130

7. Sand is pouring onto a conical pile in such a way that at a certain instant the height is 80 inches and is increasing at 5 inches per minute and the radius is 50 inches and is increasing at 2 inches per minute. How fast is the volume increasing at that instant? (The volume of a cone is $V = (1/3)\pi r^2 h$.)

Let $V(t)$ = the vol of the sand at time t
$h(t)$ = the ht of the sand at time t
$r(t)$ = the radius of the base of the sand at time t

At a certain instant we have $h=80$ $\frac{dh}{dt}=5$ $r=50$ $\frac{dr}{dt}=2$

We want $\frac{dV}{dt}$ at the instant

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

$$\left.\frac{dV}{dt}\right|_{\text{at this instant}} = \frac{2}{3}\pi\, 50\cdot 80\cdot 2 + \frac{1}{3}\pi(50)^2 5 \quad \frac{in^3}{\cancel{sec}\ min}$$