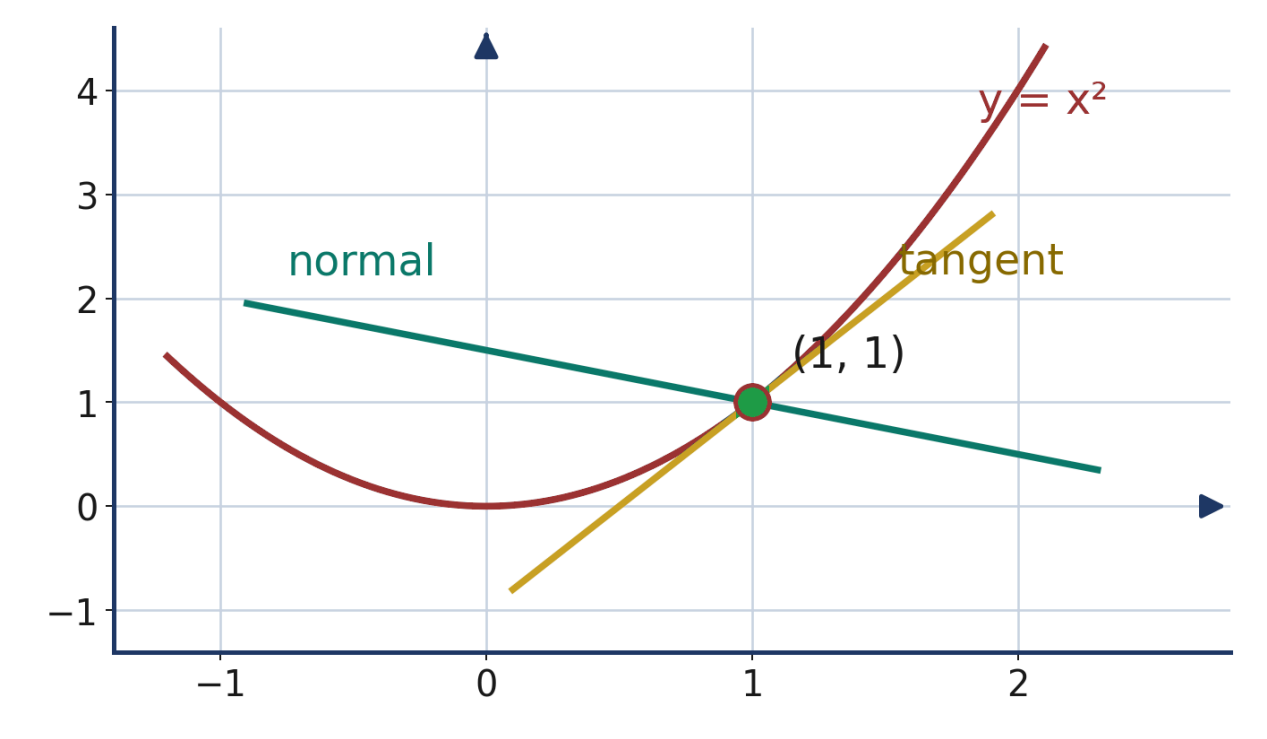
Find the tangent slope from the derivative, flip it and change its sign, then use the point to write the line.

© 2026 Brett Robbins. All Rights Reserved.

Worked examples

EXAMPLE 1

Q Find the normal line to $y = x^2$ at $x = 1$.



SOLUTION

Tangent slope: derivative $2x$ at $x = 1$ is 2.

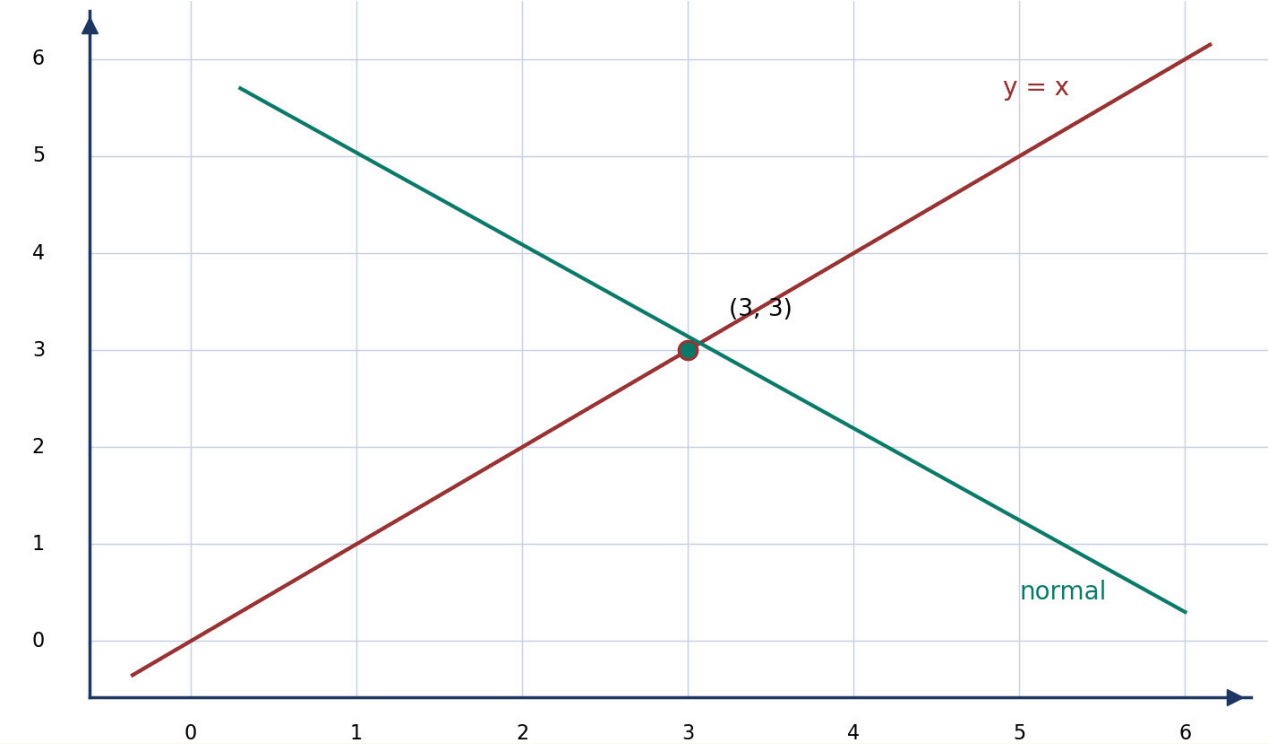
Normal slope is the negative reciprocal: $-\frac{1}{2}$

