$y = \sqrt{7x + \sqrt{7x + \sqrt{7x}}}$

$= \left(7x + \left(7x + (7x)^{\frac{1}{2}}\right)^{\frac{1}{2}}\right)^{\frac{1}{2}} \longrightarrow$

$y' = \frac{1}{2}\left[\cancel{7x + \left(7x + (7x)^{\frac{1}{2}}\right)^{\frac{1}{2}}}\right]^{-\frac{1}{2}} \left[7 + \frac{1}{2}\left(7x + (7x)^{\frac{1}{2}}\right)^{-\frac{1}{2}} \cancel{\left(7 + \frac{1}{2}(7x)\right)} \right. ($

Try Again:

$\frac{1}{2}\left[\text{WHOLE MESS}\right]^{-\frac{1}{2}} \left[7 + \frac{1}{2}\left(7x + (7x)^{\frac{1}{2}}\right)^{-\frac{1}{2}} \cdot \left(7 + \frac{1}{2}(7x)^{-\frac{1}{2}}(7)\right)\right]$

There's the 7

$= \frac{7}{2}\left[7x + \left(7x + (7x)^{\frac{1}{2}}\right)^{\frac{1}{2}}\right]^{-\frac{1}{2}} \left(7 + \frac{1}{2}\left(7x + (7x)^{\frac{1}{2}}\right)^{-\frac{1}{2}}\left(1 + \frac{1}{2}(7x)^{-\frac{1}{2}} \right)\right)$

A model for the length of daylight (in hours) in Philadelphia on the tth day of the year is

21 $$L(t) = 12 + 2.8 \sin\left[\frac{2\pi}{365}(t - 80)\right].$$

Use this model to compare how the number of hours of daylight is increasing in Philadelphia on June 5 and June 15. (Assume there are 365 days in a year. Round your answers to four decimal places.)

June 5 $L'(t) =$ ______

June 15 $L'(t) =$ ______

$$\frac{d}{dx}\left[2.8 \sin\left(\frac{2\pi}{365}(t-80)\right) + 12\right] = 0$$

x t

$$\frac{d}{dx}[f(t)] = 0$$

S 2.5 #21

$$\frac{d}{dt}\left[2.8 \sin\left(\frac{2\pi}{365}(t-80)\right) + 12\right] = L(t)$$

$$L(t) = f(g(t))$$

$$g(t) = \frac{2\pi}{365}(t-80)$$

$$f(g) = 2.8 \sin(g) + 12$$

$$\frac{d}{dt}[L(t)] = \frac{df}{dg}\cdot\frac{dg}{dt} = 2.8\cos(g)\cdot\frac{2\pi}{365}$$

$$\frac{2\pi}{365}\cdot 2.8\cos\left(\frac{2\pi}{365}(t-80)\right)$$

June 5th 31, 28, 31, 30, 31, 5

$t = 156$

June 15th $t = 166$

$$L'(156) = 2.8\left(\frac{2\pi}{365}\right)\cos\left(\frac{2\pi}{365}(156-80)\right)$$

$$= \frac{2.8\cdot 2\pi}{365}\left(\cos\left(\frac{2\pi}{365}(148)\right)\right)$$

```
2.8*cos(2π/365(X
-80))*2π/365
       .0101039777
2.8*cos(2π/365(1
56-80))*2π/365
       .0125084109
```

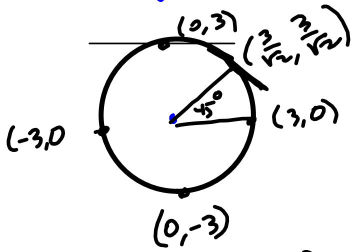
$\boxed{.0125084109 = L'(156)}$

Section 2.6 - Implicit Differentiation

It's like a function

It makes sense to ask what's the slope @ (3,7)?

$x^2+y^2=9$ is a circle, not a function



Technique: Assume y is a function of x, at least locally.

By Chain Rule

$$\frac{d}{dx}\left[y^2\right] = 2y \cdot \frac{dy}{dx} = 2yy'$$

$$x^2+y^2=9$$

$$\frac{d}{dx}\left[x^2+y^2=9\right] \longrightarrow$$

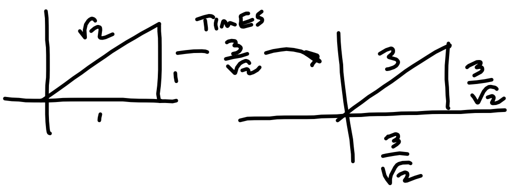
$$2x + 2yy' = 0$$

solve for y':

$$2yy' = -2x$$

$$y' = -\frac{2x}{2y} = -\frac{x}{y}$$

$$\sqrt{2} \cdot \frac{3}{\sqrt{2}}$$



Find $\frac{dy}{dx}$ @ (0,3)

$$y'\Big|_{(0,3)} = -\frac{0}{3} = 0$$

$$y'\Big|_{(3,0)} = \frac{-3}{0} = \text{undefined}$$

$$y'\Big|_{\left(\frac{3}{\sqrt{2}}, \frac{3}{\sqrt{2}}\right)} = \frac{-\frac{3}{\sqrt{2}}}{\frac{3}{\sqrt{2}}} = -1$$

Find an equation of the tangent line to the hyperbola

$$\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$$

at the point (x_0, y_0).

$$\frac{2x}{a^2} - \frac{2yy'}{b^2} = 0$$

$$-\frac{2yy'}{b^2} = -\frac{2x}{a^2}$$

$$y' = \frac{-2b^2x}{2a^2y} = -\frac{b^2x}{a^2y} \Longrightarrow @ (x_0, y_0)$$

$$y' = -\frac{b^2x_0}{a^2y_0}$$