

Math 120 - Quiz 6 - December 3, 2015

Name and Section Solutions

Marla is running counter-clockwise around a circular track. She runs at a constant speed of 5 meters per second. She takes 64 seconds to complete one lap of the track. From her starting point, it takes her 10 seconds to reach the northernmost point of the track.

1. (6 points) Draw a sketch of the track and compute the values of all the constants below. Do not use decimal approximations. Use fractions where necessary and keep pi as π in your constants.

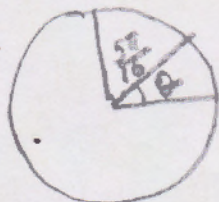
$$v = 5 \text{ m/s}$$

$$\text{Circumference} = 64 \times 5 = 320 \text{ meters}$$

$$\text{radius} = \frac{320}{2\pi} = \frac{160}{\pi} \text{ meters}$$

$$\omega = \frac{5}{\left(\frac{160}{\pi}\right)} = \frac{5\pi}{160} = \frac{\pi}{32} \text{ rad/s}$$

$$\text{In 10 seconds, she covers } 10 \times \frac{\pi}{32} = \frac{5\pi}{16} \text{ radians}$$



$$\theta = \frac{\pi}{2} - \frac{5\pi}{16} = \frac{3\pi}{16}$$

$$\text{Radius of the track: } r = \frac{160}{\pi} \text{ meters}$$

$$\text{Angular Speed: } \omega = \frac{\pi}{32} \text{ radians/second}$$

$$\text{Linear Speed: } v = 5 \text{ meters/second}$$

$$\text{Starting angle: } \theta = \frac{3\pi}{16} \text{ radians}$$

2. (2 points) Impose a coordinate system with the origin at the center of the circle above, with the positive y-axis pointing North, and give the parametric equations for her motion in terms of time t in seconds. Do not use decimal approximations. Use fractions where necessary and keep pi as π in your constants.

$$x = \frac{160}{\pi} \cos\left(\frac{\pi}{32}t + \frac{3\pi}{16}\right)$$

$$y = \frac{160}{\pi} \sin\left(\frac{\pi}{32}t + \frac{3\pi}{16}\right)$$

3. (2 points) Where is she with respect to the center of the track 32 seconds after she starts running? Describe her position in relation to the center of the track using the words North, South, East and West. Round your answers to two digits after the decimal.

$$x(32) = \frac{160}{\pi} \cos\left(\pi + \frac{3\pi}{16}\right) \approx -42.35$$

$$y(32) = \frac{160}{\pi} \sin\left(\pi + \frac{3\pi}{16}\right) \approx -28.29$$

She is 42.35 m West and 28.29 m. South of the center.