

1-1

idea of limits

$$s(t) = -16t^2 + v_0 t + s_0 \\ = -\frac{1}{2}gt^2 + v_0 t + s_0$$

$$g \approx 32.2 \text{ ft/sec}^2$$

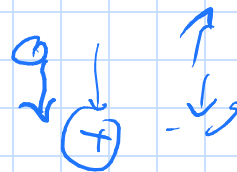
$$\frac{1}{2}g = 16$$

$$\approx 9.8 \text{ m/sec}^2$$

v_0 : initial velocity

s_0 : " position

Ex Given $s(t) = \frac{1}{2}gt^2$
 $= 16t^2$



a) ~~1 to 2 sec?~~ $\rightarrow t=0 \rightarrow 2$

$$\text{average speed} = \frac{\Delta s}{\Delta t} \\ = \frac{s(2) - s(0)}{2 - 0}$$

$$= \frac{64 - 0}{2}$$

$$= 32 \text{ ft/sec / ft/s}$$

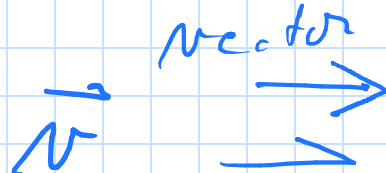
b) $1 \leq t \leq 2$

$$\text{avg. speed} = \frac{s(2) - s(1)}{2 - 1}$$

$$= 64 - 16$$

$$= 48 \text{ ft/sec}$$

velocity: $v(t)$
speed: $|v(t)|$



Ex Given: $y(t) = 16t^2$ $[t_0, t_0+h]$

Find $|v|_{avg}$? $= \frac{\Delta y}{\Delta t}$

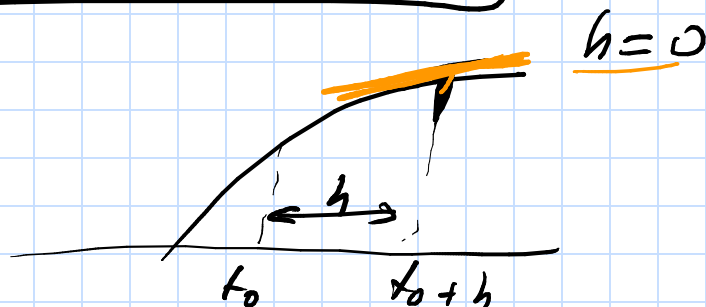
$$(a+b)^2 = a^2 + 2ab + b^2$$

$$|v|_{avg} = \frac{y(t_0+h) - y(t_0)}{t_0+h - t_0} \rightarrow \text{fctn all terms eliminate}$$

$$= \frac{1}{h} (16(t_0+h)^2 - 16t_0^2)$$

$$= \frac{1}{h} (16t_0^2 + 32ht_0 + 16h^2 - 16t_0^2)$$

$$= 32t_0 + 16h \text{ ft/sec}$$



$$\lim_{h \rightarrow 0} |v|_{avg} = 32t_0$$

$$m_{tan} = \lim_{x \rightarrow a} \frac{f(x) - f(a)}{x - a}$$

$$= \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$$

Ex

Given: $y = x^2$ @ $P(2, 4)$
Find: m ? Tangent line

x_1 y_1

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

Soln

$$\begin{aligned} m &= \lim_{h \rightarrow 0} \frac{f(x_1 + h) - f(x_1)}{h} \\ &= \lim_{h \rightarrow 0} \frac{f(2 + h) - f(2)}{h} \\ &= \lim_{h \rightarrow 0} \frac{(2 + h)^2 - 4}{h} \\ &= \lim_{h \rightarrow 0} \frac{\cancel{4} + 4h + \cancel{h^2} - \cancel{4}}{h} \\ &= \lim_{h \rightarrow 0} (4 + h) \\ &= 4 \end{aligned}$$

$$\frac{4h}{h} + \frac{h^2}{h}$$

$$\begin{aligned} y &= 4(x - 2) + 4 \\ &= 4x - 4 \end{aligned}$$

$$\lim_{x \rightarrow a} f(x) =$$