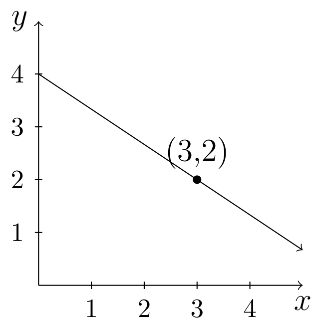
Goals:

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

Motivating Example:

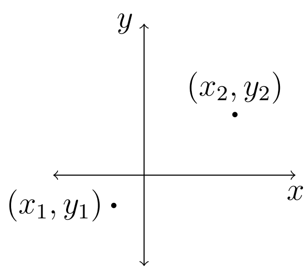


(a) Write an equation for this line and identify the slope.

(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

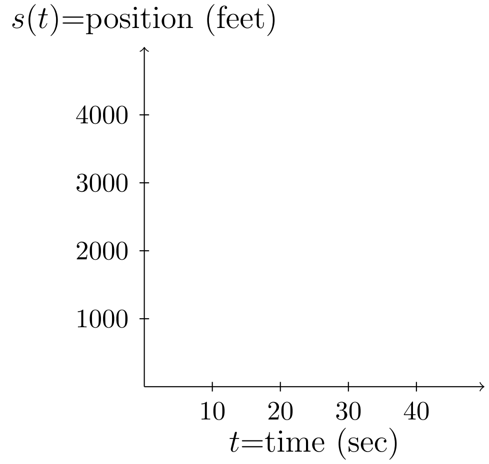


Slope = m =

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 $[10, 20]$:

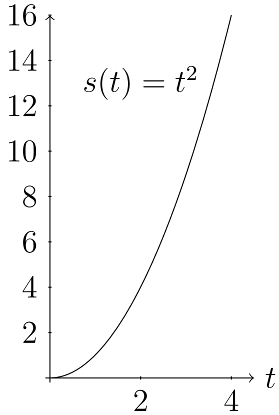
Average velocity over $[15, 16]$:

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