Chpt 4

∠ Trigonometric Functions

∠ 4.8 Applications of Trigonometric Functions

Chpt 4

Homework

- 4.8 p359 1-49 odd

Chpt 4

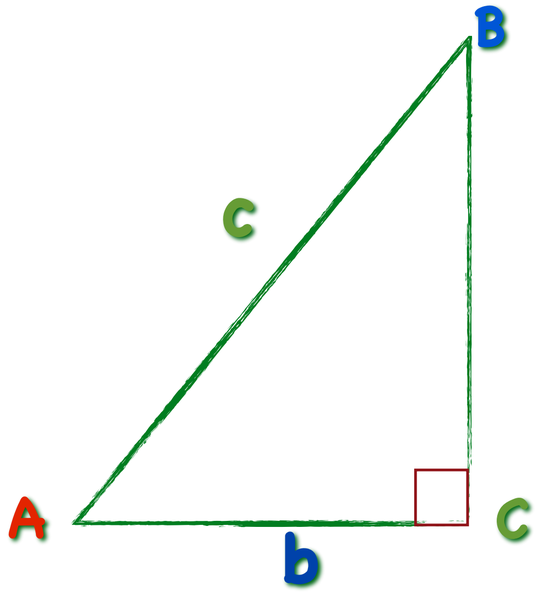
Objectives

- Solve a right triangle
- Solve real-world problems with right triangles.
- Solve problems involving bearings

Solving Right Triangles

Solve a right triangle
Solve realistic problems with right triangles.
Solve problems involving bearings

- **Solving a right triangle** means finding the missing lengths of its sides and the measurements of its angles. We will label right triangles so that side **a** is opposite angle **A**, side **b** is opposite angle **B**, and side **c**, the hypotenuse, is opposite right angle **C**.

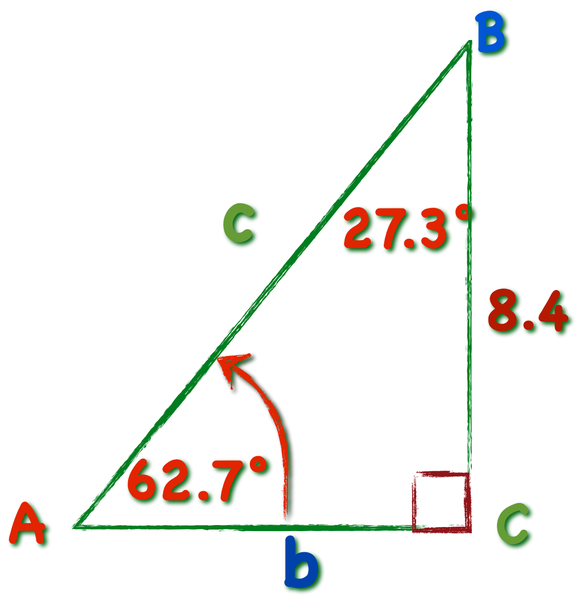


When solving a right triangle, we will use the sine, cosine, and tangent functions, rather than their reciprocals.

Solving a Right Triangle

Solve a right triangle
Solve realistic problems with right triangles.
Solve problems involving bearings

Let $A = 62.7^\circ$ and $a = 8.4$. Solve the right triangle, rounding lengths to four decimal places.



$A + B = 90^\circ$ $\qquad B = 90^\circ - A = 90^\circ - 62.7^\circ = 27.3^\circ$

$\tan B = \dfrac{b}{a}$ $\qquad \sin A = \dfrac{a}{c}$

$\tan 62.7^\circ = \dfrac{8.4}{b}$ $\qquad b = \dfrac{8.4}{\tan 62.7^\circ} \approx 4.3355$

