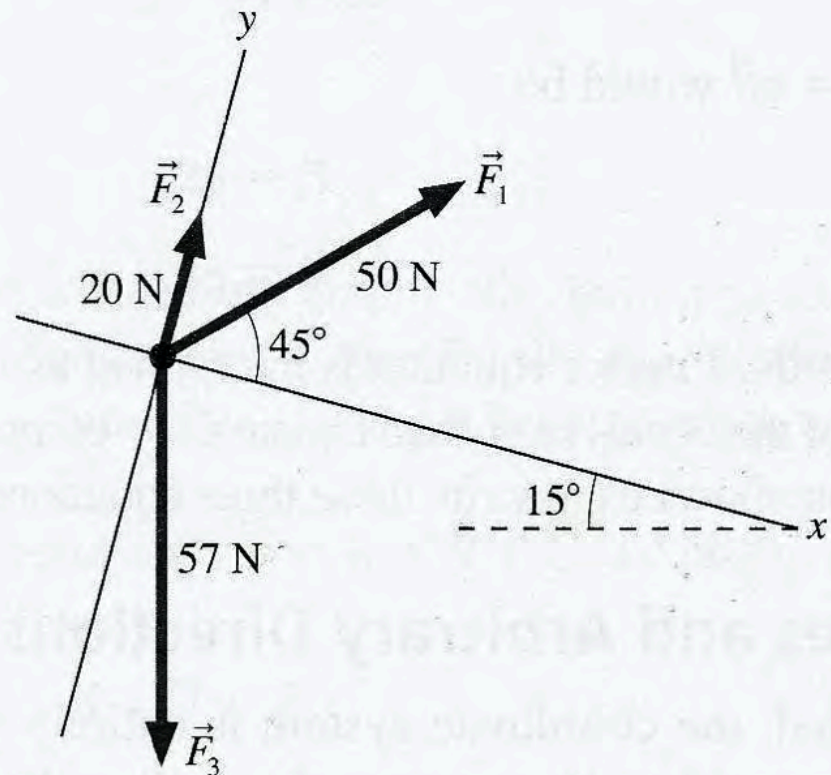FIGURE 3.23 shows three forces acting at one point. What is the net force $\vec{F}_{net} = \vec{F}_1 + \vec{F}_2 + \vec{F}_3$?

Note: Be a bit carful here. Notice that the coord. system is tilted....

FIGURE 3.23 Three forces.

A construction worker stands in a 2.6-m-deep hole, 3.1 m from the edge of the hole. He tosses a hammer to a companion outside the hole. If the hammer leaves his hand 1.0 m above the bottom of the hole at an angle of 35°, what's the minimum speed it needs to clear the edge of the hole? How far from the edge of the hole does it land?

We want v_0 so that the hammer will just clear the point $x = 3.1$ m, $y = 1.6$ m.
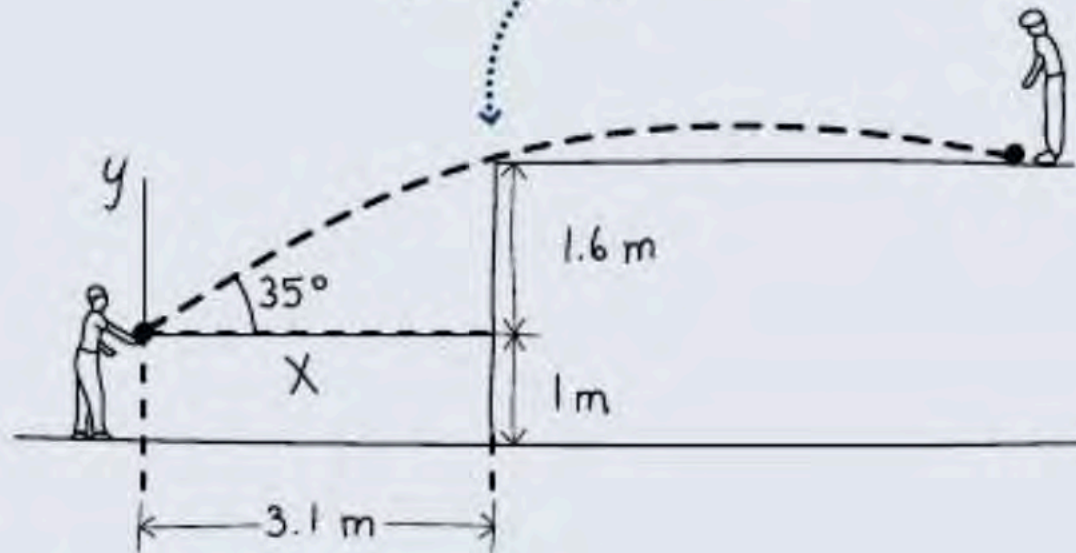
35°

