

Math 108 Exam #4

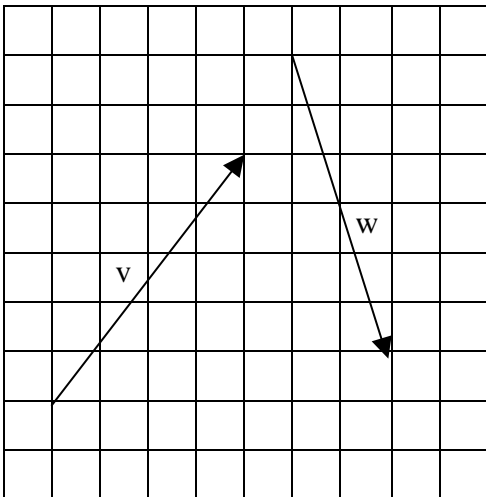
Find exact values for the angles of a triangle with sides of lengths 6.2, 13.9 and 15.6.

Find exact values for the angles and sides of a triangle with two sides measuring lengths 30.4 and 17.6 and an angle opposite of the side of length 30.4 measuring  $100.65^\circ$ .

An airplane is sighted at the same time by two observers who are 5 miles apart from each other and directly in front of the path of the airplane. They report angles of elevation of the airplane as  $13^\circ$  and  $22^\circ$ . To the nearest foot, how high is the airplane?

In flying the 76 miles from Champaign to Peoria, a student pilot sets a heading that is  $10^\circ$  off course and maintains an average speed of 100 miles per hour. After 15 minutes, the instructor notices the course error and tells the student to correct his heading. To the nearest tenth of a degree, through what angle will the plane turn to correct the heading, and to the nearest tenth of a mile, how many miles away is Peoria when the plane turns?

Use the grid system for the vectors in the figure to determine exact values for the magnitudes and directions of each of the vectors shown and to draw the graph of  $v-w$ .



Math 108 Exam #4

Find the vector with initial point  $J = (-5, -8)$  and terminal point  $K = (-2, 6)$ .

Find the exact values for the magnitudes of the vectors  $-5i - 8j$  and  $-2i + 6j$ .

Find the dot product of the vectors  $-5i - 8j$  and  $-2i + 6j$ .

Find the exact value for the angle between the vectors  $-5i - 8j$  and  $-2i + 6j$ .

A carton weighing 110 pounds is on a conveyer belt that has a slope of  $8^\circ$ . Find the force, to the nearest tenth of a pound, required to keep the carton from sliding down the conveyer belt and the force, to the nearest tenth of a pound, that the carton exerts perpendicular to the conveyer belt.

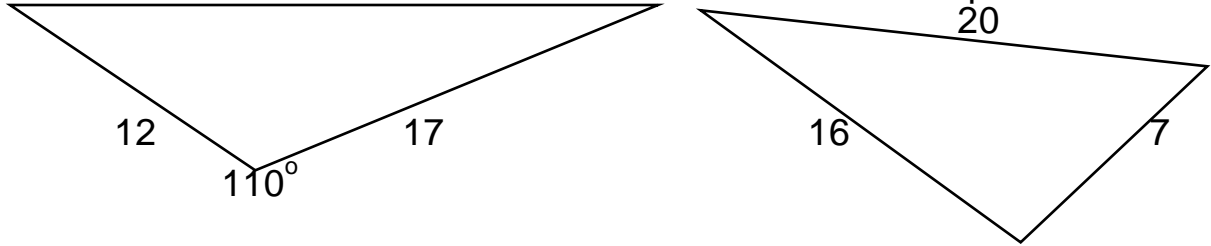
An aircraft going from Atlanta to Savannah has its controls set on a bearing of  $S53^\circ E$  and is traveling at a speed of 640 mph. The wind is blowing from the north to the south at a speed of 62 miles per hour. Find the actual speed of the aircraft, to the nearest mph, and the actual bearing of the aircraft, to the nearest tenth of a degree.

The points  $(4, \quad)$ ,  $(-3, \quad/2)$ ,  $(2, 3 \quad/4)$  and  $(5, -6 \quad)$  are given in polar coordinates. Plot and label these points on a polar coordinate system.

Change the equation  $x^2 - y^2 = 2xy$  to polar form.

Simplify the polar form of the equation  $x^2 - y^2 = 2xy$  so that only one trigonometric function appears.

Solve the following triangles. Use degrees. Do not round off during the calculations. Round off the answers to five decimal places.

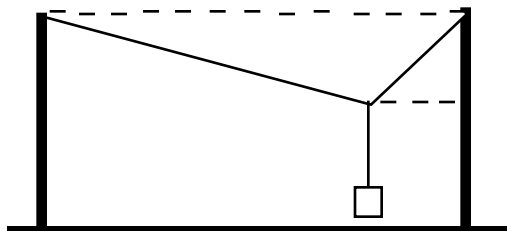


Using the notation of our text book, determine how many triangles can be formed with the following sets of properties. Solve those triangles to five decimal places.

