Math 1300: Calculus I **Fall 2020**

Lecture 7: Section 2.6: Derivatives and Rates of Change

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Today's Goal:

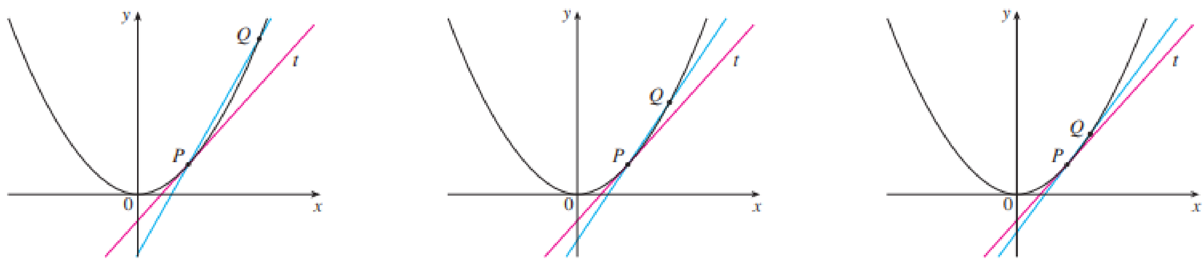
Logistics: We have a check-in today!

We have Quiz 2 Tuesday night. It will cover 2.4 - 2.6 and Project 3 (in general, quizzes cover everything from the what the last quiz covered up until what we cover the Monday before the quiz, but not this time since we will only half-finish 2.7 on Monday).

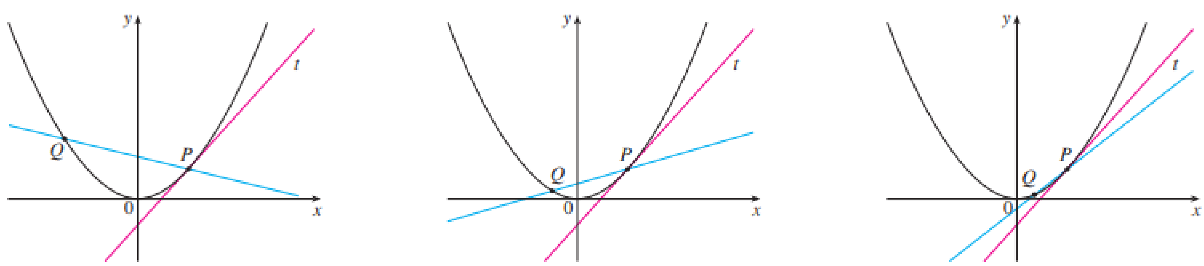
Warm-Up 7.1 *Evaluate the infinite limit:*

$$\lim_{x \to -1^-} \frac{x+1}{x^2-1}$$

7.1 Slopes of Secant Lines and Tangent Lines



Q approaches *P* from the right



Q approaches *P* from the left

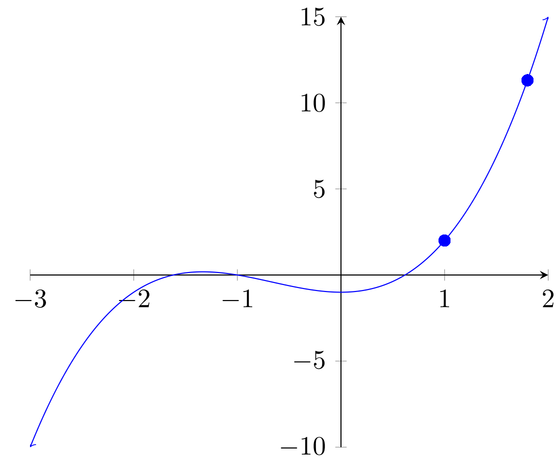
FIGURE 3

Suppose $P = (2, 1)$ and $Q = (3, 4)$ are two points on $f(x) = x^2 - 2x + 1$.

- Slope of the line between P and Q:

- Slope of the tangent line at P:

7.2 In general



- The slope of the secant line connecting the points $(a, f(a))$ and $(a+h, f(a+h))$ is:

  The difference quotient gives the average rate of change.

- To find the exact slope of the tangent line, take a limit:

  The derivative at a point gives the instantaneous rate of change. We can obtain this as a single value, $f'(a)$, or evaluate the limit with x as a variable to obtain a function $f'(x)$ which gives the instantaneous rate of change of f for any x we want to plug in.

Example 7.2 *Find the equation of the tangent line to* $f(x) = 3x - 3x^2$ *at* $x = 2$.

Example 7.3 *If* $s(t) = 3t - t^2$ *gives the position in feet as a function of time* t *in minutes, what is the instantaneous velocity at* $t = 2$*?*

Example 7.4 *What is the equation of the tangent line to* $f(x) = \sqrt{x-1}$ *at* $x = 2$*?*

Example 7.5 *What is the equation of the tangent line to* $f(x) = \frac{3}{2x}$ *at* $x = 3$*?*