Slope of a Tangent Line Visually

by Sophia

☰ WHAT'S COVERED

In this lesson, you will learn what a tangent line is and how to estimate its slope graphically. Specifically, this lesson will cover:

1. Estimating the Slope of a Tangent Line Graphically
2. Horizontal Tangent Lines

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1. Estimating the Slope of a Tangent Line Graphically

A **tangent line** is a line that touches a graph at one specific point (but does not cross it).

> ↪ EXAMPLE The graph of $f(x) = 2\sqrt{x}$ and its tangent line at (4, 4) are shown below. Use this picture to estimate the slope of the tangent line.
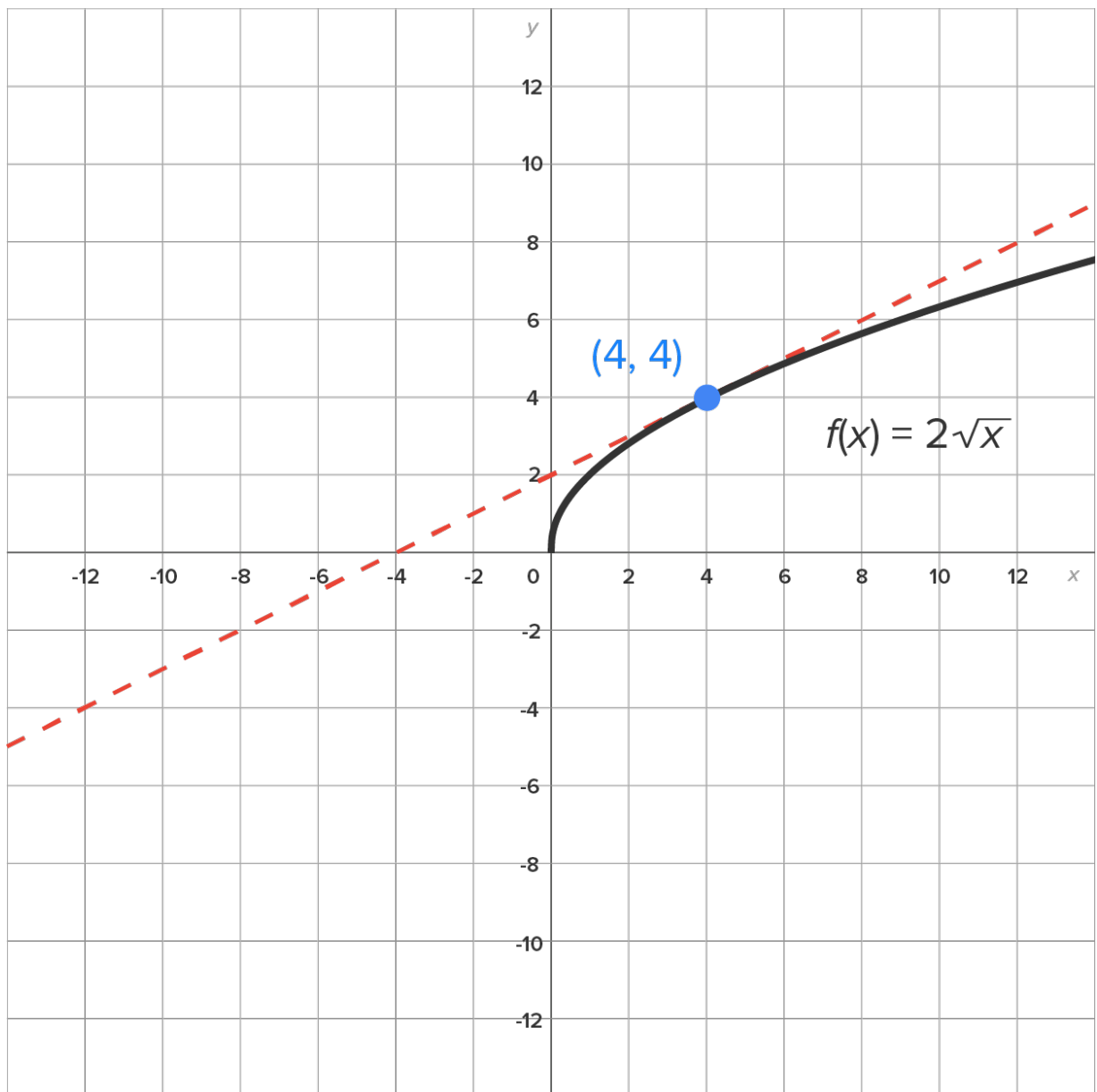
In order to estimate the slope of a line, two points are needed. Thus, we need another point on the line besides (4, 4) to estimate the slope of this line. Inspecting closely, it looks like the point (8, 6) is also contained on the line.

