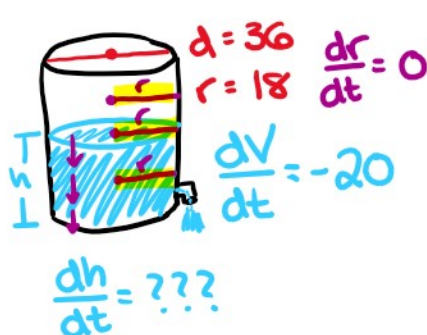


Volume of a cylinder: $V = \pi r^2 h$ ^{product rule}

Volume of a cone: $V = \frac{1}{3} \pi r^2 h$ ^{product rule}
_{cannot convert}

A cylindrical water cooler has a diameter of 36 inches. If it dispenses water at a rate of 20 cubic inches per second, how quickly does the water level change?



$$V = \pi r^2 h$$

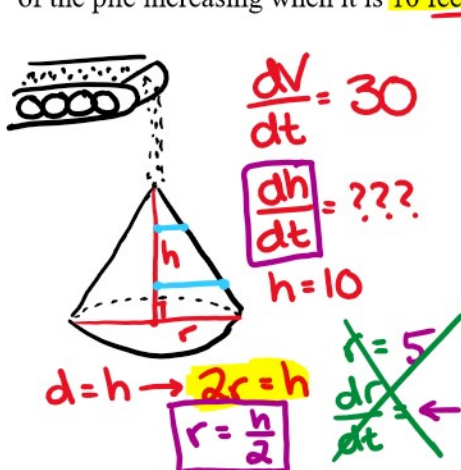
$$\frac{dV}{dt} = \pi r^2 \cdot \frac{dh}{dt} + h \cdot 2\pi r \cdot \frac{dr}{dt}$$

$$-20 = \pi (18)^2 \frac{dh}{dt} + (0) \cdot 2\pi (18) (0)$$

$$-20 = 324\pi \cdot \frac{dh}{dt}$$

$$\boxed{\frac{dh}{dt} = \frac{-20}{324\pi} = -0.02}$$

Gravel is being dumped from a conveyor belt at a rate of 30 cubic feet per minute onto a pile shaped like a cone. The pile's diameter and height are always equal. How fast is the height of the pile increasing when it is 10 feet high?



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

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

$$V = \frac{1}{12} \pi h^3$$

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

$$30 = \frac{1}{4} \pi (10)^2 \frac{dh}{dt}$$

$$30 = 25\pi \frac{dh}{dt}$$

$$\boxed{\frac{dh}{dt} = \frac{30}{25\pi} = \frac{6}{5\pi} = 0.38}$$

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

$$\frac{dV}{dt} = \frac{1}{3} \pi r^2 \cdot \frac{dh}{dt} + h \cdot \frac{2}{3} \pi r \cdot \frac{dr}{dt}$$

$$30 = \frac{1}{3} \pi (5)^2 \frac{dh}{dt} + 10 \cdot \frac{2}{3} \pi (5) (0)$$

WRONG !!