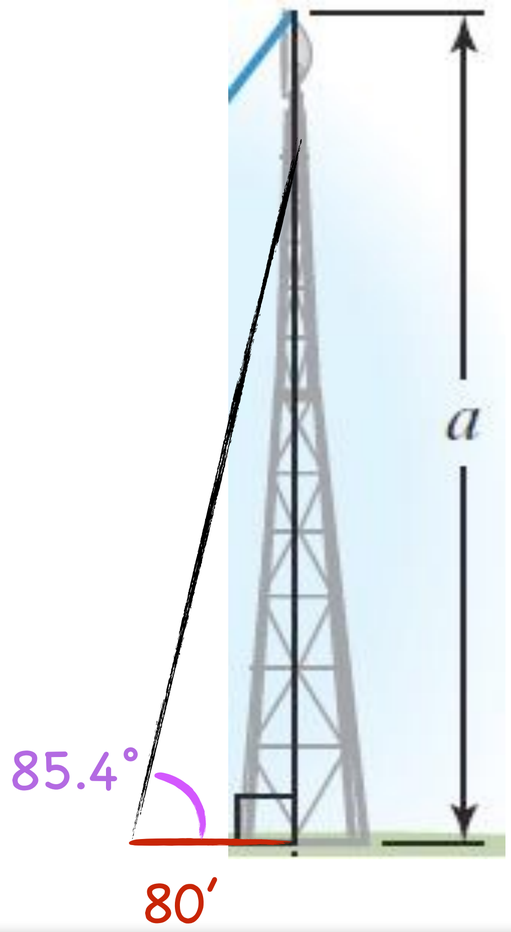
$\sin 62.7^\circ = \dfrac{8.4}{c}$ $\qquad c = \dfrac{8.4}{\sin 62.7^\circ} \approx \dfrac{8.4}{.8886} \approx 9.4531$

When solving a triangle always use the values you have been given in the problem. If you calculate one value incorrectly and then use that value in another calculation, that calculation will also be incorrect.

Finding a Side of a Right Triangle

Solve a right triangle
Solve realistic problems with right triangles.
Solve problems involving bearings

- From a point on level ground 80 feet from the base of the Eiffel Tower, the angle of elevation is 85.4°. Approximate the height of the Eiffel Tower to the nearest foot.



$$\tan 85.4^\circ = \frac{a}{80}$$

$$80 \tan 85.4^\circ = a \approx 80(12.4288)$$

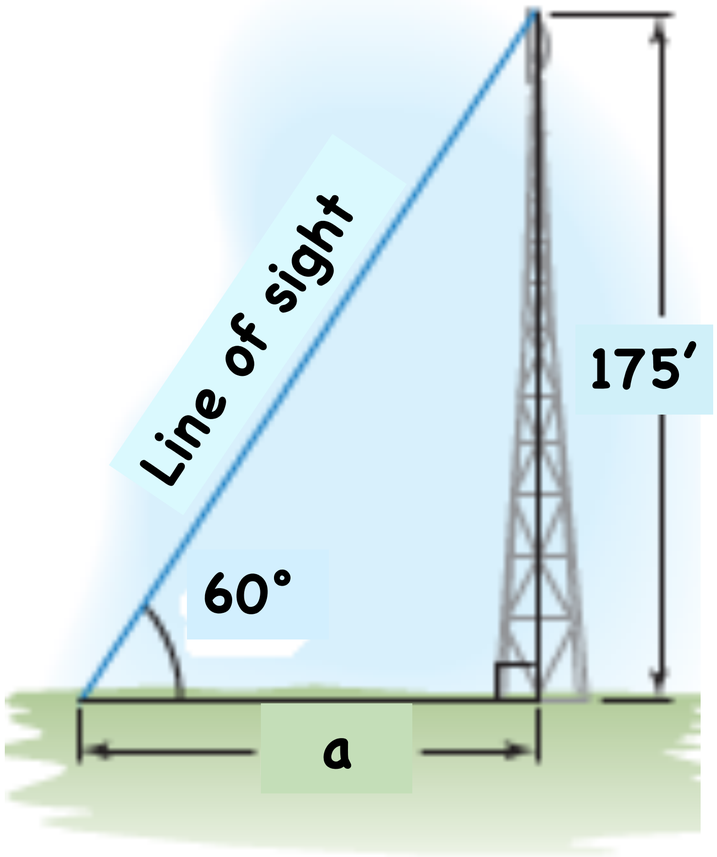
$$a \approx 994.3065$$

The height of the Eiffel Tower is about 994 feet.

Finding a Side of a Right Triangle

Solve a right triangle
Solve realistic problems with right triangles.
Solve problems involving bearings

- The height of a tower is 175 feet. ZiHong is looking up at the top of the tower at a 60 degree angle. How far away from the base of the tower is Z?



