SAMPLE PROBLEM B

Resolving Vectors

PROBLEM

Find the components of the velocity of a helicopter traveling 95 km/h at an angle of 35° to the ground.

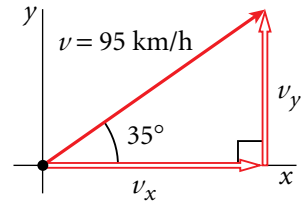
SOLUTION

1. DEFINE

Given: $v = 95$ km/h $\quad \theta = 35°$

Unknown: $v_x = ? \quad v_y = ?$

Diagram: The most convenient coordinate system is one with the *x*-axis directed along the ground and the *y*-axis directed vertically.



2. PLAN

Choose an equation or situation:

Because the axes are perpendicular, the sine and cosine functions can be used to find the components.

$$\sin\theta = \frac{v_y}{v}$$

$$\cos\theta = \frac{v_x}{v}$$

Rearrange the equations to isolate the unknowns:

$$v_y = v\sin\theta$$

$$v_x = v\cos\theta$$

TIP

Don't assume that the cosine function can always be used for the x-component and the sine function can always be used for the y-component. The correct choice of function depends on where the given angle is located. Instead, always check to see which component is adjacent and which component is opposite to the given angle.

3. CALCULATE

Substitute the values into the equations and solve:

$$v_y = (95 \text{ km/h})(\sin 35°)$$

$$\boxed{v_y = 54 \text{ km/h}}$$

$$v_x = (95 \text{ km/h})(\cos 35°)$$

$$\boxed{v_x = 78 \text{ km/h}}$$

4. EVALUATE

Because the components of the velocity form a right triangle with the helicopter's actual velocity, the components must satisfy the Pythagorean theorem.

$$v^2 = v_x^2 + v_y^2$$

$$(95)^2 = (78)^2 + (54)^2$$

$$9025 \approx 9000$$

The slight difference is due to rounding.