

5a.

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

$$V = 25\pi h$$

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

you are given the rate of change of h so

$$-5\pi\sqrt{h} = 25\pi \frac{dh}{dt}$$

$$\frac{dh}{dt} = \frac{-5\pi\sqrt{h}}{25\pi}$$

$$\frac{dh}{dt} = \frac{-\sqrt{h}}{5}$$

5b.

$$\frac{dh}{dt} = \frac{-\sqrt{h}}{5}$$

$$\frac{dh}{\sqrt{h}} = \frac{-1}{5} dt$$

$$\int \frac{dh}{\sqrt{h}} = \int \frac{-1}{5} dt$$

$$2\sqrt{h} = \frac{-1}{5}t + C$$

When $t = 0$, $h = 17$.

$$2\sqrt{17} = \frac{-1}{5}0 + C$$

$$C = 2\sqrt{17}$$

and

$$2\sqrt{h} = \frac{-1}{5}t + 2\sqrt{17}$$

$$\sqrt{h} = \frac{-1}{10}t + \sqrt{17}$$

$$h = \left(\frac{-1}{10}t + \sqrt{17} \right)^2$$

5c. The coffee pot is empty when $h = 0$.

$$h = \left(\frac{-1}{10}t + \sqrt{17} \right)^2$$

$$0 = \left(\frac{-1}{10}t + \sqrt{17} \right)^2$$

$$0 = \frac{-1}{10}t + \sqrt{17}$$

$$t = 10\sqrt{17} \text{ sec}$$