

Objectives:

- Precisely define the derivative of a function at a point a and its connection to the tangent line at a .

Remember:

A _____ of a function $f(x)$ connects two points $(a, f(a))$ and $(a+h, f(a+h))$.

The slope of the secant line is:

This slope represents the _____ of the function.

As $a+h$ and a get closer together, the secant line becomes more like the _____ at a .

The slope of a tangent line is:

This slope represents the _____ of the function at a and is called the _____ of $f(x)$ at a or _____.

Calculating the Derivative

(See the project from recitation for more examples - solutions will be posted on the course website.)

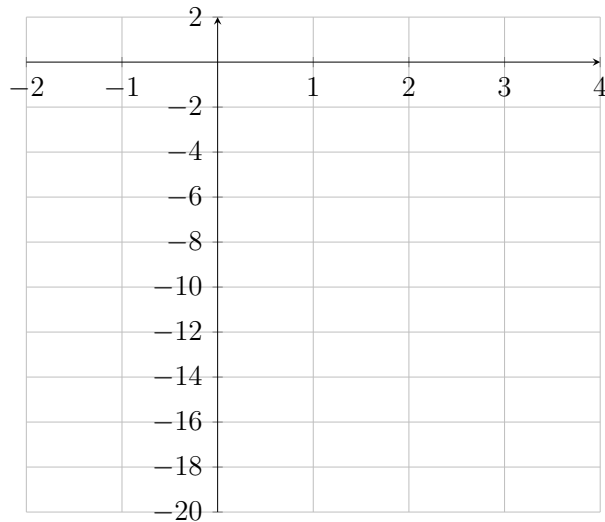
Example: Find the derivative of $f(x) = 3x - 3x^2$ at a point a .

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

Step 1 Find the slope of the tangent line using the definition of a derivative.

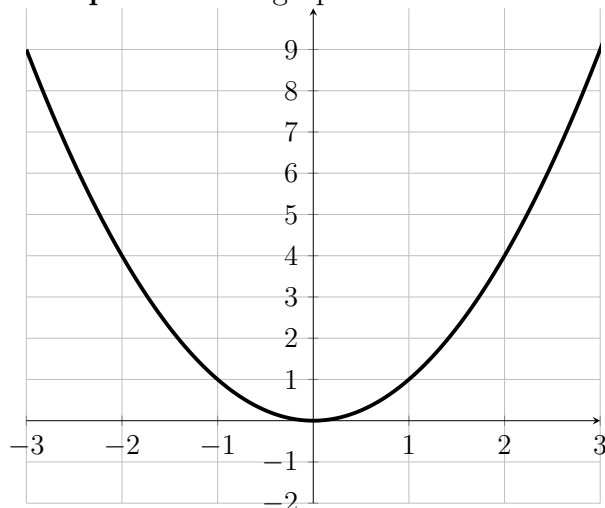
Step 2 Use the slope and the point $(a, f(a))$ to find the point-slope form of the tangent line.

What does this tangent line look like? Graph $f(x) = 3x - 3x^2$ and the tangent line at $x = 2$.



Example: If $s(t) = 3t - 3t^2$ gives the position (ft) of an object as a function of time (min), what is the instantaneous velocity of the object at $t = 4$ minutes?

Example: Use the graph to estimate the following:



$$f(0) \approx$$

$$f'(0) \approx$$

$$f(1) \approx$$

$$f'(1) \approx$$

$$f(2) \approx$$

$$f'(2) \approx$$

$$f(-1) \approx$$

$$f'(-1) \approx$$