Thus, the slope of the tangent line is approximately $m = \dfrac{6-4}{8-4} = \dfrac{2}{4} = \dfrac{1}{2}$. In fact, this is the exact slope of the tangent line.

📄 **TERM TO KNOW**

Tangent Line
A line that touches (but does not cross) the graph of a function at a specific point.
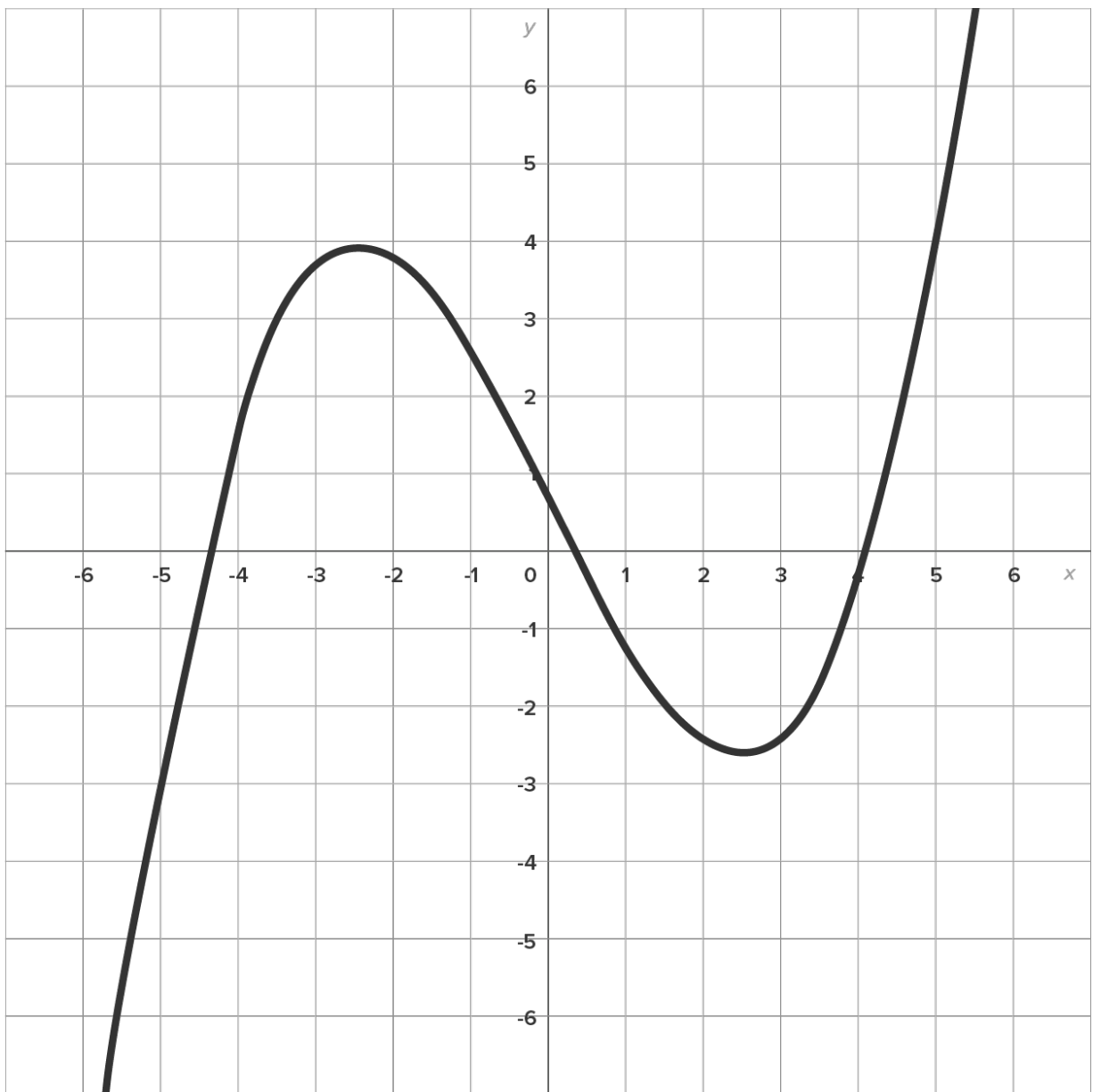
2. Horizontal Tangent Lines

Tangent lines whose slopes are 0, also known as horizontal tangent lines, are very useful in calculus. It is important (and quite simple) to identify the places on a graph where the tangent line is horizontal.

