Assignments for the Week of Sept 12:

- Read 2.2-2.4
- 45 minutes of Khan Academy
- Due Fri. 16 Sept:
  2.2 #3-67 odd; 87-95 odd; 97-100 all; 105,106,111,113,115
  2.3 #1-53 odd; 63-85 odd; 91-105 odd; 111-115 odd

The Derivative

The slope of the tangent line to the graph of f at the point $(c, f(c))$ is given by:

$$m = \lim_{\Delta x \to 0} \frac{\Delta y}{\Delta x} = \lim_{\Delta x \to 0} \frac{f(c+\Delta x) - f(c)}{\Delta x}$$

The derivative of f at x is given by

$$f'(x) = \lim_{\Delta x \to 0} \frac{f(x+\Delta x) - f(x)}{\Delta x}$$

2.2 Basic Differentiation Rules

1. The derivative of a constant function is zero, i.e., for $c \in \mathbb{R}$, $\frac{d}{dx}[c] = 0$

2. Power Rule for $n \epsilon \mathbb{Q}$, $\frac{d}{dx}[x^n] = nx^{n-1}$

3. Constant Multiple Rule $\in \mathbb{R}$, $\frac{d}{dx}[cf(x)] = cf'(x)$

4. Sum & Difference Rules $\frac{d}{dx}[f(x) \pm g(x)] = f'(x) \pm g'(x)$

Derivatives of Trig Functions

1. $\frac{d}{dx}[\sin x] = \cos x$
2. $\frac{d}{dx}[\cos x] = -\sin x$
3. $\frac{d}{dx}[\tan x] = \sec^2 x$
4. $\frac{d}{dx}[\cot x] = -\csc^2 x$
5. $\frac{d}{dx}[\sec x] = \sec x \tan x$
6. $\frac{d}{dx}[\csc x] = -\csc x \cot x$

44. $h(x) = \frac{2x^3 - 3x + 1}{x} = \frac{2x^3}{x} - \frac{3x}{x} + \frac{1}{x} = 2x^2 - 3 + x^{-1}$

$h'(x) = 4x + 0 - x^{-2} = \boxed{4x - x^{-2}} = \boxed{4x - \frac{1}{x^2}}$

$= \boxed{\frac{4x^3 - 1}{x^2}}$

46. $y = (3x)(6x - 5x^2) = 18x^2 - 15x^3$

$y' = \boxed{36x - 45x^2}$

52. $f(x) = \frac{2}{\sqrt[3]{x}} + 3\cos x$

$= 2x^{-1/3} + 3\cos x$

$f'(x) = \boxed{\frac{-2}{3}x^{-4/3} - 3\sin x}$

2.2 cont.

$s(t)$ = position

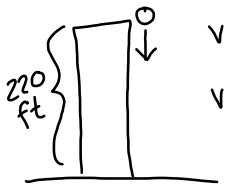
$V(t) = s'(t)$ = velocity

$a(t) = V'(t) = s''(t)$ = acceleration

average velocity: $\frac{\Delta s}{\Delta t}$ (slope of secant)

instantaneous velocity $= s'(t)$ (slope of tangent)

92.



initial velocity $V_0 = -22$ ft/s

$V(3) = ?$

$V(t) = ?$ after falling 108 ft

$V_0 = V(0)$

$S_0 = S(0)$

$s(t) = \frac{1}{2}at^2 + V_0t + S_0$

$g = -9.8\ m/s^2$

$= -32\ ft/s^2$

$s(t) = \frac{1}{2}(-32)t^2 + (-22)t + 220$

$s(t) = -16t^2 - 22t + 220$

$V(t) = s'(t) = -32t - 22$

$V(3) = -32(3) - 22 = -96 - 22 = \boxed{-118\ ft/s}$

$220 - 108 = -16t^2 - 22t + 220$

$16t^2 + 22t - 108 = 0$

solve(16t^2+22t-108=0,t)

$t = 2$ s

$V(2) = -32(2) - 22 = -64 - 22 = \boxed{-86\ ft/s}$

The volume of a sphere is given by $V(r) = \frac{4}{3}\pi r^3$

Find the rate of change of volume with respect to radius when the radius is 2 cm.

$$V'(r) = \frac{4}{3}\pi(3r^2)$$

$$V'(r) = 4\pi r^2 \quad \text{(surface area)}$$

$$V'(2) = 4\pi(2)^2 = \boxed{16\pi \text{ cm}^2}$$

d((4/3)π*x^3,x)