

VECTOR COMPONENTS

☞ Sketch a diagram for each problem, then solve it.

1. A laser beam is aimed 15.95° above the horizontal at a mirror 11,648 m away. It glances off the mirror and continues for an additional 8570. m at 11.44° above the horizon. What is the resultant displacement of the beam?
2. Three forces act on a point: 3 N at 0° , 4 N at 90° , and 5 N at 217° . What is the net force?
3. A cyclist heads due west on a straight road. A northeast wind is blowing at 10 m/s.
 - a. Is this wind more like a headwind or a tailwind?
 - b. What is the effective speed of this headwind/tailwind?
4. One unfortunate winter day I happened to slip on an icy ramp inclined 30° to the horizontal. Find my acceleration down the ramp given that the acceleration due to gravity points straight down and has a value of 9.8 m/s^2 . (Assume the ice is perfectly frictionless.)
5. A radio broadcast tower is held upright with a guy wire under 3500 N of tension. The guy wire meets the ground at a 60° angle.
 - a. What is the magnitude of the component of this force that prevents the tower from toppling?
 - b. What is the magnitude of the component of this force that keeps the tower in contact with the earth?
6. A force of 90 N is applied to a lawnmower along a handle that makes a 30° angle with the vertical.
 - a. What is the magnitude of the component of this force that propels the lawnmower?
 - b. What is the magnitude of the component of this force that keeps the lawnmower in contact with the ground?
7. A boy pulls a sled along level ground by means of a rope under 78 N of tension. The rope with which he pulls the sled makes an angle of 37° with the horizontal.
 - a. What is the magnitude of the component of the tension responsible for actually moving the sled?
 - b. What is the magnitude of the component of the tension that is wasted?
8. A cyclist heads out on a straight road with a bearing of 60° east of north. A north wind is blowing at 10 m/s.
 - a. Is this wind more like a headwind or a tailwind?
 - b. What is the effective speed of this headwind/tailwind?
9. A cyclist heads out on a straight road with a bearing of 60° east of north. A southwest wind is blowing at 10 m/s.
 - a. Is this wind more like a headwind or a tailwind?
 - b. What is the effective speed of this headwind/tailwind?