1. At what velocity does a football need to be thrown at a 45° angle in order to make it all the way across a football field?

$$300 = v\cos(45)t$$

$$y = v\sin(45)t - 16t^2$$

$$t = \frac{300}{v\cos(45)}$$

$$y = \frac{v\sin 45(300)}{v\cos 45} - 16\left(\frac{300}{v\cos(45)}\right)^2$$

$$y = 300\tan(45) - \frac{16(90000)}{v^2\cos^2(45)}$$

$$0 = 300 - \frac{1440000}{v^2}\sec^2(45)$$

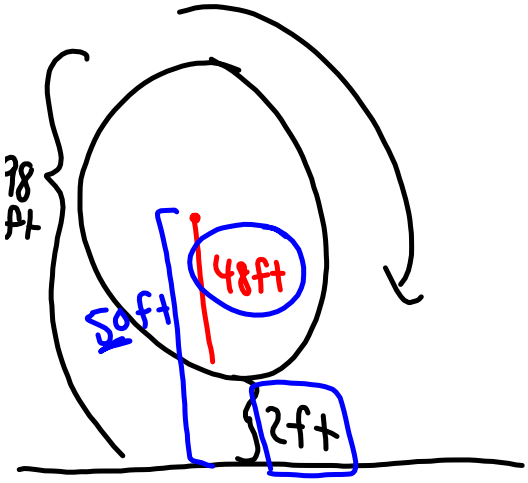
$$300 = \frac{2880000}{v^2}$$

$$\sqrt{v^2} = \frac{2880000}{300} = \sqrt{9600}$$

$$v = 9.79 \text{ ft/s}$$

2. Suppose Danny stands at the point (300, 0) and launches a football at 67 mph at an angle of 45° towards Johnny who is at the origin. Suppose Johnny also throws a football towards Danny at 60 mph at an angle of 50° at the exact same moment. There is a 4 mph breeze in Johnny's favor. Do the balls collide in midair?

3. Nikki got on a Ferris wheel ten seconds ago. She started 2 feet off the ground at the lowest point of the wheel and will make a complete cycle in four minutes. The ride reaches a maximum height of 98 feet and spins clockwise. Write parametric equations that model Nikki's position over time. Where will Nikki be three minutes from now?



4 minutes for 1 revolution

240 seconds in 2π

$\frac{2\pi}{240} = \frac{\pi}{120}$

$X = 48\cos\left(\frac{\pi}{120}t\right)$

$y = 50 - 48\sin\left(\frac{\pi}{120}t\right)$

$X = r\cos\left(\frac{2\pi t}{\text{sec}}\right)$

$y = r\sin\left(\frac{2\pi t}{\text{sec}}\right) + \text{center height}$

$X = 48\sin\left(-\frac{\pi t}{120}\right)$

$y = 50 - 48\cos\left(-\frac{\pi t}{120}\right)$

Candice gets on a Ferris wheel at its lowest point, 3 feet off the ground. The Ferris wheel spins clockwise to a maximum height of 103 feet, making a complete cycle in 5 minutes.

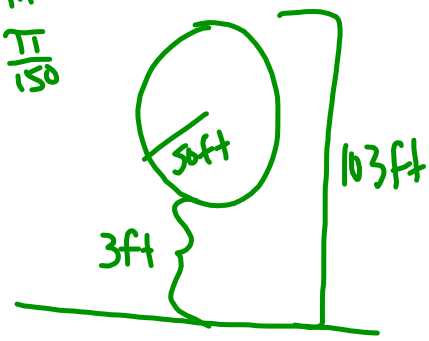
1. Write a set of parametric equations to model Candice's position.

$x = 50\cos\left(\frac{\pi}{150}t\right)$

$y = 53 - 50\sin\left(\frac{\pi}{150}t\right)$

$5\text{ min} = 300\text{ sec}$

$\frac{2\pi}{300} = \frac{\pi}{150}$



2. Where will Candice be in two minutes?

3. Where will Candice be in four minutes?

One minute ago Guillermo got on a Ferris wheel at its lowest point, 3 feet off the ground. The Ferris wheel spins clockwise to a maximum height of 83 feet, making a complete cycle in 6 minutes.

4. Write a set of parametric equations to model Guillermo's position.

5. Where will Guillermo be in two minutes?

6. Where will Guillermo be in four minutes?