Review Law of Triangles, Vectors, and Parametric

1. Two ranger towers at points *P* and *Q*, located 12 kilometers apart, receive a distress signal from campers at campsite *C*. The campsite is at an angle of 71° from the first tower and 100° from the second, each angle having as one side the line segment connecting the towers. Which tower is closer, and how far is it from the campsite?

2. An airplane is sighted simultaneously from two towns that are 3 miles apart. The angle of elevation of town *A* is 40.8° and the angle of elevation of town *B* is 75°. If the airplane is directly above a straight line between the two towns, how far is the airplane from each town?

3. An airplane pilot leaves San Francisco on her way to San Luis Obispo. Unfortunately, she flies 30° off course for 50 miles before discovering her error. If the direct air distance between the two cities is 200 miles, how far is the pilot from San Luis Obispo when she discovers her error?

4. Two planes start from the same point at the same time and fly on courses which diverge by 48°. If one plane averages 320 miles per hour and the other plane averages 480 miles per hour, how far apart are the planes after 24 minutes?

5. Each of two legs of a stepladder is 12 feet long. If the angle formed by the legs measures 13°, bow far apart are the feet of the stepladder?

6. A triangular parking lot has sides of lengths 420 feet, 350 feet, and 150 feet. Find the smallest of the three angles of the parking lot.

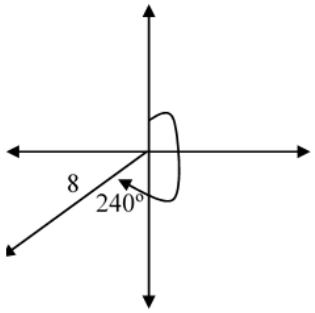
7. An isosceles triangle has base of length 20 centimeters. If the vertex angle of the triangle measures 30°, find the perimeter of the triangle.

8. Two planes, one flying at 300 miles per hour and the other at 450 miles per hour, left the same airport at noon. At 3 pm they were 1200 miles apart. What was the measure of the angle between their flight paths?

9. Two vectors, $\vec{a}$ and $\vec{b}$, have magnitudes of 10 and 15 respectively. The angle between them is 50º.
   a. Find $\left|\vec{a}-\vec{b}\right|$, and the angle this difference makes with $\vec{a}$.
   b. Find $\left|\vec{a}+\vec{b}\right|$, and the angle this sum makes with $\vec{a}$.

10. An object moves 12 meters along a bearing of 90º and then turns and moves 18 more meters along a bearing of 150º. Find the resultant of these two displacement vectors as a distance and bearing (clockwise from north).

11. Resolve the vector into horizontal and vertical components.



12. A ship sails 90 miles on a bearing of 225º then turns and sails 100 miles on a bearing of 315º. Find the resultant displacement vector as a distance and bearing.

13. The angle of elevation to the top of a mountain is 35 degrees. If a tour guide states that the base of the mountain is 2.5 miles from the center of town, how high is the mountain?

14. An airplane is flying at a speed of 675 kph. At the same time, the air is moving with respect to the ground at an angle of 35º to the plane's path through the air with a speed of 60 kph. Find the plane's ground speed if it is flying with the wind.

15. Ichiro throws a baseball with an initial speed of 145 feet per second at an angle of 20° to the horizontal. The ball leaves Ichiro's hand at a height of 5 feet.
   a. Find parametric equations that model the position of the ball as a function of time.
   b. How long is the ball in the air?
   c. Determine the horizontal distance that the ball travels.
   d. When is the ball at its maximum height? Determine the maximum height of the ball.

16. A ship sails 50 miles on a bearing of 200°, then turns and sails on a bearing of 280° for 25 more miles. Find its displacement vector
   a. as the sum of two components, and
   b. as a magnitude and direction

17. Bob throws a ball straight up with an initial speed of 50 feet per second from a height of 6 feet.
    (a) Find parametric equations that model the motion of the ball as a function of time.
    (b) How long is the ball in the air?
    (c) When is the ball at its maximum height? Determine the maximum height of the ball.

18. Alice throws a ball straight up with an initial speed of 40 feet per second from a height of 5 feet.
    (a) Find parametric equations that model the motion of the ball as a function of time.
    (b) How long is the ball in the air?
    (c) When is the ball at its maximum height? Determine the maximum height of the ball.

Convert the parametric equation into a rectangular equation

19. $x = 3t + 2 \qquad y = t + 1$
20. $x = t + 2 \qquad y = \sqrt{t}$
21. $x = t^2 + 4 \qquad y = t^2 - 4$
22. $x = 3t^2 \qquad y = t + 1$
23. $x = 2\cos t \qquad y = 3\sin t$
24. $x = \sec t \qquad y = \tan t$

Answers

1. Tower Q is closer; 72.53 km from C
2. (A) 3.22 mi; (B) 2.18 mi
3. 159 mi
4. 142.68 mi
5. 2.7 ft.
6. 19.92°
7. 97.27 cm
8. 60.61°
9. a. 11.496 at 88.215º
   b. 22.756 at 30.328º
10. 26.153 bearing 126.586º
11. $\langle -4, -6.928 \rangle$
12. 134.536 bearing 273.013º
13. 1.751 mi
14. 724.966 kph
15. a. $x = 136.255t \qquad y = -16t^2 + 49.593t + 5$
    b. 3.20 seconds
    c. 436.017 feet
    d. 43.43 feet at 1.55 seconds
16. a. $\langle -33.303, -44.599 \rangle$
    b. 55.902 bearing 223.435º
17. a. $x = 0 \qquad y = -16t^2 + 50t + 6$
    b. 3.24 seconds
    c. 45.0625 feet at 1.5625 seconds
18. a. $x = 0 \qquad y = -16t^2 + 40t + 5$
    b. 2.62 seconds
    c. 30 feet at 1.25 seconds
19. $y = \frac{1}{3}x + \frac{1}{3}$
20. $y = \sqrt{x - 2}$
21. $y = x - 8$
22. $x = 3(y - 1)^2$
23. $\frac{x^2}{4} + \frac{y^2}{9} = 1$
24. $x^2 - y^2 = 1$