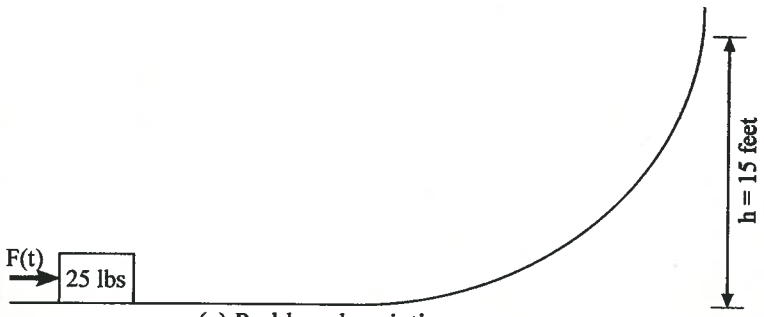
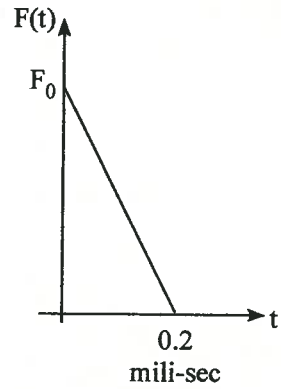
Problem 4: (20 pts) A 25 pound block sits on a frictionless surface initially at rest. It will be acted upon by a dynamic load F(t) that varies linearly with time and is of duration 0.2 mili-seconds. What should be the peak value of the force, F_0, in order for the block to slide up the curved surface until a peak height of 15 feet?



(a) Problem description



(b) Impulsive Force

$mg = 25$ pounds

Conservation of energy $\Rightarrow$ $mgh_f = \frac{1}{2} m v_i^2$ (h_f = 15 ft; v_i from impulse)

$$375 \text{ ft lb} = \frac{1}{2}\left(\frac{25}{32.2}\right) v_i^2$$

$$31.08 \frac{ft}{s} = v_i$$

impulse & momentum $\Rightarrow$ $\int F dt = \Delta(mv)$

$$\frac{1}{2} F_0 (0.0002) = \frac{25}{32.2}(31.08)$$

$$F_0 = \frac{2\left(\frac{25 \text{ lb}}{32.2 \text{ ft/s}^2} * 31.08 \text{ ft/s}\right)}{0.0002 \text{ s}}$$

$$F_0 = 241{,}300 \text{ pounds}$$