

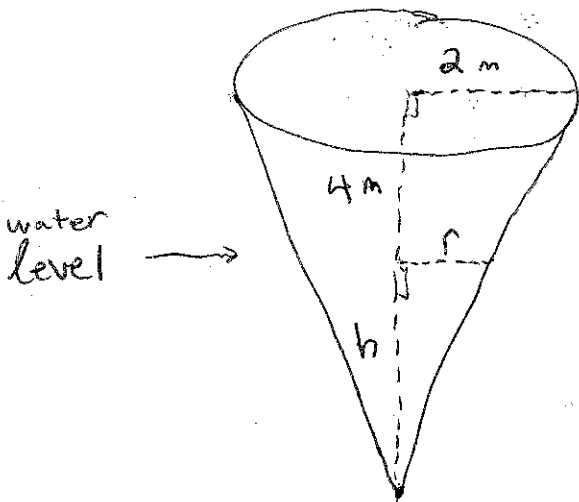
Quiz 8

NAME:

PERM:

SECTION: T 8 AM / T 4 PM / T 5 PM / T 6 PM / TH 6 PM

1. A water tank has the shape of an upside down right circular cone. The radius of the base is 2 m and the height is 4 m. If water is being pumped into the tank at a rate of $2 \text{ m}^3/\text{min}$, find the rate at which the water level is rising when the water is 3 m deep. (Recall that the volume of a right circular cone is $V = \frac{1}{3}\pi r^2 h$.)



$$V = \frac{1}{3}\pi r^2 h.$$

$$\text{Given: } \frac{dV}{dt} = 2 \text{ m}^3/\text{min}.$$

$$\text{Want: } \frac{dh}{dt} \text{ when } h = 3 \text{ m}.$$

$$\text{Use similar } \Delta\text{s to eliminate } r: \frac{r}{2} = \frac{h}{4} \rightarrow r = \frac{h}{2}.$$

$$\Rightarrow V = \frac{1}{3}\pi \left(\frac{h}{2}\right)^2 h = \frac{1}{3}\pi \frac{h^2}{4} h = \frac{\pi h^3}{12}$$

$$\rightarrow \frac{dV}{dt} = \frac{3\pi h^2}{12} \cdot \frac{dh}{dt} = \frac{\pi h^2}{4} \cdot \frac{dh}{dt}$$

$$\rightarrow 2 \frac{\text{m}^3}{\text{min}} = \frac{\pi (3\text{m})^2}{4} \cdot \frac{dh}{dt} = \frac{\pi}{4} \cdot 9\text{m}^2 \cdot \frac{dh}{dt}$$

$$\rightarrow \frac{dh}{dt} = \frac{2(4)}{\pi \cdot 9} = \boxed{\frac{8}{9\pi} \text{ m/min}}$$