Given info. (at key moment):

\[ x' = \frac{40}{\text{mph}} \]

Differentiated:
\[ 2x \cdot x' = 2h \cdot h' \]

Substituting \( x = 40 \), \( h = 4 \), \( h = \sqrt{17} \) gives
\[ 2 \cdot 40 = 2\sqrt{17} \cdot h' \]

\[ h' = \frac{80}{2\sqrt{17}} = \frac{160}{\sqrt{17}} \text{ (mph)} \approx 38.8 \text{ mph} \]

\[ V = \frac{4}{3} \pi r^3 \]
\[ V' = \frac{4}{3} \pi \cdot 3r^2 \cdot r' \]
\[ V' = 4 \pi r^2 \cdot r' \]

At this moment:
\[ r = 2 \]
\[ r' = -1 \]
\[ V' = 4\pi \cdot 2^2 \cdot (-1) \]
\[ V' = -16\pi \text{ min}^3/\text{hr} \]

\[ A = \pi r^2 \]
\[ A' = 2\pi r \cdot r' \]

Given:
\[ r = 10 \text{ (clean 20)} \]
\[ A' = 100 \text{ ft}^2/\text{min} \]

Sub:
\[ 100 = 2\pi \cdot 10 \cdot r' \]
\[ r' = \frac{100}{20\pi} = \frac{5}{\pi} \text{ ft/min} \]

\[ A = w \cdot h \]
\[ A' = w'h + wh' \]

Given:
\[ w = 2 \]
\[ w = 6 \]
\[ h = 8 \]

Sub:
\[ A' = 2 \cdot 8 - 6 \cdot 3 \]
\[ = 16 - 18 \]
\[ = -2 \text{ in}^2/\text{sec} \]
5. Given

\[ V = 10s^2 \quad V' = 20s\cdot s' \quad \text{Given} \quad s' = 2 \quad \text{Given} \quad v' = 20 \cdot 8 \cdot 2 = 320 \text{ in}^3/\text{min}. \]

6. \[ V = \frac{1}{3} \pi r^2 h \quad \text{when} \quad \frac{h}{r} = \frac{12}{6} = 2 \]
   \[ \text{ie.} \quad h = \frac{12}{2} r \]
   \[ V = \frac{1}{3} \pi r^2 \cdot \frac{12}{2} r \]
   \[ V = \frac{4}{3} \pi r^3 \]
   \[ V' = \frac{4}{3} \pi r^2 \cdot r' \]
   \[ r' = -2 \quad r = 2 \]
   \[ V' = \frac{12}{3} \pi r^2 \cdot (-2) \]
   \[ = \frac{12}{3} \pi (-8) \]
   \[ = \boxed{48 \pi} \text{ ft}^3/\text{min} \]

7. \[ x^2 + y^2 = 10^2 \]
   \[ z = -1 \quad z = 3 \quad \text{key moment} : \]
   \[ 3 \quad \frac{10}{\sqrt{11}} \]

8. \[ x^2 + 30y^2 = k^2 \quad x' = 10 \quad \text{and} \quad 300 \text{ft} \]
   \[ x = 10 \quad \text{sec} \quad 400 \text{sec} = 400 \]
   \[ x' = 10 \quad \text{ft} \cdot \text{sec} \quad h = 500 \]
   \[ \frac{400}{500} \]
   \[ h' = \frac{400}{500} \cdot 10 \]
   \[ = 8 \text{ ft/sec}. \]