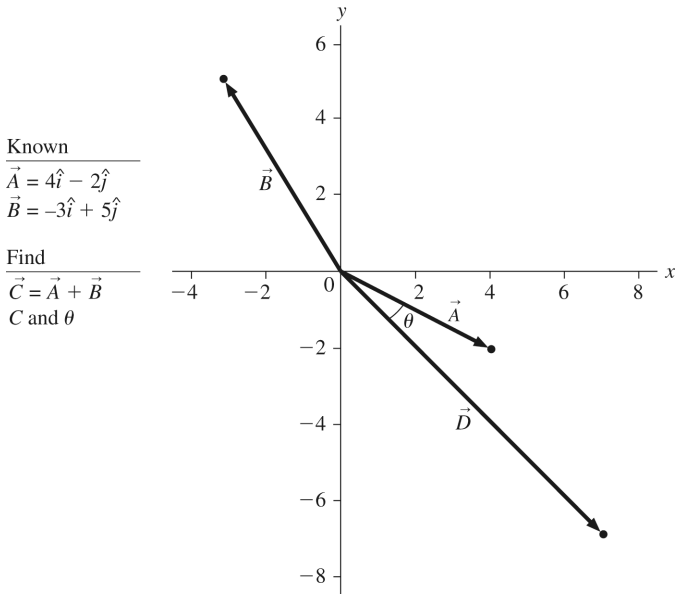
Solutions to HW5, Chapter 3

NOTE! The problems in masteringphysics.com had their numbers altered slightly for each individual student. The solutions below use the same numbers as those used in the book for that problem!

3.14. Visualize:



Solve: **(a)** We have $\vec{A} = 4\hat{i} - 2\hat{j}$, $\vec{B} = -3\hat{i} + 5\hat{j}$, and $-\vec{B} = 3\hat{i} - 5\hat{j}$. Thus, $\vec{D} = \vec{A} + (-\vec{B}) = (4+3)\hat{i} + (-2-5)\hat{j} = 7\hat{i} - 7\hat{j}$.

(b) Vectors $\vec{A}$, $\vec{B}$, and $\vec{D}$ are shown in the figure above.

(c) Since $\vec{D} = 7\hat{i} - 7\hat{j} = D_x\hat{i} + D_y\hat{j}$, $D_x = 7$ and $D_y = -7$. Therefore, the magnitude and direction of $\vec{D}$ are

$$D = \sqrt{(7)^2 + (-7)^2} = 7\sqrt{2} = 9.9 \qquad \theta = \tan^{-1}\left(\left|D_y\right|/D_x\right) = \tan^{-1}(7/7) = 45^\circ$$

Assess: Since $\left|D_y\right| = \left|D_x\right|$, the angle $\theta = 45°$, as expected.

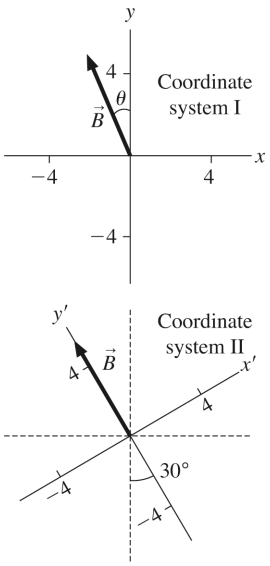
3.18. Visualize:

Known

$\vec{B}$ = (5.0 m, 30° counterclockwise from vertical)
$\theta = 30°$

Find

B_x B_y in coordinate systems I and II



Solve: In coordinate system I, the vector $\vec{B}$ makes an angle of 30° counterclockwise from vertical, so it has an angle of $\theta = 60°$ with the negative x-axis. Since $\vec{B}$ points to the left and up, it has a negative x-component and a positive y-component. Thus, $B_x = -(5.0\text{ m})\cos(60°) = -2.5\text{ m}$ and $B_y = +(5.0\text{ m})\cos(60°) = 4.3\text{ m}$. Thus, $\vec{B} = -(4.3\text{ m})\hat{i} + (2.5\text{ m})\hat{j}$.

In coordinate system II, the vector $\vec{B}$ is along the +y-axis. This means the x-component is zero. Thus, $B_x = 0.0$, and $B_y = 5.0$ m. Thus $\vec{B} = (0.0\text{ m})\hat{i} + (5.0\text{ m})\hat{j}$.

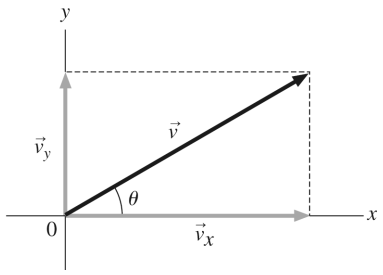
3.34. Visualize:

Known

v = 3.0 m/s
v_x = 2.5 m/s

Find

θ v_y



Solve: (a) Since $v_x = v\cos\theta$, we have $2.5\text{ m/s} = (3.0\text{ m/s})\cos\theta \Rightarrow \theta = \cos^{-1}\left(\dfrac{2.5\text{ m/s}}{3.0\text{ m/s}}\right) = 34°$.

(b) The vertical component is $v_y = v\sin\theta = (3.0\text{ m/s})\sin(34°) = 1.7\text{ m/s}$.