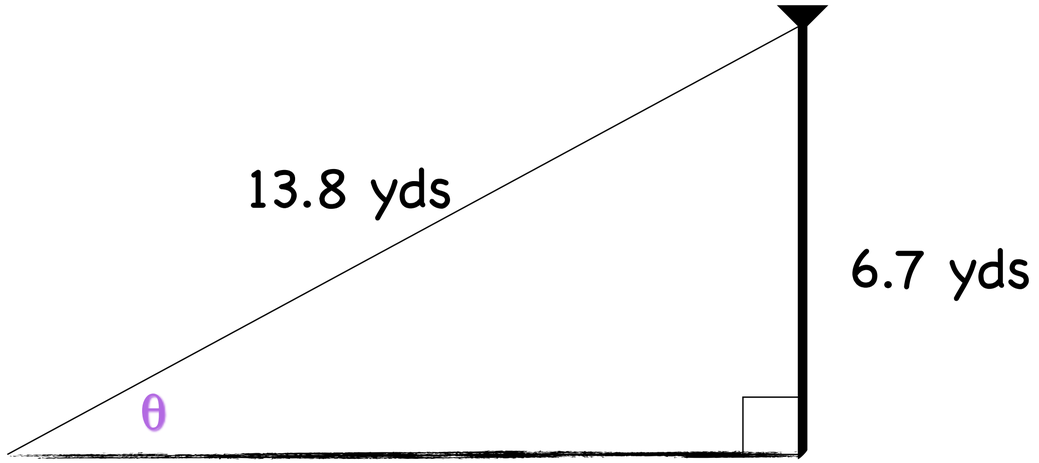
$$\tan 60^\circ = \frac{175}{a} \qquad a = \frac{175}{\tan 60^\circ} \approx 101.03$$

The person is approximately 101 feet from the tower.

Finding an Angle of a Right Triangle

Solve a right triangle
Solve realistic problems with right triangles.
Solve problems involving bearings

A guy wire is 13.8 yards long and is attached from the ground to a light pole 6.7 yards above the ground. Find the angle, to the nearest tenth of a degree, that the wire makes with the ground.



$$\sin\theta = \frac{6.7}{13.8}$$

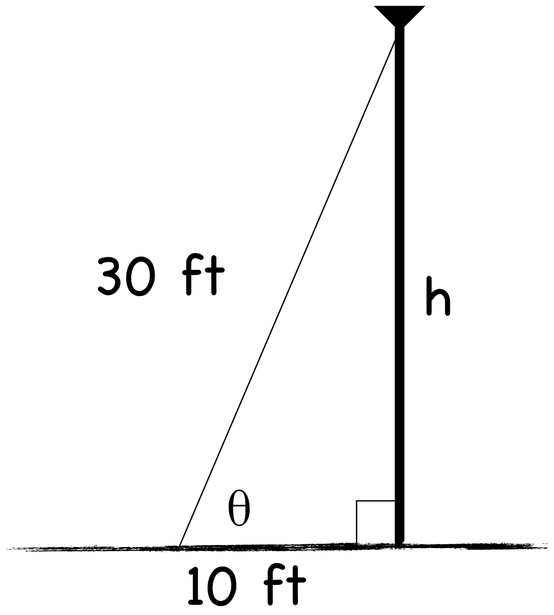
$$\sin^{-1}\left(\frac{6.7}{13.8}\right) = \theta$$

$$\theta \approx 29.0457^\circ$$

The wire makes an angle of approximately 29.0° with the ground.

Finding a Side of a Right Triangle

- A guy wire is 30 feet long and is attached from the ground to a light pole. We stand the light pole upright and the wire is anchored 10 feet from the pole. Find the height of the light pole.



$$\cos\theta = \frac{10}{30} \qquad \theta = \cos^{-1}\left(\frac{10}{30}\right) \qquad \theta \approx 70.5288^\circ$$

$$\sin 70.5288 = \frac{h}{30} \qquad h = 30\sin 70.5288 \approx 28.2843$$

The light pole is approximately 28.3 feet tall.

