thur. wk 5

$f(x) = (3x + x^2)(e^x + \sqrt{x})$

$f'(x) = (3 + 2x) \cdot (e^x + \sqrt{x}) + (3x + x^2)(e^x + \frac{1}{2}x^{-1/2})$

$g(x) = \dfrac{\sqrt{x} + e^x}{x+1}$

$g'(x) = \dfrac{(x+1) \cdot (\frac{1}{2}x^{-\frac{1}{2}} + e^x) - (\sqrt{x} + e^x)(1)}{(x+1)^2}$

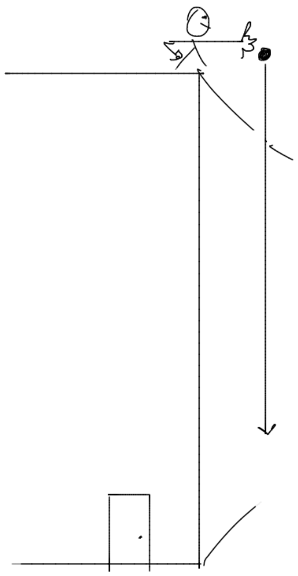
section 3-4 : Applications of Derivatives

Pure Math	Application
$f(x) = 3x + 7$ $f'(x) = 3$	$f(x) = 3x+7$ (position) is height (ft) @ time x (sec) $f'(x) = 3$ ft/sec (velocity (signed speed))
$s(t) = -16t^2 + 50t + 100$ $s'(t) = -32t + 50$ $s''(t) = -32$ 2nd derivative	$s(t) = -16t^2 + 50t + 100$ ft describes height (feet) of ball thrown from 100 feet up, upward @ 50 ft/sec (on Earth) Initial Position (sub $t=0$ into $s(t)$) $= s(0) = -16 \cdot 0 + 50 \cdot 0 + 100$ $s(0) = 100$ Velocity of ball: $s'(t) = -32t + 50$ ft/sec Initial Velocity: $= t=0 \rightsquigarrow s'(t) \Rightarrow s'(0) = 50$

Acceleration of ball: $s''(t) = -32$ ft/sec^2

on Earth

g = gravity ≈ -32 ft/sec^2 or $g \approx -9.8$ m/sec^2



Suppose you throw a tomato down from 100' up @ 25 ft/sec.

height = 0 i.e., $s(t) = 0$

① When does it hit ground?

– with what speed does hit ground

– what if you threw it upwards? this is +

$s(t) = -16t^2 - 25t + 100$

① down ⇒ Initial vel = -25

solve $s(t) = 0$

$-16t^2 - 25t + 100 = 0$

$t = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

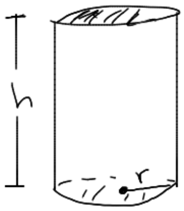
$= \dfrac{25 \pm \sqrt{25^2 + 4 \cdot 1600}}{-32} \approx 1.83$ sec

② speed ↔ |velocity| = $|s'(t)|$ combine

ground ↔ $s(t) = 0$ ← ① → $t = 1.83$

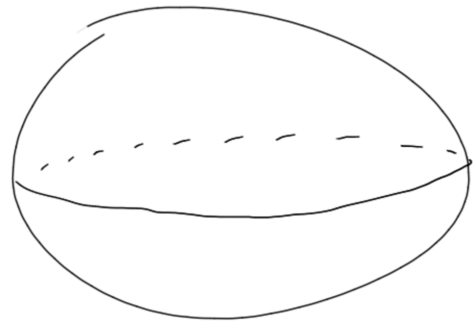
$s'(t) = -32t - 25$, $s'(1.83) \approx -32(2) - 25 = \overbrace{-64 - 25}^{-89} \approx 80\text{–}90$ ft/sec

Geometry & Calculus



$$V = \pi r^2 h$$

$$\frac{dV}{dr} = 2\pi r h$$



$$V = \frac{4}{3}\pi r^3$$

$$\frac{dV}{dr} = \frac{4}{3} \cdot 3\pi r^2 = 4\pi r^2$$

$$\text{Surf Area} = 4\pi r^2$$