X

1.6 m

1 m

3.1 m

FIGURE 3.18 Our sketch for Example 3.5.

→ Practice these "projectile motion" problems, keeping careful track of what assumptions are stated (or need to be presumed!)

‖ A rifle is aimed horizontally at a target 50 m away. The bullet hits the target 2.0 cm below the aim point.

a. What was the bullet's flight time?

b. What was the bullet's speed as it left the barrel?

‖ A supply plane needs to drop a package of food to scientists working on a glacier in Greenland. The plane flies 100 m above the glacier at a speed of 150 m/s. How far short of the target should it drop the package?

‖ **FIGURE P3.25** shows vectors $\vec{A}$ and $\vec{B}$. Find vector $\vec{C}$ such that $\vec{A} + \vec{B} + \vec{C} = \vec{0}$. Write your answer in component form.
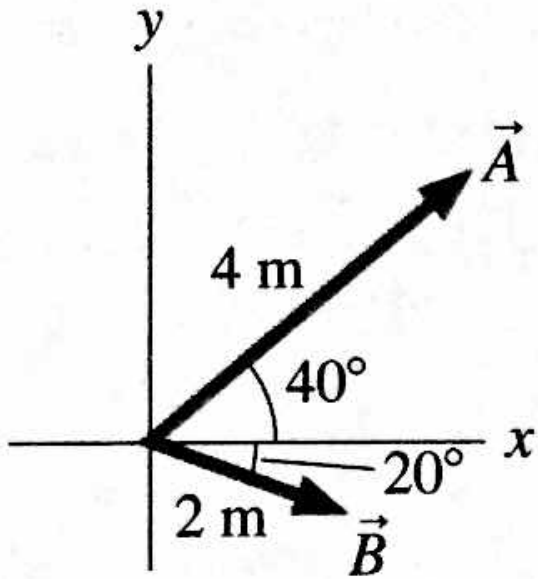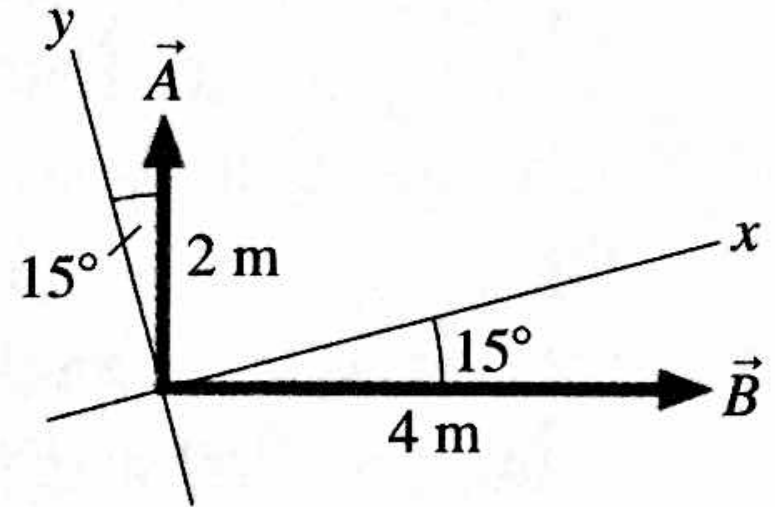

FIGURE P3.25

FIGURE P3.26

‖‖ **FIGURE P3.26** shows vectors $\vec{A}$ and $\vec{B}$. Find $\vec{D} = 2\vec{A} + \vec{B}$. Write your answer in component form.