↪ **EXAMPLE** Estimate the slope of the tangent line to the curve $f(x) = x^3 - 3x + 4$ at the point (1, 2). The graph of $f(x)$ and its tangent line are shown here:

$f(x) = x^3 - 3x + 4$

(1, 2)
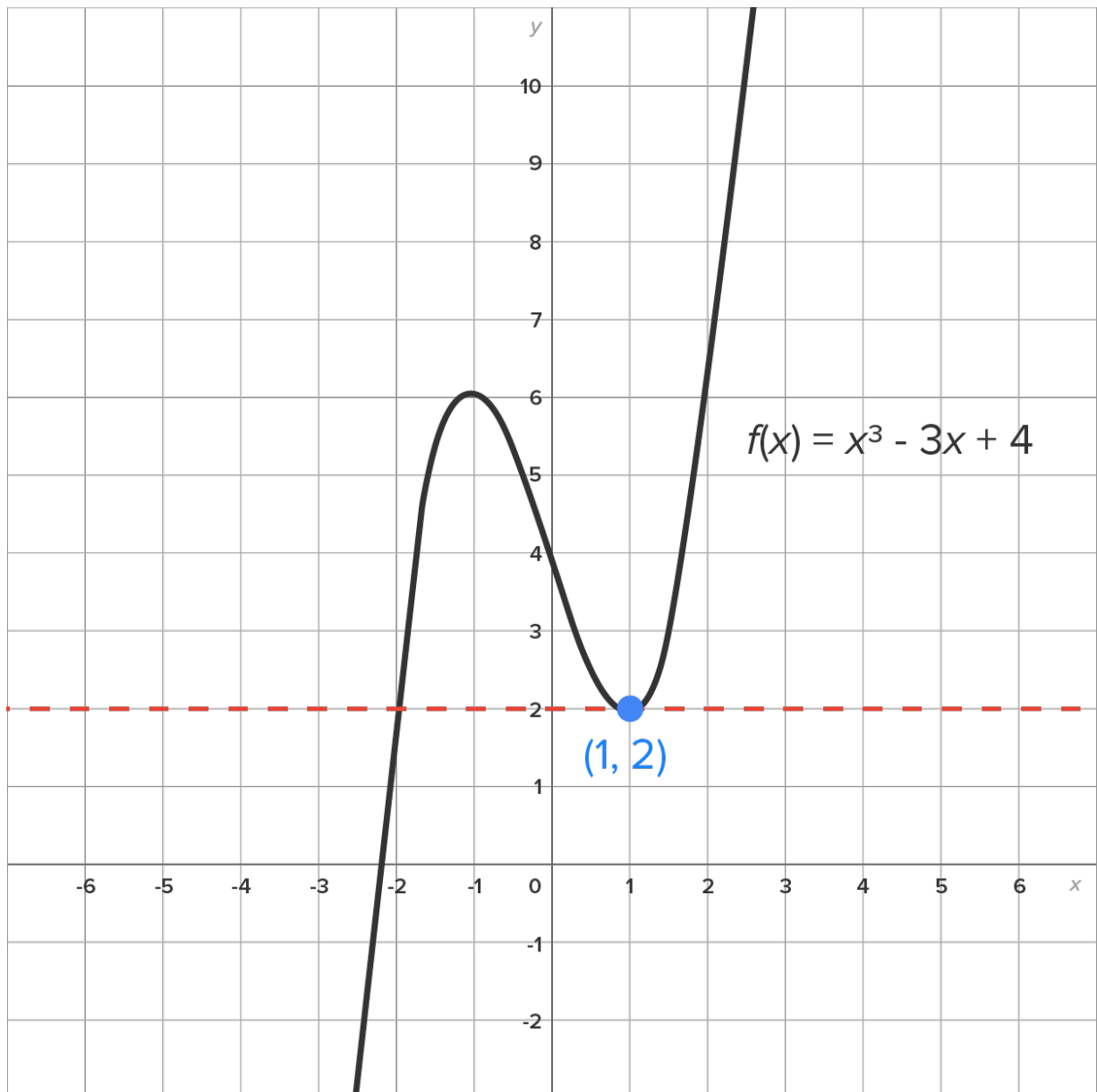
The tangent line appears to be horizontal, which means its slope is zero.

↪ **EXAMPLE** Estimate all values of x for which the graph of $y = f(x)$ below has a horizontal tangent line.

Looking at the graph, the values of x for which the tangent lines are horizontal are about $x = -2.5$ and $x = 2.5$.

In this lesson, you learned about tangent lines, which are lines that touch (but do not cross) the graph of a function at a specific point. You learned that given the graph of a function, you can visually **estimate the slope of the tangent line graphically**. This can be accomplished by estimating another point on the tangent line. You also learned that tangent lines whose slopes are 0 are known as **horizontal tangent lines**; these are very useful in calculus.

SOURCE: THIS WORK IS ADAPTED FROM CHAPTER 0 OF *CONTEMPORARY CALCULUS* BY DALE HOFFMAN.

Tangent Line

A line that touches (but does not cross) the graph of a function at a specific point.