FIGURE 17–10 Example 17–6.
(See also Example 16–9, Fig. 16–28.)

EXAMPLE 17–6 **Potential above two charges.** Calculate the electric potential (*a*) at point A in Fig. 17–10 due to the two charges shown, and (*b*) at point B. [This is the same situation as Example 16–9, Fig. 16–28, where we calculated the electric field at these points.]

APPROACH The total potential at point A (or at point B) is the sum of the potentials at that point due to each of the two charges Q_1 and Q_2. The potential due to each single charge is given by Eq. 17–5. We do not have to worry about directions because electric potential is a scalar quantity. But we do have to keep track of the signs of charges.

SOLUTION (*a*) We add the potentials at point A due to the each charge Q_1 and Q_2, and we use Eq. 17–5 for each:

$$V_A = V_{A2} + V_{A1}$$

$$= k \frac{Q_2}{r_{2A}} + k \frac{Q_1}{r_{1A}}$$

where $r_{1A} = 60\,\text{cm}$ and $r_{2A} = 30\,\text{cm}$. Then

$$V_A = \frac{(9.0 \times 10^9\,\text{N}\cdot\text{m}^2/\text{C}^2)(5.0 \times 10^{-5}\,\text{C})}{0.30\,\text{m}}$$

$$+ \frac{(9.0 \times 10^9\,\text{N}\cdot\text{m}^2/\text{C}^2)(-5.0 \times 10^{-5}\,\text{C})}{0.60\,\text{m}}$$

$$= 1.50 \times 10^6\,\text{V} - 0.75 \times 10^6\,\text{V}$$

$$= 7.5 \times 10^5\,\text{V}.$$

(*b*) At point B, $r_{1B} = r_{2B} = 0.40\,\text{m}$, so

$$V_B = V_{B2} + V_{B1}$$

$$= \frac{(9.0 \times 10^9\,\text{N}\cdot\text{m}^2/\text{C}^2)(5.0 \times 10^{-5}\,\text{C})}{0.40\,\text{m}}$$

$$+ \frac{(9.0 \times 10^9\,\text{N}\cdot\text{m}^2/\text{C}^2)(-5.0 \times 10^{-5}\,\text{C})}{0.40\,\text{m}}$$

$$= 0\,\text{V}.$$

NOTE The two terms in the sum in (*b*) cancel for any point equidistant from Q_1 and Q_2 ($r_{1B} = r_{2B}$). Thus the potential will be zero everywhere on the plane equidistant between the two charges. This plane is an equipotential surface with $V = 0$.

Simple summations like these can easily be performed for any number of point charges.