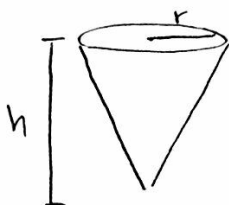


Quiz 14

March 11, 2016

1. An ice cream cone is a cone h inches tall with radius r inches. Its volume is given by the formula $V(r, h) = \frac{1}{3}\pi r^2 h$. A particular cone is 6 inches tall and has a radius of 1 inch. If the height is increased by 0.5 inches, use calculus to *estimate* the change in the radius needed so that the volume stays the same. Give your answer to 3 decimal places.



$$\begin{aligned}\Delta V &\approx \frac{\partial V}{\partial r} \cdot \Delta r + \frac{\partial V}{\partial h} \cdot \Delta h \\ &= \frac{2}{3}\pi r h \Delta r + \frac{1}{3}\pi r^2 \Delta h\end{aligned}$$

$$0 = \frac{2}{3}\pi(1)(6)\Delta r + \frac{1}{3}\pi(1^2)(.5)$$

$$0 = 4\pi\Delta r + \frac{1}{6}\pi$$

$$\Delta r = \frac{-\frac{1}{6}\pi}{4\pi} = -\frac{1}{24} = \boxed{-.042 \text{ inches}}$$

2. Use chain rule to compute $\frac{dz}{dt}$ for $z = x^2 y^3$, $x(t) = 2t - 1$, and $y(t) = e^{-3t}$.

$$\begin{aligned}\frac{dz}{dt} &= \frac{\partial z}{\partial x} \cdot \frac{dx}{dt} + \frac{\partial z}{\partial y} \cdot \frac{dy}{dt} \\ &= 2xy^3(2) + 3x^2y^2(-3e^{-3t}) \\ &= \boxed{4xy^3 - 9x^2y^2e^{-3t}}\end{aligned}$$