Finding a Side of a Right Triangle

Solve a right triangle
Solve realistic problems with right triangles.
Solve problems involving bearings

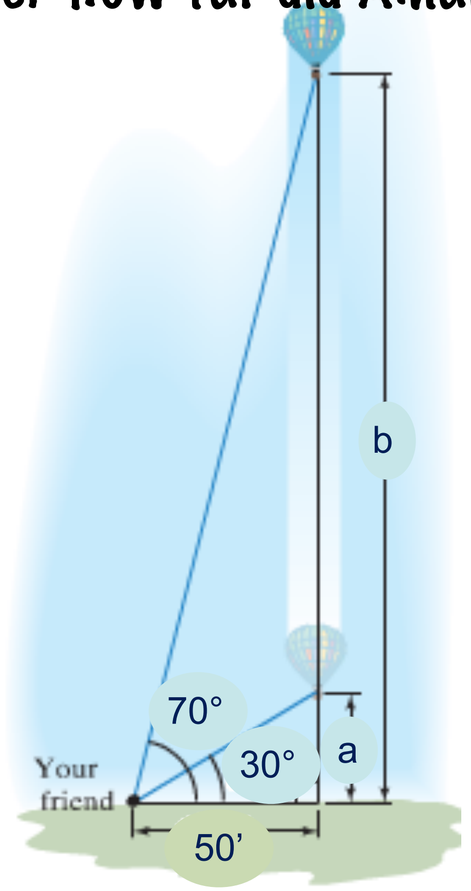
Amairany is ascending in a hot air balloon. Her friend Samantha is filming the ride for SnapChat. Samantha is 50 feet away from the launch point when she starts filming the ride. Initially the camera is at a 30° angle. Aftrer one minute elapses the camera is at a 70° angle. How far did Amairany travel in that minute? What was Amairany's speed in fpm?

$$\tan 30^\circ = \frac{a}{50} \qquad a = 50\tan 30^\circ \approx 50(.5774) \approx 28.8675$$

$$\tan 70^\circ = \frac{b}{50} \qquad b = 50\tan 70^\circ \approx 50(2.7475) \approx 137.3739$$

$$137.3739 - 28.8675 = 108.5064$$

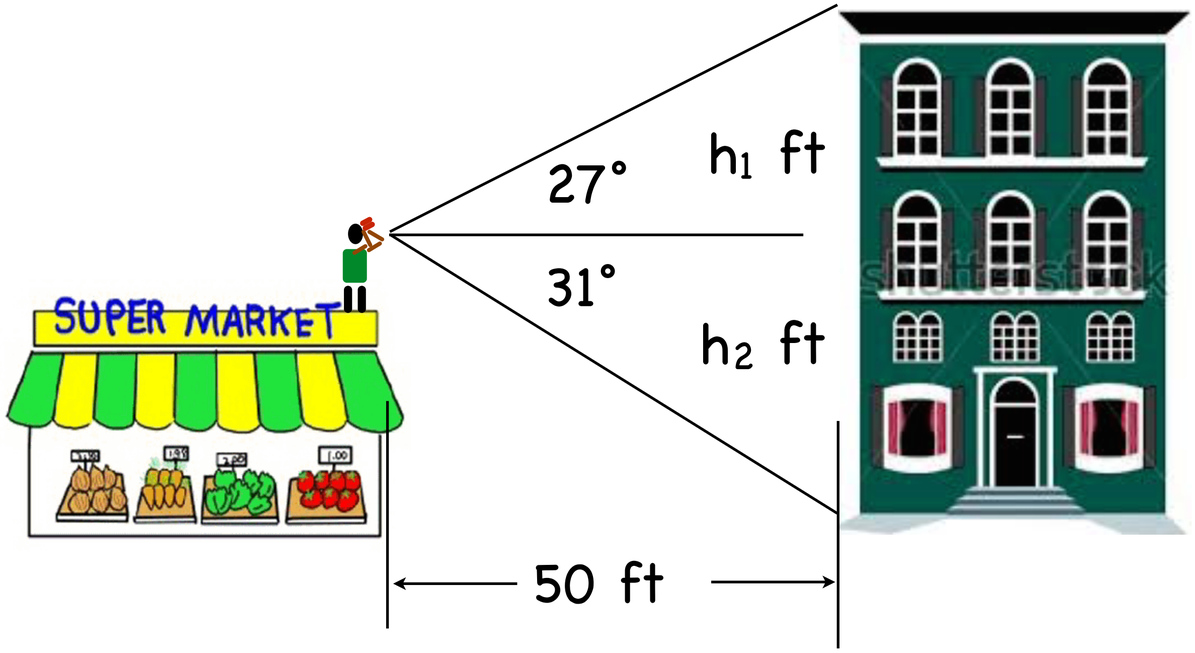
You are ascending at about 108.5 feet per minute.



