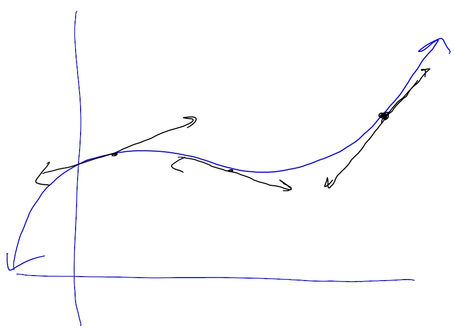
Section 2.1: Tangent and Velocity Problems

(1) What is a tangent line?

A tangent line to a curve at a point is a line that "just touches" the curve at that point. (Unless the curve is itself a line). See various examples below.



(2) What is a secant line? How do we find their slope?

A secant line to a curve between two points in the line that goes through those two points. To find the slope, you find the change in the y values over the change of x, i.e. the slope of the secant line to a curve $f(x)$ from $x = a$ to $x = b$ is given by $\dfrac{f(b) - f(a)}{b - a}$

(3) How can we use secant lines to help us find the slope of tangent lines?

If we find the slope of the secant lines from $x = a$ to $x = b$ as b gets closer and closer to a, then the slope of the secant lines gets closer and closer to the slope of the tangent lines.

(4) What is instantaneous velocity? How is it related to average velocity? To tangent lines?

The instantaneous velocity of an object tells the velocity of that object at a given point in time. We find it by taking the average velocity over smaller and smaller time intervals. Given a graph of a position function, the slope of the secant line gives us average velocity and the slope of the tangent line gives the instantaneous velocity.

Important formulas to know from this section:

Slope of secant line/average velocity:

$$\frac{f(b)-f(a)}{b-a}$$

Slope of tangent line/instantantanous velocity:

(at $x = a$) $\lim_{x\to a} \frac{f(x)-f(a)}{x-a}$

or

$\lim_{h\to 0} \dfrac{f(a+h)-f(a)}{f}$

Suggested Practice Problems: 2.1: 3, 5, 8