§ 2.9 # 5

$f(x) = \sqrt{-x+1} = \sqrt{-(x-1)}$

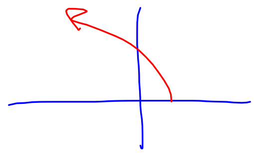
$x_1 = 0$

$\Delta x = .9$

Tangent Line

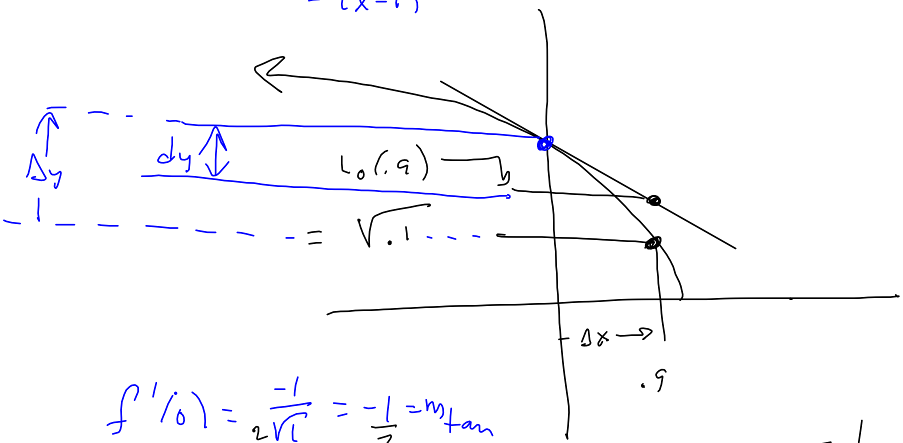
$f'(x) = \frac{1}{2}(-x+1)^{-\frac{1}{2}}(-1)$

$= \frac{-1}{\sqrt{-(x-1)}}$



$\sqrt{-x}$

$-(x-1)$



$f'(0) = \frac{-1}{2\sqrt{1}} = \frac{-1}{2} = m_{tan}$

$y = f'(x_1)(x-x_1) + f(x_1)$

$= -\frac{1}{2}(x-0) + 1$

$= -\frac{1}{2}x + 1 = L_0(x)$

$\sqrt{-x+1}\Big|_{x=0} = \sqrt{1} = 1$

$x_2 = .9 = x_1 + \Delta x = 0 + .9.$

$= .9$

$\rightsquigarrow (.9, L_0(.9))$

$-vs-\ (.9, f(.9))$

$f(.9) \approx .3162277660$

$L(.9) = .55$

1–4 A particle moves according to a law of motion $s = f(t)$, $t \geqslant 0$, where t is measured in seconds and s in feet.

(a) Find the velocity at time t.
(b) What is the velocity after 1 second?
(c) When is the particle at rest?
(d) When is the particle moving in the positive direction?
(e) Find the total distance traveled during the first 6 seconds.
(f) Draw a diagram like Figure 2 to illustrate the motion of the particle.
(g) Find the acceleration at time t and after 1 second.
(h) Graph the position, velocity, and acceleration functions for $0 \leqslant t \leqslant 6$.
(i) When is the particle speeding up? When is it slowing down?

1. $f(t) = t^3 - 9t^2 + 24t$ **2.** $f(t) = 0.01t^4 - 0.04t^3$

s = position in feet as a function of t = time in seconds

(2) $s = f(t) = .01t^4 - .04t^3$

(a) $\Rightarrow v(t) = f'(t) = .04t^3 - .12t^2$ = velocity in $\frac{ft}{s}$

(b) $v(1) = .04 - .12 = -.08$

(c) particle @ rest $\Rightarrow v(t) \overset{SET}{=} 0 \Rightarrow$

$.04t^3 - .12t^2 = 0$

$\Rightarrow 4t^3 - 12t^2 = 0$

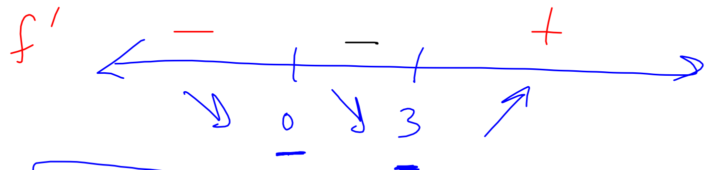
$\Rightarrow t^3 - 3t^2 = 0$

$t^2[t-3] = 0 \Rightarrow t \in \{0, 3\}$

(d) when is particle moving in a positive direction? $t = 0, 3$

$v(t) = f'(t) > 0$

Sign pattern on f':



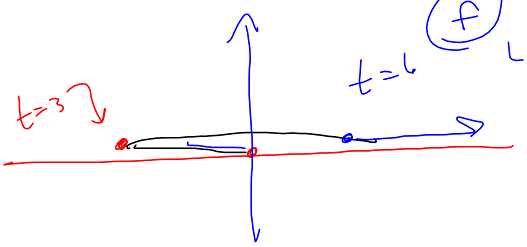
$.04t^3 - .12t^2$

$.04t^2[t-3] = 0$

$\boxed{\text{So } v(t) > 0 \text{ when } t > 3}$

(e) Total distance traveled in 1st 6 seconds

(f) Like figure 2. I used it for part (e)



On $(0,3)$ $v(t) < 0$

$f'(t)$

$f(3) = .01t^4 - .04t^3 \Big|_{t=3} = .01(81) - .04(27) = -.27$

$f(6) = .01(6)^4 - .04(6)^3 = 4.32$.