Finding a Side of a Right Triangle

Solve a right triangle
Solve realistic problems with right triangles.
Solve problems involving bearings

- Nathanial foolishly stands atop a building. He measures the angle of elevation to the top of the building across the street to be 27° and the angle of depression (to the base of the building) to be 31°. If the two buildings are 50 feet apart, how tall is the taller building?



$$\frac{h_1}{50} = \tan 27^\circ \qquad h_1 = 50 \tan 27^\circ \approx 25.48$$

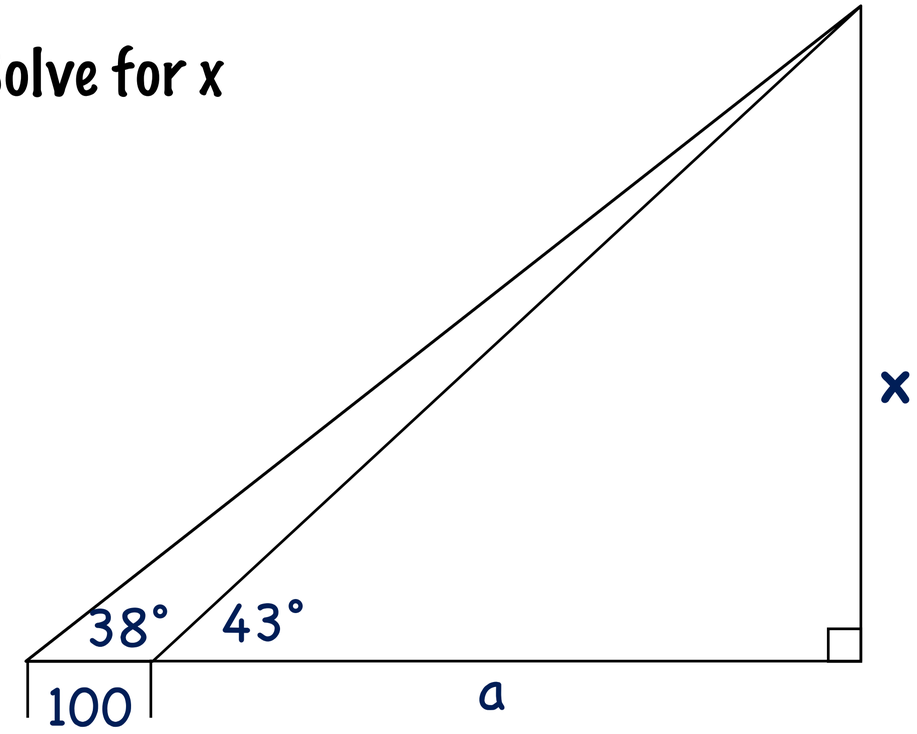
$$\frac{h_2}{50} = \tan 31^\circ \qquad h_2 = 50 \tan 31^\circ \approx 30.04$$

$$h = 50 \tan 27^\circ + 50 \tan 31^\circ \approx 55.5 \text{ feet}$$

Finding a Side of a Right Triangle

Solve a right triangle
Solve realistic problems with right triangles.
Solve problems involving bearings

Solve for x



$$\tan 43^\circ = \frac{x}{a} \qquad a = \frac{x}{\tan 43^\circ}$$

$$\tan 38^\circ = \frac{x}{a+100} \qquad a+100 = \frac{x}{\tan 38^\circ}$$

$$\frac{x}{\tan 43^\circ} + 100 = \frac{x}{\tan 38^\circ}$$

$$\frac{x}{\tan 38^\circ} - \frac{x}{\tan 43^\circ} = 100$$

$$x\left(\frac{1}{\tan 38^\circ} - \frac{1}{\tan 43^\circ}\right) = 100$$

$$x = \frac{100}{\frac{1}{\tan 38^\circ} - \frac{1}{\tan 43^\circ}} \approx 481.7584$$

Trigonometry and Bearings

Solve a right triangle
Solve realistic problems with right triangles.
Solve problems involving bearings

Bearings

- In navigation and surveying problems, the term **bearing** is used to specify the location of one point relative to another. The bearing from point **O** to point **P** is the acute angle, **measured in degrees**, between ray $\overrightarrow{OP}$ and a **north-south line**. The north-south line and the east-west line intersect at right angles. Each bearing has three parts: a **letter** (N or S), the **measure** of an acute angle, and a **letter** (E or W).

