17. All distances in this solution are understood to be in meters.

(a) $\vec{a} + \vec{b} = (4.0 + (-1.0))\,\hat{\imath} + ((-3.0) + 1.0)\,\hat{\jmath} + (1.0 + 4.0)\,\hat{k} = 3.0\,\hat{\imath} - 2.0\,\hat{\jmath} + 5.0\,\hat{k}$.

(b) $\vec{a} - \vec{b} = (4.0 - (-1.0))\,\hat{\imath} + ((-3.0) - 1.0)\,\hat{\jmath} + (1.0 - 4.0)\,\hat{k} = 5.0\,\hat{\imath} - 4.0\,\hat{\jmath} - 3.0\,\hat{k}$.

(c) The requirement $\vec{a} - \vec{b} + \vec{c} = 0$ leads to $\vec{c} = \vec{b} - \vec{a}$, which we note is the opposite of what we found in part (b). Thus, $\vec{c} = -5.0\,\hat{\imath} + 4.0\,\hat{\jmath} + 3.0\,\hat{k}$.

26. The vector equation is $\vec{R} = \vec{A} + \vec{B} + \vec{C} + \vec{D}$. Expressing $\vec{B}$ and $\vec{D}$ in unit-vector notation, we have $1.69\,\hat{\text{i}} + 3.63\,\hat{\text{j}}$ and $-2.87\,\hat{\text{i}} + 4.10\,\hat{\text{j}}$, respectively. Where the length unit is not displayed in the solution below, the unit meter should be understood.

(a) Adding corresponding components, we obtain $\vec{R} = -3.18\,\hat{\text{i}} + 4.72\,\hat{\text{j}}$.

(b) and (c) Converting this result to polar coordinates (using Eq. 3-6 or functions on a vector-capable calculator), we obtain

$$(-3.18, 4.72) \quad \longrightarrow \quad (5.69 \angle 124^\circ)$$

which tells us the magnitude is 5.69 m and the angle (measured counterclockwise from $+x$ axis) is $124^\circ$.

37. From the figure, we note that $\vec{c} \perp \vec{b}$, which implies that the angle between $\vec{c}$ and the $+x$ axis is 120°.

(a) Direct application of Eq. 3-5 yields the answers for this and the next few parts. $a_x = a\cos 0° = a = 3.00$ m.

(b) $a_y = a \sin 0° = 0$.

(c) $b_x = b\cos 30° = (4.00\,\mathrm{m})\cos 30° = 3.46$ m.

(d) $b_y = b\sin 30° = (4.00\,\mathrm{m})\sin 30° = 2.00$ m.

(e) $c_x = c\cos 120° = (10.0\,\mathrm{m})\cos 120° = -5.00$ m.

(f) $c_y = c\sin 30° = (10.0\,\mathrm{m})\sin 120° = 8.66$ m.

(g) In terms of components (first $x$ and then $y$), we must have

$$\begin{aligned} -5.00\,\mathrm{m} &= p(3.00\,\mathrm{m}) + q(3.46\,\mathrm{m}) \\ 8.66\,\mathrm{m} &= p(0) + q(2.00\,\mathrm{m}) \ . \end{aligned}$$

Solving these equations, we find $p = -6.67$

(h) and $q = 4.33$ (note that it's easiest to solve for $q$ first). The numbers $p$ and $q$ have no units.

53. (a) With $a = 17.0$ m and $\theta = 56.0°$ we find $a_x = a\cos\theta = 9.51$ m.

(b) And $a_y = a\sin\theta = 14.1$ m.

(c) The angle relative to the new coordinate system is $\theta' = 56 - 18 = 38°$. Thus, $a'_x = a\cos\theta' = 13.4$ m.

(d) And $a'_y = a\sin\theta' = 10.5$ m.