

7.1 Force and Acceleration as Vectors

These problems taken from the Nelson Text: Pg. 363 – 364, 369 – 370


Pg. 363 – 364

2. Three forces of 10 N, 20 N, and 30 N are in a state of equilibrium.
 - a. Draw a sketch of these three forces.
 - b. What is the angle between the equilibrant and each of the smaller forces?
3. Two forces of 10 N and 20 N are acting on an object. How should these forces be arranged to produce the largest possible resultant?
4. Explain in your own words why three forces must lie in the same plane if they are acting on an object in equilibrium.
5. Determine the resultant and equilibrant of each pair of forces acting on an object.
 - a. \vec{f}_1 has a magnitude of 5 N acting due east, and \vec{f}_2 has a magnitude of 12 N acting due north.
 - b. \vec{f}_1 has a magnitude of 9 N acting due west, and \vec{f}_2 has a magnitude of 12 N acting due south.
6. Which of the following sets of forces acting on an object could produce equilibrium?
 - a. 2 N, 3 N, 4 N
 - b. 9 N, 40 N, 41 N
 - c. $\sqrt{5}$ N, 6 N, 9 N
 - d. 9 N, 10 N, 19 N
8. A force, \vec{f}_1 , of magnitude 6 N acts on particle P. A second force, \vec{f}_2 , of magnitude 8 N acts at 60° to \vec{f}_1 . Determine the resultant and equilibrant of \vec{f}_1 and \vec{f}_2 .
9. Resolve a force of 10 N into two forces perpendicular to each other, such that one component force makes an angle of 15° with the 10 N force.

3. An airplane has an air speed of 300 km/h and is heading due west. If it encounters a wind blowing south at 50 km/h, what is the resultant ground velocity of the plane?
4. Adam can swim at the rate of 2 km/h in still water. At what angle to the bank of a river must he head if he wants to swim directly across the river and the current in the river moves at the rate of 1 km/h?
6. A boat heads 15° west of north with a water speed of 12 m/s. Determine its resultant velocity, relative to the ground, when it encounters a 5 m/s current from 15° north of east.
7. An airplane is heading due north at 800 km/h when it encounters a wind from the northeast at 100 km/h.
 - a. What is the resultant velocity of the airplane?
 - b. How far will the plane travel in 1 h?
9. A small airplane has an air speed of 244 km/h. The pilot wishes to fly to a destination that is 480 km due west from the plane's present location. There is a 44 km/h wind from the south.
 - a. In what direction should the pilot fly in order to reach the destination?
 - b. How long will it take to reach the destination?

Answers to Selected Problems

Pg. 363 – 364

2. a. 
 - b. 180°
3. a line along the same direction
4. For three forces to be in equilibrium, they must form a triangle, which is a planar figure.
5. a. The resultant is 13 N at an angle of $N 22.6^\circ W$. The equilibrant is 13 N at an angle of $S 22.6^\circ W$.
b. The resultant is 15 N at an angle of $S 36.9^\circ W$. The equilibrant is 15 N at $N 36.9^\circ E$.
6. a. yes b. yes c. no d. yes
8. The resultant would be 12.17 N at 34.7° from the 6 N force toward the 8 N force. The equilibrant would be 12.17 N at 145.3° from the 6 N force away from the 8 N force.
9. 9.66 N 15° from given force, 2.95 N perpendicular to 9.66 N force

Pg. 369 - 370

3. 304.14, $W 9.5^\circ S$
4. 60° upstream
6. 13 m/s, $N 37.6^\circ W$
7. a. 732.71 km/h, $N 5.5^\circ W$
b. about 732.71 km
9. a. about 10.4° south of west
b. 2 h, 53.1° downstream to the bank