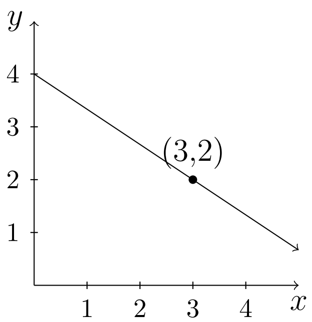
**Goals:**

- Define, compute, and draw secant and tangent lines.
- Interpret the slope of secant and tangent lines.

**Motivating Example:**

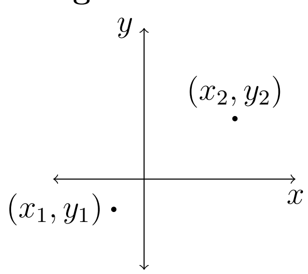



(a) Write an equation for this line and identify the slope.

(b) If the $x$-values represent hours since you started hiking and the $y$-values represent the number of miles between you and your destination, what does the slope represent? What units should the slope be in?

(c) If the $x$-values represent the number of books a publisher sells and the $y$-values represent the publisher's revenue (total amount of money received), what does the slope represent? What units should the slope be in?

**Background**

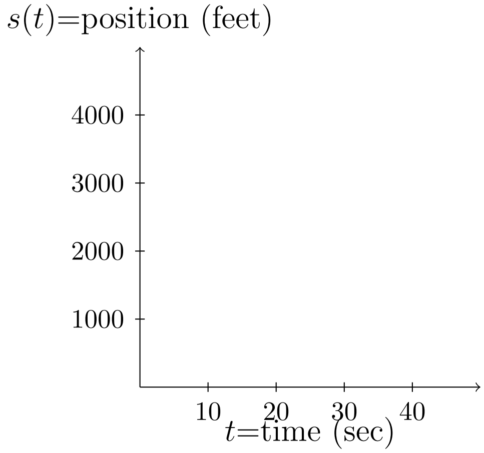



Slope $= m =$

Point slope form of the line:

If $s(t)$ is a function that represents ____________________, then the slope of the line between $\big(a, s(a)\big)$ and $\big(b, s(b)\big)$ represents ________________________________________.

**Average Velocity Example 1**




| s | s(t) |
|---|---|
| 0 | 200 |
| 10 | 500 |
| 15 | 1000 |
| 16 | 1200 |
| 20 | 2100 |
| 30 | 3200 |

Average velocity over $[0, 30]$:

Average velocity over $[10, 20]$:

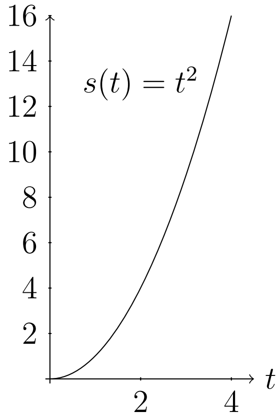
Average velocity over $[15, 16]$:

Which of these is the closest estimate to the velocity of the object at $t = 15$?

Write an equation for (but do not compute) an even more accurate estimate of velocity at $t = 15$:

In general, to find the average slope of a function $f(x)$ over the interval $[a, a + h]$, compute the **difference quotient**:

**Average Velocity Ex. 2**




Let $t$ be time in seconds and $s(t)$ be distance traveled in feet.

Average slope over $[2, 4]$:

A line through two points on a function is called a ____________________ .

The slope of the secant line between $(2, 4)$ and $(4, 16)$ is ______________ .

Average velocity over $[2, 3]$:

Average velocity over $[2, 2.1]$:

As the intervals get smaller, the secant lines get closer and closer to the tangent line at $t = 2$. The slope of the **tangent line** of $f(t)$ at $t = 2$ is exactly equal to the velocity of the object at $t = 2$.

Let's find the slope of the tangent line at $t = 2$ using the difference quotient. The average velocity between 2 and $2+h$ seconds is:

**Additional Examples**