N 40° E N 28° W S 56° E S 61° W

Trigonometry and Bearings

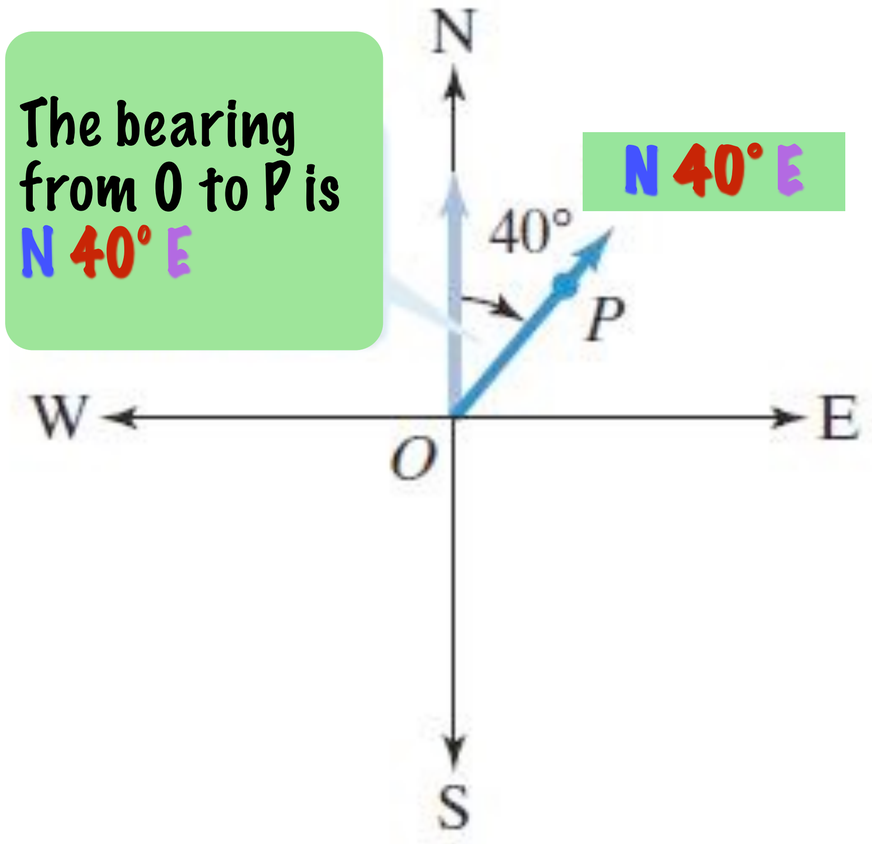
Solve a right triangle
Solve realistic problems with right triangles.
Solve problems involving bearings

If the acute angle is measured from the north side of the north-south line, then we write N first.

Second, we write the measure of the acute angle.

If the acute angle is measured on the east side of the north-south line, then we write E last.

