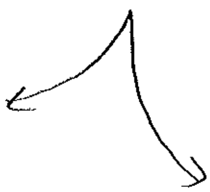
Name *Answer Key*

Sec 2.7 notes day 1

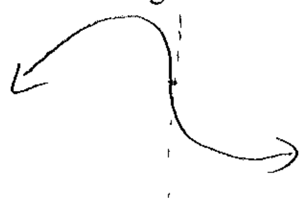
Show Tech 2.8. Look at Example 1 on page 146.

Differentiation: like continuity with two exceptions.

Corner in graph



Vertical tangent



A function is **not** differentiable *a* if it is not continuous at *a*, has a corner at *a*, or has a vertical tangent at *a*.

Homework page 155 #1-16.

2.7 day 2

Example 1: Find $f'(x)$ for the function $f(x) = \sqrt{x}$ and state the domain of $f'(x)$.

$$f'(x) = \lim_{h \to 0} \frac{\sqrt{x+h} - \sqrt{x}}{h}\left(\frac{\sqrt{x+h} + \sqrt{x}}{\sqrt{x+h} + \sqrt{x}}\right)$$

$$= \lim_{h \to 0} \frac{x+h-x}{(\sqrt{x+h} + \sqrt{x})h} = \lim_{h \to 0} \frac{1}{\sqrt{x+h} + \sqrt{x}} = \frac{1}{2\sqrt{x}} = f'(x)$$

$$D = (0, \infty)$$

$$f'(x) = \frac{dy}{dx} \quad \text{and} \quad f'(a) = \left.\frac{dy}{dx}\right|_{x=a}$$

$f'(x)$ is called a first order derivative and is defined as instantaneous rate of change.

$f''(x)$ is called a second order derivative and is defined as acceleration.

Example 2: If $f(x) = x^3 - x$, find and interpret $f''(x)$.

$$f'(x) = \lim_{h \to 0} \frac{(x+h)^3 - (x+h) - x^3 + x}{h} = \lim_{h \to 0} \frac{\cancel{x^3} + 3x^2h + 3xh^2 + h^3 \cancel{-x} - h \cancel{-x^3} \cancel{+x}}{h}$$

$$\lim_{h \to 0} 3x^2 + 3xh + h^2 - 1 = \boxed{3x^2 - 1}$$

$$f''(x) = \lim_{h \to 0} \frac{3(x+h)^2 - 1 - 3x^2 + 1}{h} = \lim_{h \to 0} \frac{\cancel{3x^2} + 6xh + 3h \cancel{-1} \cancel{-3x^2} \cancel{+1}}{h} = \boxed{6x = f''(x)}$$

Assume that *f(x)* is the position function of an object that moves in a straight line.

$\therefore a(x) = v'(x) = f''(x)$

$f'''(x)$ is called the third order derivative and is defined as jerk.

Example 1: If $f(x) = x^3 - x$ find and interpret $f'''(x)$.

$$\lim_{h \to 0} \frac{6(x+h) - 6x}{h} = \lim_{h \to 0} \frac{\cancel{6x} + 6h \cancel{-6x}}{h} = 6$$

Homework page 156 (19-23, 26, 27, 35-38, 42-44)