

2.6 Related Rates

$$18. \quad V = \frac{4}{3} \pi r^3$$

$$\frac{d}{dt} [V] = \frac{d}{dt} \left[\frac{4}{3} \pi r^3 \right]$$

$$\frac{dV}{dt} = 4\pi r^2 \cdot \frac{dr}{dt}$$

$$\frac{dV}{dt} = 4\pi (6)^2 \cdot 2 = 288\pi \text{ in}^3/\text{min}$$

$$\frac{dr}{dt} = 2 \text{ in}/\text{min}$$

$$\frac{dV}{dt} = ? \text{ when } r=6$$

$$22. \quad V = \frac{1}{3} \pi r^2 h$$

$$V = \frac{1}{3} \pi r^2 \cdot (3r)$$

$$V = \pi r^3$$

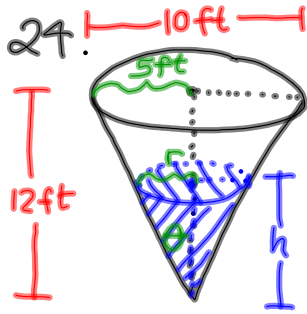
$$\frac{dV}{dt} = 3\pi r^2 \cdot \frac{dr}{dt}$$

$$\frac{dV}{dt} = 3\pi (6)^2 \cdot 2 = 216\pi \text{ in}^3/\text{min}$$

$$\frac{dr}{dt} = 2 \text{ in}/\text{min}$$

$$h = 3r$$

$$\frac{dV}{dt} = ? \text{ when } r=6 \text{ in}$$



$$\frac{dV}{dt} = 10 \text{ ft}^3/\text{min}$$

$$\frac{dh}{dt} = ? \text{ when } h = 8 \text{ ft}$$

$$\frac{r}{h} = \frac{5}{12} \quad r = \frac{5h}{12}$$

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

$$V = \frac{1}{3} \pi \left(\frac{25}{144}\right) h^3$$

$$V = \frac{1}{3} \pi \left(\frac{5h}{12}\right)^2 \cdot h$$

$$\frac{dV}{dt} = \frac{25\pi}{144} h^2 \cdot \frac{dh}{dt}$$

$$V = \frac{1}{3} \pi \cdot \frac{25h^2}{144} \cdot h$$

$$\frac{dh}{dt} = \frac{\frac{dV}{dt}}{\frac{25\pi}{144} h^2} = \frac{10}{\frac{25\pi}{144} \cdot 8^2} = \frac{10 \cdot 144}{25\pi \cdot 64} = \frac{9 \text{ ft}}{10\pi \text{ min}}$$

2.6
15-23 odd