The bearing from O to P is N 40° E



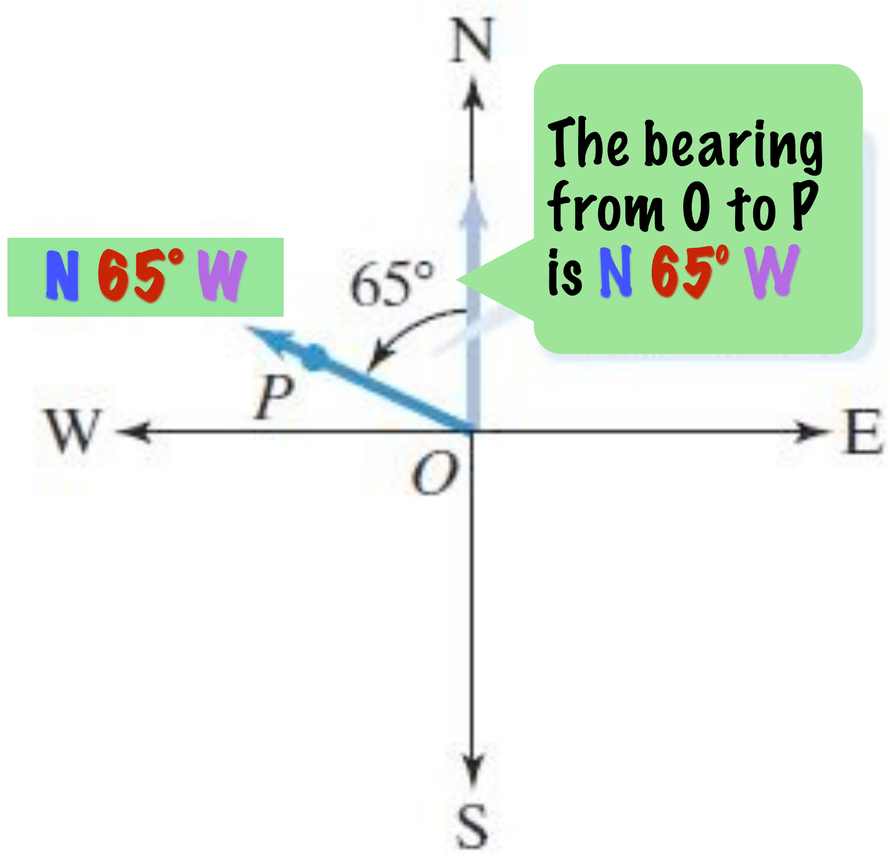
Trigonometry and Bearings

Solve a right triangle
Solve realistic problems with right triangles.
Solve problems involving bearings

If the acute angle is measured from the north side of the north-south line, then we write N first.

Second, we write the measure of the acute angle.

If the acute angle is measured on the west side of the north-south line, then we write W last.



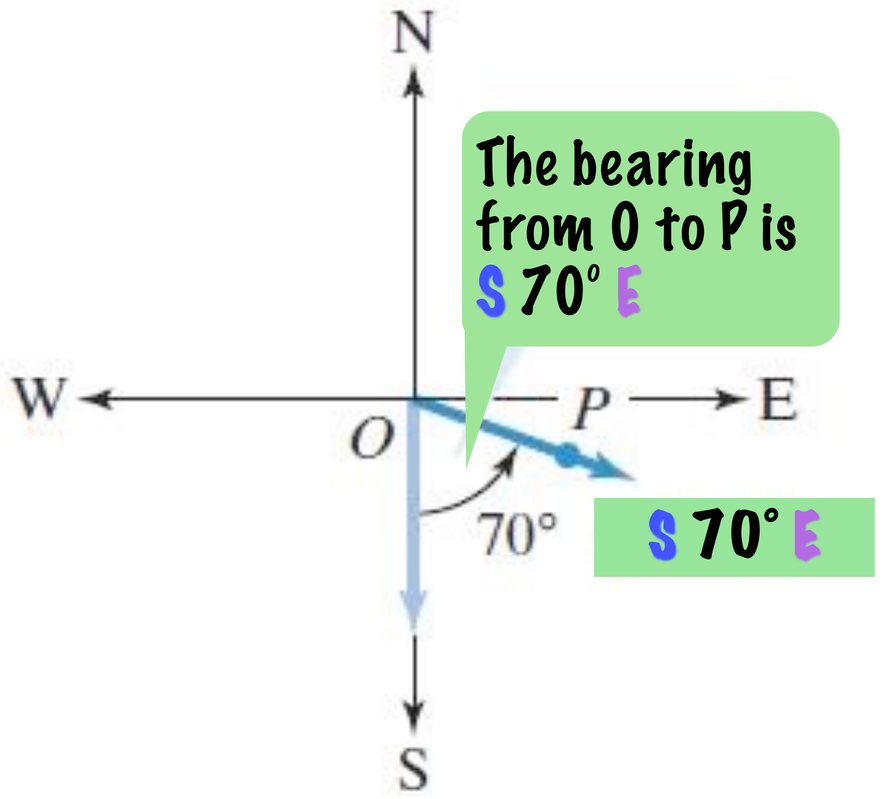
Trigonometry and Bearings

Solve a right triangle
Solve realistic problems with right triangles.
Solve problems involving bearings

If the acute angle is measured from the south side of the north-south line, then we write S first.

