33.56 $100gpm$ **of water flows through a nominal 4 inch steel pipe then hits a tee splitting into a 3 inch pipe and a 2-1/2 inch steel pipe. The velocity through the 2-1/2 inch pipe is** $2.5fps$**. What is the velocity through the 3 inch pipe?**

A. $2.7\frac{ft}{s}$

B. $3.5\frac{ft}{s}$

C. $4.5\frac{ft}{s}$

D. $6.9\frac{ft}{s}$

Consider creating a table to organize the information as it is compiled during the solution process. Label the pipes 1, 2, and 3 for ease of reference. Use the Schedule 40 Steel Pipe table to look up the internal area for each pipe size.

	$D_{nominal}\,[in]$	$A\,[in^2]$	$v\left[\frac{ft}{s}\right]$	$Q\left[\frac{ft^3}{s}\right]$	$Q\,[gpm]$
1	4				100
2	$2\frac{1}{2}$	4.785	2.5	$Q_{2\left[\frac{ft^3}{s}\right]}$	$Q_{2[gpm]}$
3	3	7.389	v_3	$Q_{3\left[\frac{ft^3}{s}\right]}$	$Q_{3[gpm]}$

Use the equation $Q = vA$ to solve for Q_2. To quickly convert to gpm from $\frac{ft^3}{s}$, multiply by $448.8\frac{gpm}{\frac{ft^3}{s}}$.

$$Q_2 = \left(2.5\frac{ft}{s}\right)\left(4.785in^2\right)\left(\frac{1ft^2}{144in^2}\right) = 0.083\frac{ft^3}{s}\left(448.8\frac{gpm}{\frac{ft^3}{s}}\right) = 37.3gpm$$

Subtract Q_2 from Q_1 to find the volume flow rate through the $3in$ pipe, Q_3. Convert to $\frac{ft^3}{s}$.

$$Q_3 = Q_1 - Q_2 = 100gpm - 37.3gpm = 62.7gpm\left(\frac{1\frac{ft^3}{s}}{448.8gpm}\right) = 0.14\frac{ft^3}{s}$$

Solve for the velocity, v_3.

$$v_3 = \frac{Q_3}{A_3} = \frac{0.14\frac{ft^3}{s}}{\left(7.389in^2\right)\left(\frac{1ft^2}{144in^2}\right)} = 2.7\frac{ft}{s}$$

Answer A