# MATH 3A TANGENT PROBLEM AND LIMITS

## I. Secant line and tangent line

What is a secant line? How do we compute its slope?

What is a tangent line? How do we compute its slope?

## II. Limits

What does this expression mean?

$$\lim_{x \to a} f(x) = L$$

Finding limit numerically:

Finding limit graphically:

## III. Practice

1. A ball is thrown up into the air and its height measured in feet after $t$ seconds is given by the function $h(t) = \frac{-16}{3}t^3 + 10t$.

a) Find the coordinates of the points when $t = 0$ and $t = 3$ on the graph.
b) Find the slope of the secant line joining these two points.
c) What quantity does the number you found in part b) represent?

2. Consider the function $f(x) = x^2 + x + 1$. Let $P = (0, 1)$ which is a point on the graph. Let $Q = (x, f(x))$ be another point on the graph.

a) Find the slope of the secant line joining $P$ and $Q$ for the following $x$ values.
i. $x = 0.1$
ii. $x = 0.01$
iii. $x = 0.001$
b) Based on your answers in part a), guess what the slope of the tangent line at $P$ is.
c) Find the equation of the tangent line to the graph at $P$.
(Hint: To find equation of a line, you need the slope and a point. What is the slope of the tangent line? What is a point on the line?)

3. Below is the graph of a function $y = f(x)$.

Find the follwing limits (if exists) based on the graph.

a) $\lim_{x \to -1} f(x) =$
b) $\lim_{x \to 0} f(x) =$
c) $\lim_{x \to 2} f(x) =$
d) $\lim_{x \to \infty} f(x) =$