Vector Practice Problems
(Precalculus Chapter 8 Section 5)

Draw vector diagrams to solve each problem.
1) After walking 11 km due north from camp, a hiker then walks 11 km due east.
   a) What is the total distance walked by the hiker? 22 km
   b) Determine the total displacement from the starting point. 16 km 45° (NE)

2) Two boys push on a box. One pushes with a force of 125 N to the east. The other exerts a force of 165 N to the north. What is the size and direction of the resultant force on the box? 210 N 37° (E of N)

3) An explorer walks 13 km due east, then 18 km north, and finally 3 km west.
   a) What is the total distance walked? 34 km
   b) What is the resulting displacement of the explorer from the starting point? 21 km 30° (E of N)

4) A motorboat heads due east at 16 m/s across a river that flows due north at 9.0 m/s.
   a) What is the resultant velocity (speed and direction) of the boat? 18 m/s 29° N of S (61°)
   b) If the river is 136 m wide, how long does it take the motorboat to reach the other side? 8.5 s
   c) How far downstream is the boat when it reaches the other side of the river? 77 m

5) While flying due east at 120 km/h, an airplane is also carried northward at 45 km/h by the wind blowing due north. What is the plane's resultant velocity? 130 km/h 21° N of E (69°)

6) Three teenagers push a heavy crate across the floor. Dion pushes with a force of 185 N at 0⃞ Shirley exerts a force of 165 N at 30⃞ while Joan pushes with 195 N force at 300⃞ What is the resultant force on the crate? 440 N 11° W of N (349)

Solve each problem algebraically.
7) A motorboat travels at 8.5 m/s. It heads straight across a river 110 m wide.
   a) If the water flows downstream at a rate of 3.8 m/s, what is the boat's resultant velocity? 9.3 m/s 24° down stream
   b) How long does it take the boat to reach the opposite shore? 13 s

8) A boat heads directly across a river 41 m wide at 3.8 m/s. The current is flowing downstream at 2.2 m/s.
   a) What is the resultant velocity of the boat? 4.4 m/s 30.° down stream
   b) How much time does it take the boat to cross the river? 11 s
   c) How far downstream is the boat when it reaches the other side? 24 m

9) A 42-km/h wind blows toward 215⃞ while a plane heads toward 125⃞ at 152 km/h. What is the resultant velocity of the plane? 160 km/h 51° S of M (141°)

10) A heavy box is pulled across a wooden floor with a rope. The rope makes an angle of 60⃞ with the floor. A force of 75 N is exerted on the rope. What is the component of the force parallel to the floor? 38 N

11) An airplane flies toward 149⃞ at 525 km/h. What is the component of the plane's velocity
    a) toward 90⃞? 270 km/h
    b) toward 180⃞? 450 km/h

12) A student exerts a force of 72 N along the handle of a lawn mower to push it across the lawn. Find the horizontal component of this force when the handle is held at an angle with the lawn of
   a) 60⊡ $36 N$
   b) 40⊡ $55 N$
   c) 30⊡ $62 N$

13) A hiker walks 14.7 km at an angle of 305⊡ from east. Find the east-west and north-south components of this walk. $EW = 8.4 km$ $NS = 12 km$

14) Three people are pulling on a tree. The first person pulls with 15 N at 65⊡ the second with 16 N at 135⊡ the third with 11 N at 195⊡ What is the magnitude and direction of the resultant force on the tree? $27 N.$ $35° S of E$ $(125°)$

15) A net force of 55 N acts due west on an object. What single force on the object produces equilibrium? $55 N$ $East$

16) Two forces act on an object. One force is 6.0 N horizontally. The second force is 8.0 N vertically. $\left(\text{East or west} \right)$
   a) Find the magnitude and direction of the resultant. $10 N$ $53°$ $incline$
   b) If the object is in equilibrium, find the magnitude and direction of the force that produces equilibrium. $10 N$ $53°$ $decline$ $opposite$ $direction$

17) A 62-N force acts at 30⊡ and a second 62-N force acts at 60⊡
   a) Determine the resultant force. $120 N$ $45°$
   b) What is the magnitude and direction of the force that produces equilibrium? $120 N$ $225°$

18) Two forces act on an object. A 36-N force acts at 225⊡ A 48-N force acts at 315⊡ What would be the magnitude and direction of their equilibrant? $60 N$ $8.0°$ $N of W$ $(278°)$

19) The 562-N trunk is placed on an inclined plane that forms a 66⊡ angle with the horizontal.
   a) Calculate the values of F_n and F_p. $F_n = 230 N$ $F_p = 510 N$
   b) Compare your results with those given above for the same trunk on a 30⊡ incline.
      $F_n = 490 N$ $F_p = 280$

20) A car weighing 12000 N is parked on a 36⊡ slope.
   a) Find the force tending to cause the car to roll down the hill. $7100 N$ F_p
   b) What is the force the car exerts perpendicular to the hill? $9700 N$ F_n

21) The brakes in the car in problem 20 fail, and the car starts to roll down the hill. Assume there is no friction. What is the acceleration of the car? $F = m a$ $a = \dfrac{F}{m}$ $\dfrac{7100 N}{1224}$ $5.9 m/s^2$

22) The roof on a house rises 1.00 m over a horizontal distance of 3.50 m. A 71.0-kg roofer stands on the roof. Is the frictional force that keeps the roofer from slipping equal in magnitude to F_n or F_p? What is its magnitude? $F_p = 190 N$