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Work for problem 5(a)

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

\[ V = \frac{1}{3} \pi (2.5)^2 (5) \]

\[ V = \frac{5}{3} \pi (2.5)^2 \text{ cm}^3 \]
Work for problem 5(b)

\[ V = \frac{\pi}{3} \cdot r^2 \cdot h \]
\[ = \frac{\pi}{3} \left( \frac{h}{2} \right)^2 \cdot h \]
\[ V = \frac{\pi}{3} \cdot \frac{h^3}{4} \]

\[ \frac{dV}{dt} = 3 \frac{\pi}{12} \cdot h^2 \cdot \frac{dh}{dt} \]
\[ = \frac{\pi}{4} \left( \frac{5}{3} \right)^2 \left( \frac{-3}{10} \right) \]
\[ = \frac{\pi}{8} \left( \frac{-15 \pi}{2} \right) \]
\[ = \frac{-15 \pi}{8} \text{ cm}^3/\text{hr} \]

Work for problem 5(c)

\[ s = \frac{\pi}{4} \cdot r^2 \]
\[ y = \frac{h}{2} \]

\[ \frac{dV}{dt} = \frac{\pi}{4} \cdot h^2 \cdot \frac{dh}{dt} \]

\[ \frac{dV}{dt} \propto SA \]

\[ \frac{dV}{dt} = \pi \cdot h^2 \cdot k \]

\[ \frac{\pi}{4} \cdot h^2 \cdot \frac{dh}{dt} = \pi \cdot h^2 \cdot k \]

\[ \frac{dh}{dt} = k \]

The constant of proportionality \[ \frac{dh}{dt} \]
\[
\frac{r}{h} = \frac{5}{10} \\
5h = 10r \\
\frac{h}{2} = r
\]

**Work for problem 5(a)**

\[
\frac{dh}{dt} = -\frac{3}{10} \text{ cm/hr.}
\]

Find: \( V \) when \( h = 5 \text{ cm} \)

\[
\begin{align*}
V &= \frac{1}{3} \pi \left( \frac{5}{2} \right)^2 (5) \\
V &= \frac{1}{3} \pi \frac{125}{4} \\
V &= \frac{125\pi}{12} \text{ cm}^3
\end{align*}
\]
Work for problem 5(b)

\[ \text{find: } \frac{dv}{dt} \text{ when } h = 5 \text{ cm} \]

\[ \text{given: } \frac{dh}{dt} = -\frac{3}{10} \text{ cm/hr.} \]

\[ V = \frac{1}{3} \pi \left( \frac{h}{2} \right)^2 h \]

\[ \frac{dv}{dt} = \frac{1}{4} \pi \left( \frac{h}{2} \right)^2 \frac{dh}{dt} \]

\[ \frac{dv}{dt} = \frac{\pi}{4} \left( \frac{5}{2} \right)^2 \left( -\frac{3}{10} \right) \]

\[ \frac{dv}{dt} = -15 \pi \frac{25}{8} \text{ cm}^3/\text{hr.} \]

Work for problem 5(c)

\[ \frac{dA}{dt} \quad A = \pi \left( \frac{h}{2} \right)^2 \]

\[ \frac{dA}{dt} = \pi \frac{h}{2} \frac{dh}{dt} \]

\[ \frac{dA}{dt} = \pi \left( \frac{5}{2} \right) \left( -\frac{3}{10} \right) \]

\[ \frac{dA}{dt} = -15 \pi \frac{25}{20} \]

\[ \frac{dA}{dt} = -3 \pi \text{ cm}^2/\text{hr.} \]