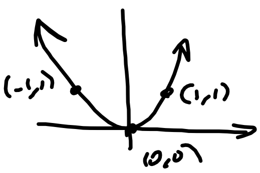
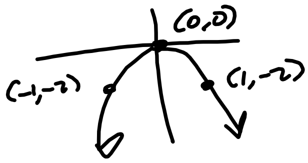
$g(x) = 5 - 2(x-5)^2$

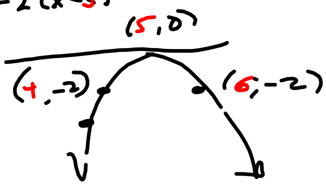
$f(x) = x^2$



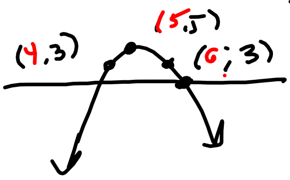

$-2x^2$




$-2(x-5)^2$




$-2(x-4)^2 + 5 = g(x)$



A model for the length of daylight (in hours) in Philadelphia on the $t$th 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

J $t = 156$

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
```

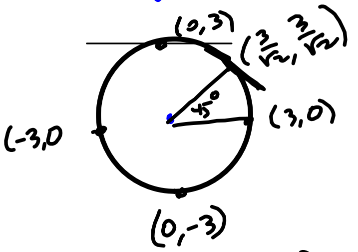
$\boxed{.0125084109 = L'(156)}$

# 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

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

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

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

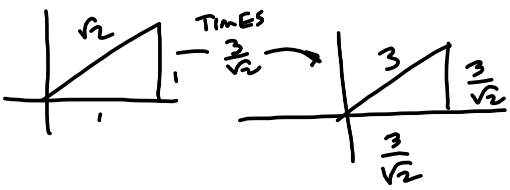
$$2x+2yy'=0$$

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 $(x_0, y_0)$.

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

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

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

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