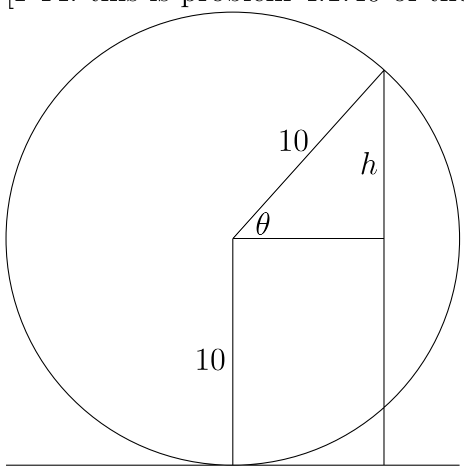
Math 1300-001, Quiz 6 Name: ____________________________

A ferris wheel with a radius of 10 meters is rotating at a rate of one revolution every two minutes. How fast is a rider rising when his seat is 16 meters above the ground? (Assume the bottom of the ferris wheel is at ground level. Use the picture below or draw your own.) [FYI: this is problem 4.1.40 of the text.]



With h and θ as in the picture, we know that

$$\frac{d\theta}{dt} = \frac{2\pi}{2} = \pi \ \frac{\text{radians}}{\text{minute}}$$

(because the wheel goes around once$=2\pi$ every two minutes) and we want to find

$$\left.\frac{dh}{dt}\right|_{h=6 \text{ meters}}$$

how fast the height is increasing when the rider is 16 meters off the ground (i.e. when $h = 16 - 10 = 6$).

The quantities θ and h are related by

$$10 \sin\theta = h.$$

Differentiating with respect to time, using the chain rule because both h and θ are functions of time, we get

$$10 \cos\theta \frac{d\theta}{dt} = \frac{dh}{dt}.$$

When the rider is 16 meters above the ground, $h = 6$ and

$$\left.\cos\theta\right|_{h=6} = \frac{8}{10}$$

(we have a $(6, 8, 10)$ right triangle). Plugging in this value of $\cos\theta$ and the known value of $dh/dt = \pi$ we get

$$\left.\frac{dh}{dt}\right|_{h=6 \text{ meters}} = 10\frac{8}{10}\pi = 8\pi \ \frac{\text{meters}}{\text{minute}}$$