Total distance $= .27 + 4.32 = \boxed{4.59 \text{ ft}}$

Net distance: $f(6)$

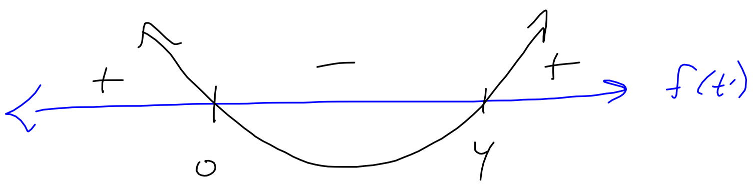
(g) acceleration $= f''(t) = v'(t) = a(t)$

$f'(t) = .04t^3 - .12t^2 \implies f''(t) = .12t^2 - .24t = a(t) =$ acceleration in ft/s²

$a(1) = .12 - .24 = \boxed{-.12 \ \frac{ft}{s^2} = a(1) = f''(1)}$

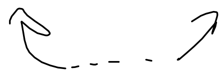
(h) graph the 3 of 'em on $[0,6]$

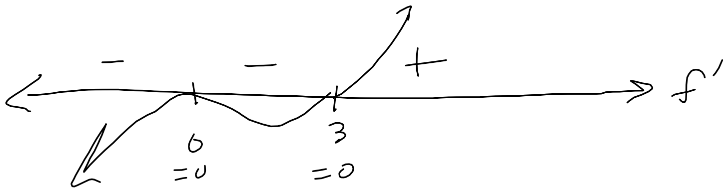
$f(t) = .01t^4 - .04t^3$ $f'(t) = .04t^3 - .12t^2$ $f''(t) = .12t^2 - .24t$



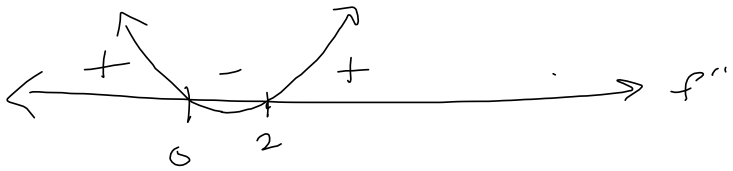
$t^4 - 4t^3 = 0$

$t^3[t-4]$



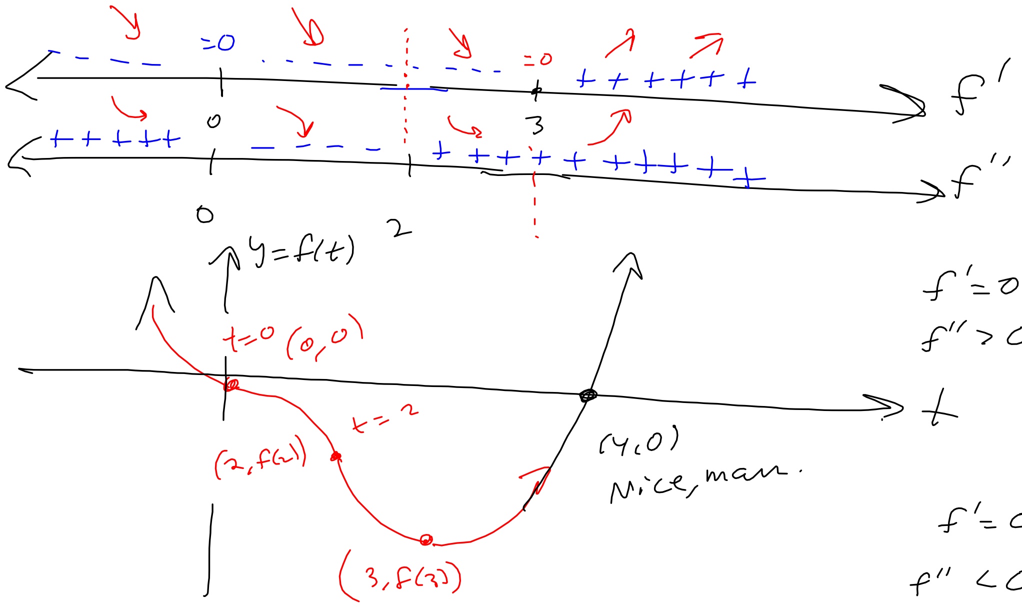


$t^2[t-3]$



$t[t-2]$

Chapter 3 method for graphing f(x)



f' = 0
f'' > 0 Min

f' = 0
f'' < 0 Max