

# RECTILINEAR MOTION

$s(t) = 8t - t^2$  Find vel. at  $t=2$ .

$$v = \frac{\Delta s}{\Delta t} = \frac{s(2) - s(0)}{2 - 0} = \frac{12 - 0}{2 - 0} = 6 \frac{\text{units}}{\text{sec}}$$

$$= \frac{s(2) - s(1)}{2 - 1} = \frac{12 - 7}{1} = 5 \frac{\text{units}}{\text{sec}}$$

$$\lim_{t \rightarrow 2} \frac{s(2) - s(t)}{2 - t} \quad \lim_{t \rightarrow 2} \frac{s(t) - s(2)}{t - 2}$$

$$v(t) = s'(t)$$

$$v(t) = 8 - 2t$$

$$v(2) = 8 - 2(2) = 4 \frac{\text{units}}{\text{sec}}$$

Find  $a$  at  $t=2$

$$a = \frac{\Delta v}{\Delta t} = \frac{v(2) - v(0)}{2 - 0} \quad \lim_{t \rightarrow 2} \frac{v(t) - v(2)}{t - 2}$$

$$v(t) = s'(t)$$

$$a(t) = v'(t) = s''(t)$$

$$s(t) = \frac{1}{3}t^3 - 3t^2 + 8t - 6$$

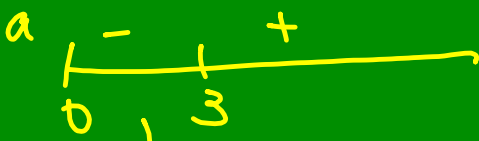
$$v(t) = t^2 - 6t + 8$$

$$a(t) = 2t - 6$$

When is it speeding up + slowing down

$$a(t) = 2t - 6 = 0$$

$$t = 3$$



When is the Skee ball moving forward + backward.

$$v(t) = t^2 - 6t + 8$$

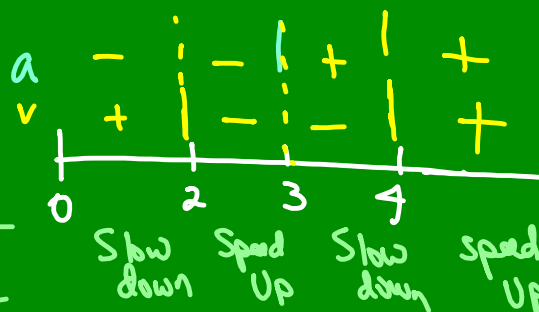
$$(t-4)(t-2)$$

$$v' = 0$$

$$t = 1, 2$$



Forward (0, 2) (4, ∞)  
Backward (2, 4)

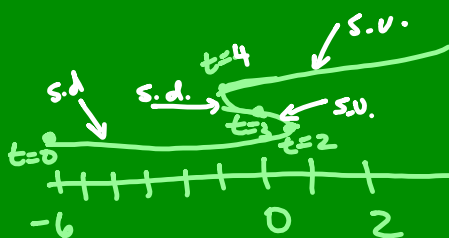


- 1) Find where velocity is +/-
- 2) Find where accel is +/-
- 3) Combine the 2 number lines to determine speeding up / slowing down

Speed up (2, 3) (4, ∞)  
Slow down (0, 2) (3, 4)

Draw a graph of the motion.

$$s(t) = \frac{1}{3}t^3 - 3t^2 + 8t - 6$$

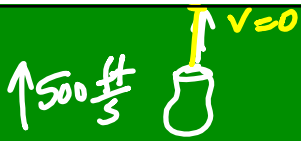


0	-6
2	2/3
3	0
4	-2/3
5	2/3

Find the distance traveled between  $t=0$  +  $t=5$

$$\begin{array}{r} 20/3 \\ 6\cancel{2/3} \\ 2/3 \\ 2/3 \\ 2/3 \\ 4/3 \\ \hline 28/3 \end{array}$$

$$\frac{28}{3} = 9\frac{1}{3}$$



$$h(t) = \frac{1}{2} a t^2 + V_1 t + S_0 \quad -32 \frac{\text{ft}}{\text{s}^2}$$

$$h(t) = -16t^2 + 500t + 6 \quad -9.8 \frac{\text{m}}{\text{s}^2}$$

$$v(t) = -32t + 500$$

$$a(t) = -32$$

Find max height.

$$v(t) = 0$$

$$0 = -32t + 500$$

$$32t = 500$$

$$t = 15.625 \text{ sec}$$

$$h(15.625) =$$

$$= -16(15.625)^2 + 500(15.625) + 6$$

$$= 3912.25 \text{ ft}$$

How fast will the bag be moving when it reaches Colby's hands at 9 ft high?

$$9 = -16t^2 + 500t + 6$$

$$0 = -16t^2 + 500t - 3$$

$$t = \frac{-500 \pm \sqrt{500^2 - 4(-16)(3)}}{2(-16)}$$

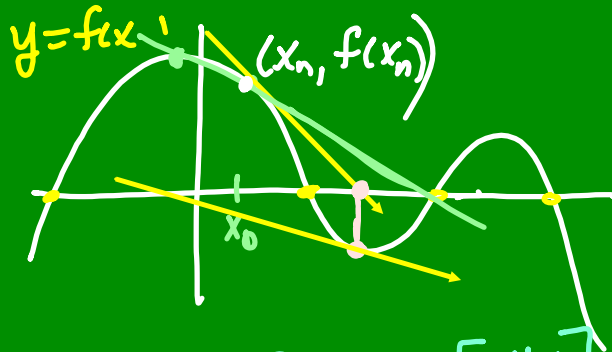
$$t = -0.005 \quad t = 31.25$$

$$v(31.25) = -32t + 500$$

$$= -32(31.25) + 500$$

$$= -500 \frac{\text{ft}}{\text{s}}$$

# Newton's Method



$$f(x) = x^3 + x - 1 \quad [-4, 1]$$

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

$$f(x) = x^3 + x - 1$$

$$y - y_1 = m(x - x_1)$$

$$y - f(x_n) = f'(x_n)(x - x_n)$$

$$0 - f(x_n) = f'(x_n)(x - x_n)$$

$$\frac{-f(x_n)}{f'(x_n)} = x - x_n$$

$$x_n - \frac{f(x_n)}{f'(x_n)} = x$$