‖ Find a vector that points in the same direction as the vector $(\hat{\imath} + \hat{\jmath})$ and whose magnitude is 1.

|| The bacterium *E. coli* is a single-cell organism that lives in the gut of healthy animals, including humans. When grown in a uniform medium in the laboratory, these bacteria swim along zigzag paths at a constant speed of 20 μm/s.
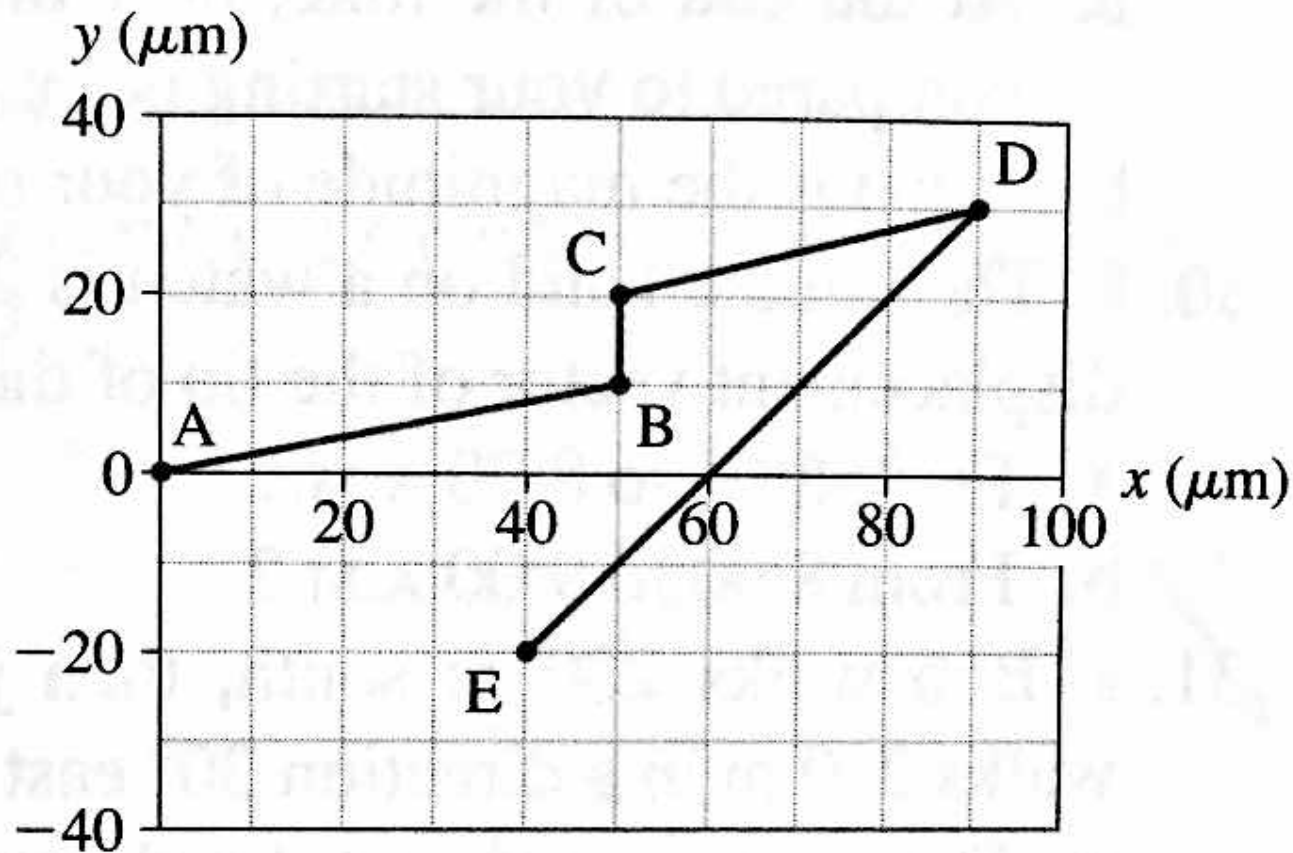

FIGURE P3.40

FIGURE P3.40 shows the trajectory of an *E. coli* as it moves from point A to point E. What are the magnitude and direction of the bacterium's average velocity for the entire trip?