$a = 8$	$b = 14$	$c = 30$	$a = 8$	$b = 14$	$c = 20$
$a = 8$	$b = 14$	$= 67^\circ$	$= 67^\circ$	$= 100^\circ$	$c = 10$
$= 67^\circ$	$b = 20$	$= 100^\circ$	$a = 30$	$= 50^\circ$	$= 60^\circ$
$= 30^\circ$	$b = 10$	$a = 6$	$= 60^\circ$	$b = 20$	$a = 16$
$= 60^\circ$	$a = 20$	$b = 16$	$= 20^\circ$	$= 40^\circ$	$= 120^\circ$

Coast Guard station Bravo is located 250 miles due north from an automated search and rescue station. Station Bravo receives a distress message from an oil tanker at a heading of  $125^\circ$ , and the automated station receives the same message at a heading of  $50^\circ$ . (Heading is defined as the angle measured clockwise from due north.) How far is the tanker from station Bravo to the nearest tenth of a mile?

A weight is attached to a rope strung between two vertical poles of the same height which are 30 feet apart. The rope makes an angle of  $40^\circ$  with one pole and  $70^\circ$  with the other pole. How far is the weight from the nearer pole? Hint: Consider the dotted lines.



An airplane flies 180 miles from point A on a heading of  $135^\circ$  and then changes to a heading of  $240^\circ$  for 100 miles. Find how far the airplane is from point A to the nearest tenth of a mile.

Two points P and Q on level ground are on opposite sides of a building. To find the distance between the points, a surveyor chooses a point R that is 400 feet from point P and 500 feet from Q and then determines that the angle PRQ has measure  $40^\circ$ . Find the distance between points P and Q to two decimal places.

A ship leaves port A on a bearing of  $N60^\circ E$  towards port B which is 200 miles away. After going through some strong currents, the captain discovers that the ship's position is  $N45^\circ E$  50 miles from port A. Now that there are no more currents to contend with, what bearing should the captain set in order to make a straight line to port B to the nearest tenth of a degree.

An oil tanker on a heading of  $250^\circ$  is advised to change course to a heading of  $235^\circ$  to avoid a large iceberg. After following a heading of  $235^\circ$  for eight hours, the captain changes course to a heading of  $274^\circ$  until the ship reaches its original course at a point 150 miles from the beginning of the avoidance maneuver. Find the additional distance to the nearest hundred yards that the ship had to travel to avoid the iceberg.

Express the magnitude and direction of  $-3i + 6j$  to five decimal places.

To five decimal places, find the horizontal and vertical components of the vector with  $\|F\| = 10.4$ ,  $\theta = 335^\circ$ .

To five decimal places, find the magnitude and direction of the vector with  $\mathbf{V} = 2.11\mathbf{i} - 7.75\mathbf{j}$ .

To five decimal places, find the components of the sum of the vectors A and B.

$$\|A\| = .332 \quad \theta_A = 32^\circ 12' \quad \|B\| = 1.06 \quad \theta_B = 100^\circ 42'$$

A balloon rising at the rate of 20 ft/sec is being pushed by a horizontal wind of 25 mph. Find the actual speed at which the balloon is moving away from its launch site, and the angle that its path makes with the ground. Use two decimal places. (60 mph = 88 ft/sec)

An airplane with a heading of  $140^\circ$  and a cruising speed of 185 mph is flying in an 18 mph wind from the south. Find the ground speed of the airplane, and the actual heading of its path. Use one decimal place.

A pilot is preparing a flight plan from the airport in Juliette to Denver, which is 280 miles due north. If the airplane cruises at 160 mph and there is a constant 18 mph wind from the west, what heading should the pilot fly, and how long will the trip take?

If a 15.3 lb block rests on a plane inclined at  $28.4^\circ$  above the horizontal, what are the magnitudes of the components of forces acting perpendicular to and parallel to the plane? Use three decimal places.

A 75 lb block rests on an inclined plane. If the block exerts a force of 67 lb perpendicular to the plane, what is the angle of inclination of the plane to the nearest tenth of a degree?

An object weighing 120 lb hangs at the end of a rope. The object is pulled sideways by a horizontal force of 30 lb. What angle does the rope make with the vertical to the nearest degree?

Two forces, one of 75 lb and the other of 100 lb, act from a point. If the angle between the forces is  $60^\circ$ , find the magnitude and direction of the resultant force. Give the direction as an angle between the resultant force and the 100 lb force. Use three decimal places.

Consider a flight from Miami to New York to be along a north-south axis with an airplane distance of approximately 1000 miles. A jet with an airspeed of 500 mph makes the round trip. If there is a constant northwest wind of 100 mph, how long will the round trip take?

A horizontal force of 750 lb is applied to a block resting on a plane inclined at  $17.9^\circ$  above the horizontal. Find the component of the force parallel to the plane to three decimal places.

Suppose that a lunar lander is to be designed for a total impact force of 3500 lb and that each of the three legs makes an angle of  $28^\circ$  with the vertical. Find the axial force each leg is designed to withstand to two decimal places.