## Module 5: Analyzing Problems in Context

A maple tree is tapped by drilling a hole into the trunk and the sap is collected in a pail with base radius 5 inches as shown in the figure on the right. Let $h$ be the height of the sap in the pail and let $r$ be the upper radius of the sap collected, both measured in inches. The volume $V$ of sap in the pail is changing at a rate of $\frac{1}{20}$ cubic inches per minute. The volume $V$ of a pail with base radius 5 , height $h$, and upper radius $r$ is $V=\frac{\pi}{3} \cdot h \cdot\left(r^{2}+5 r+25\right)$.
(a) Find an expression for $\frac{d V}{d t}$ in terms of $r, h$, and their derivatives.

(b) Suppose when $h=3, r=8$ and $\frac{d r}{d t}=2 \cdot \frac{d h}{d t}$. Find $\frac{d h}{d t}$ and explain the meaning of this answer in the context
of the problem.
(c) Suppose the pail is replaced by a circular cylinder, so that $r=5$ is constant. Find $\frac{d h}{d t}$.

