Math 1081, Quiz 3 Name: Robert Hines

1. Suppose the height of a ball thown out of a window (in feet above the ground after t seconds) is given by

$$h(t) = -16t^2 + 48t + 64, \text{ for } 0 \leq t \leq t_f,$$

(where t_f is the time at which the ball hits the ground, $h(t_f) = 0$).

(a) What is the initial height?
(b) What is the initial velocity?
(c) When does the ball reach its maximum height?
(d) What is the maximum height?
(e) When does the ball hit the ground?
(f) With what velocity does the ball hit the ground?

(a) $h(0) = 64$ ft

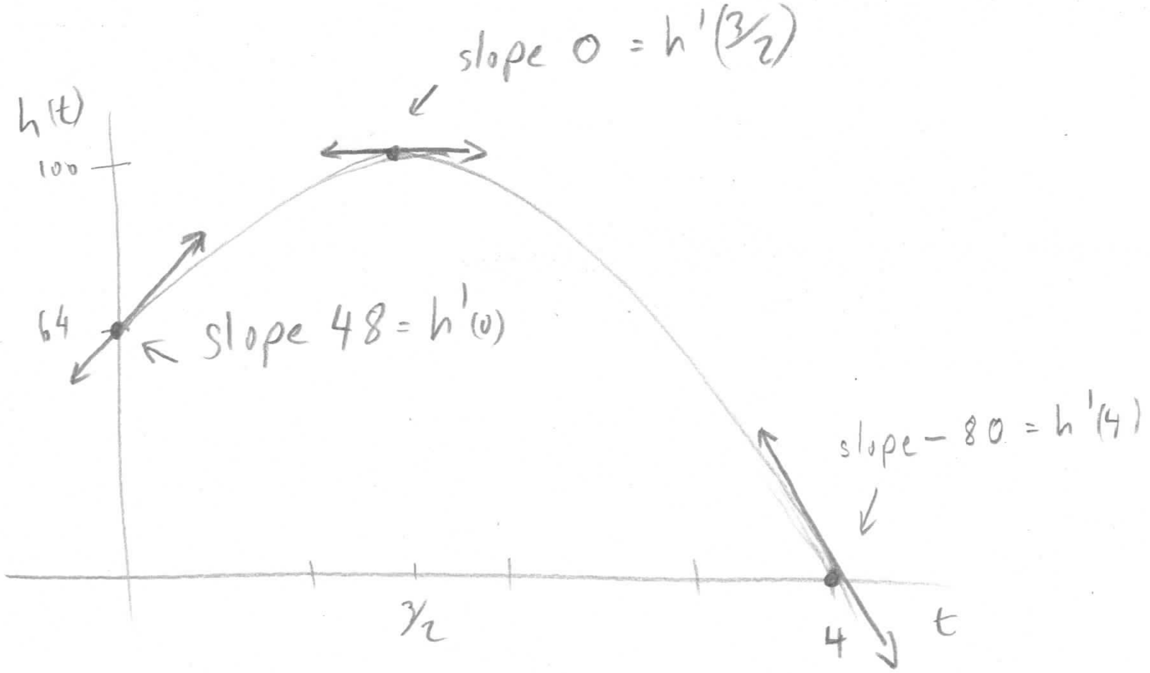
(b) $h'(0) = 48$ ft/sec

(c) $h'(t) = 0 = -32t + 48$, $t = -48/-32 = \frac{3}{2}$ sec

(d) $h\left(\frac{3}{2}\right) = -16\left(\frac{3}{2}\right)^2 + 48\left(\frac{3}{2}\right) + 64 = -36 + 72 + 64 = 100$ ft

(e) $h(t) = 0 = -16(t^2 - 3t - 4) = -16(t-4)(t+1)$, $t_f = 4$ sec

(f) $h'(4) = -32(4) + 48 = -80$ ft/sec



3. Find the following derivatives:

(a) $\dfrac{d}{dx}\dfrac{e^{3x}}{x^3+1}$

(b) $\dfrac{d}{dx}x^2\ln(3x-1)$

(c) $\dfrac{d}{dx}\sqrt[4]{4^x+x^4}$

(a) $\dfrac{(x^3+1)(3e^{3x})-(e^{3x})(3x^2)}{(x^3+1)^2} = \dfrac{3e^{3x}(x^3-x^2+1)}{(x^3+1)^2}$

(b) $x^2\dfrac{3}{3x-1} + \ln(3x-1)\,2x = \dfrac{3x^2}{3x-1} + 2x\ln(3x-1)$

(c) $\frac{1}{4}(4^x+x^4)^{-3/4}(\ln 4\cdot 4^x + 4x^3)$

$= \dfrac{x^3+(\ln 4)4^{x-1}}{\sqrt[4]{(4^x+x^4)^3}}$