GIVEN Three reservoirs are connected by three pipes as are shown in Fig. E8.14. For simplicity we assume that the diameter of each pipe is 1 ft, the friction factor for each is 0.02, and because of the large length-to-diameter ratio, minor losses are negligible.

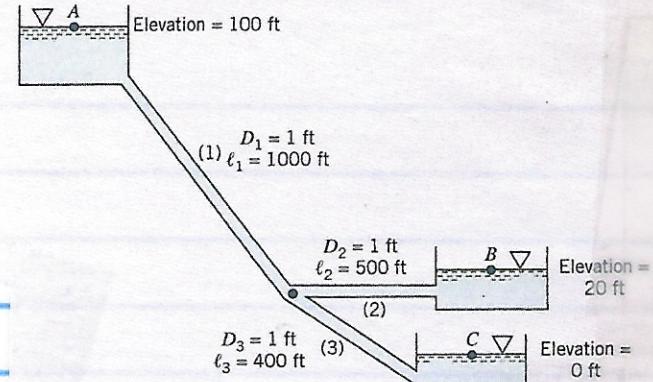**FIND** Determine the flowrate into or out of each reservoir.

■ Figure E8.14

Assume flow out A into B and C

$$Q_1 = Q_2 + Q_3 \quad \text{ie} \quad V_1 = V_2 + V_3 \qquad (1)$$

Energy : AB $\quad Z_A = Z_B + f_1 \dfrac{L_1}{D_1} \dfrac{V_1^2}{2g} + f_2 \dfrac{L_2}{D_2} \dfrac{V_2^2}{2g}$

AC $\quad Z_A = Z_c + f_1 \dfrac{L_1}{D_1} \dfrac{V_1^2}{2g} + f_3 \dfrac{L_3}{D_3} \dfrac{V_3^2}{2g}$

using given data $\quad 258 = V_1^2 + V_2^2/2 \qquad (2)$

$$322 = V_1^2 + .4 V_3^2 \qquad (3)$$

or $\quad V_3 = [160 + 1.25 V_2^2] \qquad (2)-(3)$

using $\quad 258 = (V_2 + V_3)^2 + V_2^2/2 \quad (4)$
(2) & (1)

or $[4]^2 \quad V_2^4 - 460 V_2^2 + 3748 = 0$

$\quad V_2^2 = 452 \quad V_2 = 21.3 \quad$ ft/sec not solution

$\quad$ or $= 8.3 \quad$ or $= 2.88$

$V_2 = 2.88$ ft/s $\qquad Q_1 = 12.5$ ft³/s

$V_1 = 15.9$ ft/s $\qquad Q_2 = 2.26$ ft³/s

$V_3 = 13.02$ ft/s $\qquad Q_3 = 10.2$ ft³/s

Assume flow out A dB into C

(1)

$$V_1 + V_2 = V_3$$

$$Z_A = f_1 \frac{L_1}{D_1} \frac{V_1^2}{2g} + f_3 \frac{L_3}{D_3} \frac{V_3^2}{2g} + Z_B$$

(2) $322 = V_1^2 + .4 V_3^2$

$$Z_B = f_2 \frac{L_2}{D_1} \frac{V_2^2}{2g} + f_3 \frac{L_3}{D_3} \frac{V_3^2}{2g} + Z_C$$

(3) $64.4 = V_2^2/2 + .4 V_3^2$

no solution real > 0 roots
so flow out A into B dC