PRACTICE B

Resolving Vectors

1. How fast must a truck travel to stay beneath an airplane that is moving 105 km/h at an angle of 25° to the ground?
2. What is the magnitude of the vertical component of the velocity of the plane in item 1?
3. A truck drives up a hill with a 15° incline. If the truck has a constant speed of 22 m/s, what are the horizontal and vertical components of the truck's velocity?
4. What are the horizontal and vertical components of a cat's displacement when the cat has climbed 5 m directly up a tree?

ADDING VECTORS THAT ARE NOT PERPENDICULAR

Until this point, the vector-addition problems concerned vectors that are perpendicular to one another. However, many objects move in one direction and then turn at an angle before continuing their motion.

Suppose that a plane initially travels 5 km at an angle of 35° to the ground, then climbs at only 10° relative to the ground for 22 km. How can you determine the magnitude and direction for the vector denoting the total displacement of the plane?

Because the original displacement vectors do not form a right triangle, you can not apply the tangent function or the Pythagorean theorem when adding the original two vectors.

Determining the magnitude and the direction of the resultant can be achieved by resolving each of the plane's displacement vectors into its x and y components. Then the components along each axis can be added together. As shown in **Figure 12,** these sums will be the two perpendicular components of the resultant, **d.** The resultant's magnitude can then be found by using the Pythagorean theorem, and its direction can be found by using the inverse tangent function.

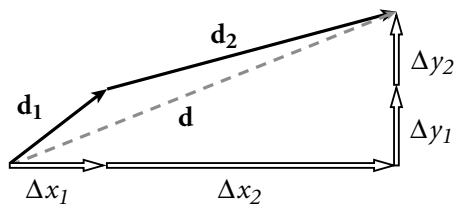

Figure 12
Add the components of the original displacement vectors to find two components that form a right triangle with the resultant vector.