Point (1, 1): $y - 1 = -\frac{1}{2}(x - 1)$

© 2026 Brett Robbins. All Rights Reserved.

EXAMPLE 2

Q Find the normal line to $y = x$ at $x = 3$.



SOLUTION

Tangent slope is 1.

Normal slope is -1.

Point (3, 3): $y - 3 = -1(x - 3)$, so $y = -x + 6$

© 2026 Brett Robbins. All Rights Reserved.

Practice questions

1 Find the normal slope to $y = x^2$ at $x = 3$.

- **A** $-\frac{1}{3}$
- **B** $-\frac{1}{6}$
- **C** $\frac{1}{6}$
- **D** -6

Understand It with Pulse | Flag a mistake

2 Find the normal line to $y = x^2$ at $x = 0$.

- **A** $x = 0$, a vertical line
- **B** $y = 0$, a horizontal line
- **C** $y = x$
- **D** $y = -x$

Understand It with Pulse | Flag a mistake

© 2026 Brett Robbins. All Rights Reserved.

3 **Find the normal line to $y = x^2$ at $x = -1$.**

- **A** $y - 1 = -\frac{1}{2}(x - 1)$
- **B** $y - 1 = \frac{1}{2}(x + 1)$
- **C** $y - 1 = 2(x + 1)$
- **D** $y - 1 = -2(x + 1)$

Understand It with Pulse | Flag a mistake

4 **Find the normal line to $y = x^3$ at $x = 1$.**

- **A** $y - 1 = 3(x - 1)$
- **B** $y - 1 = -3(x - 1)$
- **C** $y - 1 = -\frac{1}{3}(x - 1)$
- **D** $y - 1 = \frac{1}{3}(x - 1)$

Understand It with Pulse | Flag a mistake

© 2026 Brett Robbins. All Rights Reserved.

5 Find the x-intercept of the normal line to $y = x^2$ at $x = 1$.

- **A** 3
- **B** 1
- **C** $\frac{3}{2}$
- **D** -1

Understand It with Pulse | Flag a mistake

6 Find the normal line to $y = 3x$ at the point $(2, 6)$.

- **A** $y - 6 = 3\,(x - 2)$
- **B** $y - 6 = -3\,(x - 2)$
- **C** $y - 6 = \frac{1}{3}\,(x - 2)$
- **D** $y - 6 = -\frac{1}{3}\,(x - 2)$

Understand It with Pulse | Flag a mistake

© 2026 Brett Robbins. All Rights Reserved.

7 The normal slope at a point on a curve is $-\frac{1}{4}$. What is the tangent slope there?

- **A** 4
- **B** -4
- **C** $\frac{1}{4}$
- **D** $-\frac{1}{4}$

Understand It with Pulse | Flag a mistake

8 Find the normal line to $y = x^2 - 3x$ at $x = 2$.

- **A** $y = -x$
- **B** $y = x - 4$
- **C** $y = -x - 2$
- **D** $y = x$

Understand It with Pulse | Flag a mistake

© 2026 Brett Robbins. All Rights Reserved.

9 What is the normal slope when the tangent slope is 5?

A 5

B -5

C $\frac{1}{5}$

D $-\frac{1}{5}$

Understand It with Pulse | Flag a mistake

10 Find the normal line to $y = -x$ at the point $(1, -1)$.

A $y = -x - 2$

B $y = x + 2$

C $y = x - 2$

D $y = -x + 2$

Understand It with Pulse | Flag a mistake

© 2026 Brett Robbins. All Rights Reserved.

ANSWER KEY

1. $-\frac{1}{6}$

2. $x = 0$, a vertical line

3. $y - 1 = \frac{1}{2}(x + 1)$

4. $y - 1 = -\frac{1}{3}(x - 1)$

5. 3

6. $y - 6 = -\frac{1}{3}(x - 2)$

7. 4

8. $y = -x$

9. $-\frac{1}{5}$

10. $y = x - 2$

© 2026 Brett Robbins. All Rights Reserved.