Second, we write the measure of the acute angle.

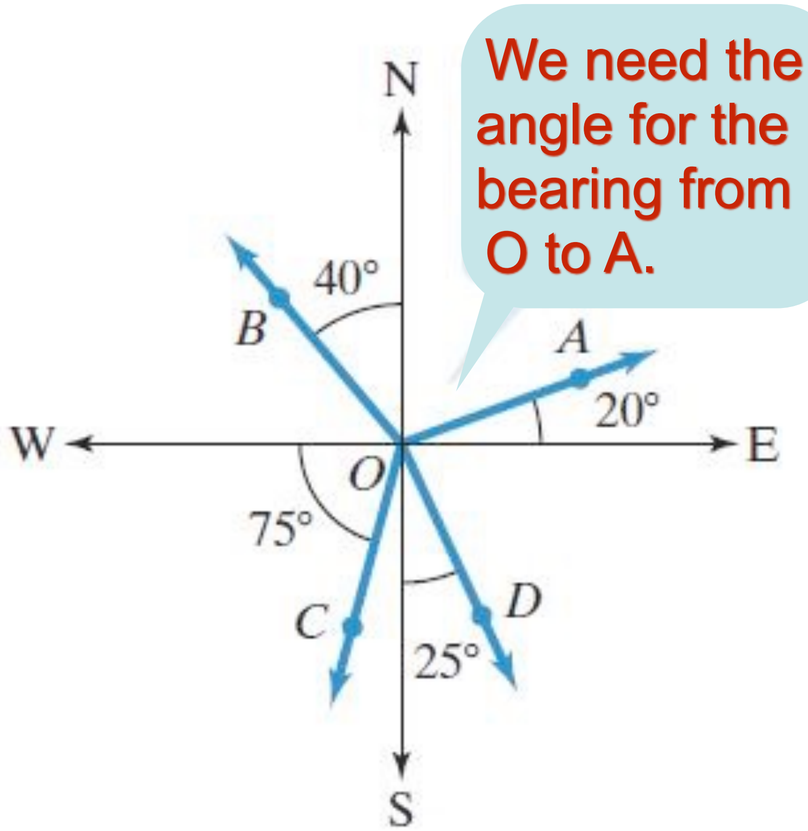
If the acute angle is measured on the east side of the north-south line, then we write E last.



Understanding Bearings

Solve a right triangle
Solve realistic problems with right triangles.
Solve problems involving bearings

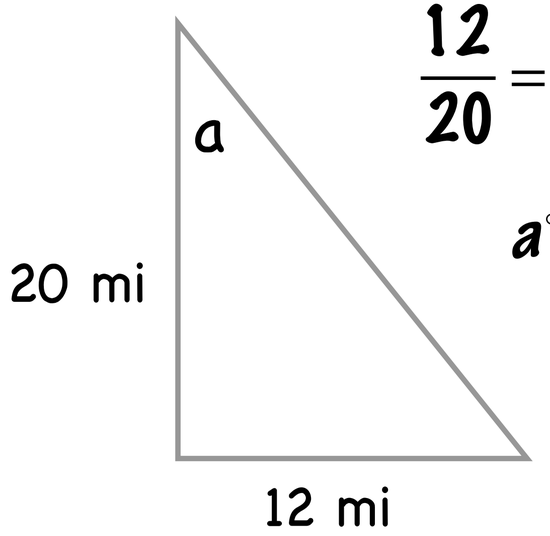
- Use the figure to find each of the following:
  - a. the bearing from O to D
    - The bearing from O to D is S 25° E.
  - b. the bearing from O to C
    - The bearing from O to C is S 15° W.
  - c. the bearing from O to B
    - The bearing from O to B is N 40° W.
  - d. the bearing from O to A
    - The bearing from O to A is N 70° E.



Understanding Bearings

Solve a right triangle
Solve realistic problems with right triangles.
Solve problems involving bearings

- A ship leaves port and sails 12 miles due west.
- It then turns and sails due north for 20 miles.
  - At this point, at what bearing should the ship sail to go directly back to port?
    - Which angle do we need?



$$\frac{12}{20} = \tan a^\circ$$

$$a^\circ = \tan^{-1}\frac{12}{20}$$

$$a^\circ = 30.96^\circ$$

S 31° E