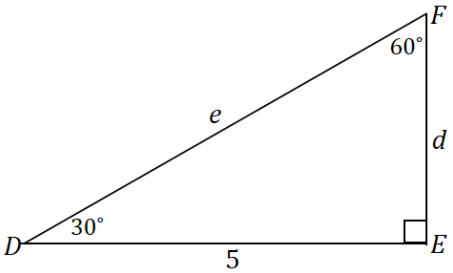
Lesson 32: Using Trigonometry to Find Side Lengths of an Acute Triangle

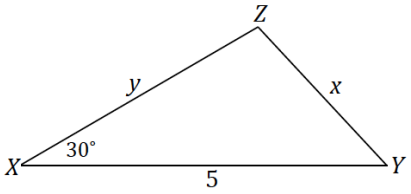
Classwork

Opening Exercise

a. Find the lengths of d and e.

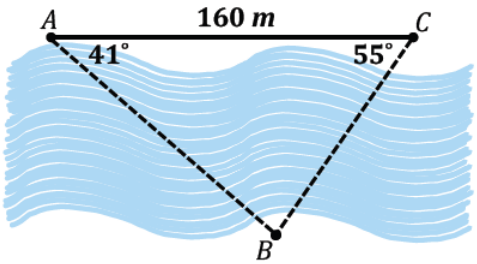


b. Find the lengths of x and y. How is this different from part (a)?



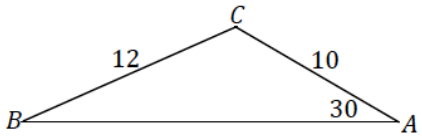
Example 1

A surveyor needs to determine the distance between two points A and B that lie on opposite banks of a river. A point C is chosen 160 meters from point A, on the same side of the river as A. The measures of angles $\angle BAC$ and $\angle ACB$ are 41° and 55°, respectively. Approximate the distance from A to B to the nearest meter.

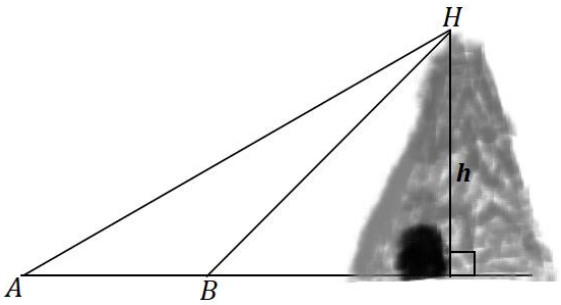


Exercises 1–2

1. In $\triangle ABC$, $m\angle A = 30$, $a = 12$, and $b = 10$. Find $\sin\angle B$. Include a diagram in your answer.

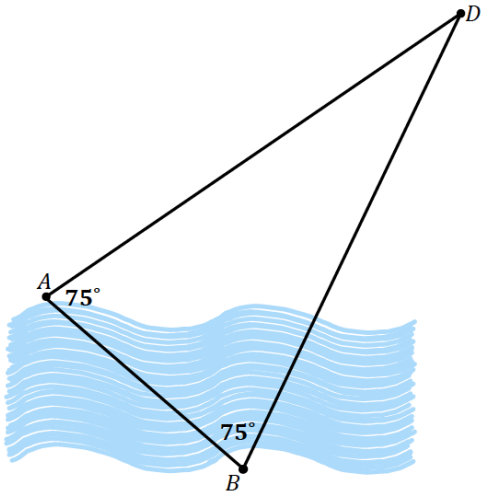


2. A car is moving towards a tunnel carved out of the base of a hill. As the accompanying diagram shows, the top of the hill, H, is sighted from two locations, A and B. The distance between A and B is 250 ft. What is the height, h, of the hill to the nearest foot?



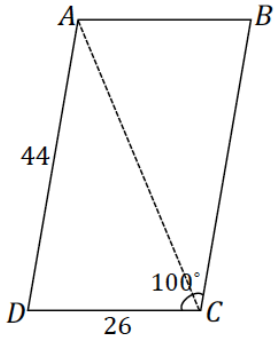
Example 2

Our friend the surveyor from Example 1 is doing some further work. He has already found the distance between points A and B (from Example 1). Now he wants to locate a point D that is equidistant from both A and B and on the same side of the river as A. He has his assistant mark the point D so that the angles $\angle ABD$ and $\angle BAD$ both measure 75°. What is the distance between D and A to the nearest meter?



Exercise 3

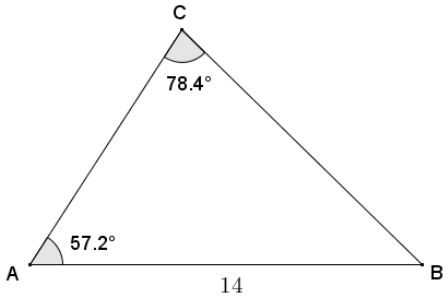
3. Parallelogram $ABCD$ has sides of lengths 44 mm and 26 mm, and one of the angles has a measure of 100°. Approximate the length of diagonal AC to the nearest mm.



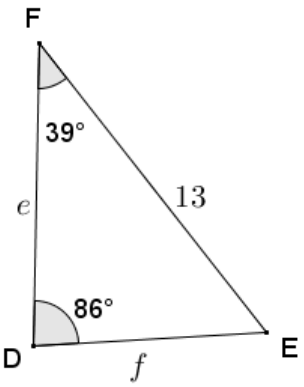
Problem Set

1. Given $\triangle ABC$, $AB = 14$, $\angle A = 57.2°$, and $\angle C = 78.4°$, calculate the measure of angle B to the nearest tenth of a degree, and use the Law of Sines to find the lengths of AC and BC to the nearest tenth.

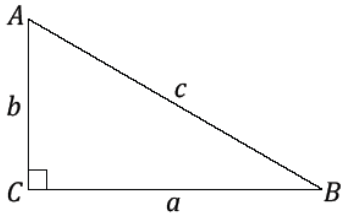
   Calculate the area of $\triangle ABC$ to the nearest square unit.



2. Given $\triangle DEF$, $\angle F = 39°$, and $EF = 13$, calculate the measure of $\angle E$, and use the Law of Sines to find the lengths of $\overline{DF}$ and $\overline{DE}$ to the nearest hundredth.



3. Does the law of sines apply to a right triangle? Based on $\triangle ABC$, the following ratios were set up according to the law of sines.



$$\frac{\sin\angle A}{a} = \frac{\sin\angle B}{b} = \frac{\sin 90}{c}$$

   Fill in the partially completed work below.

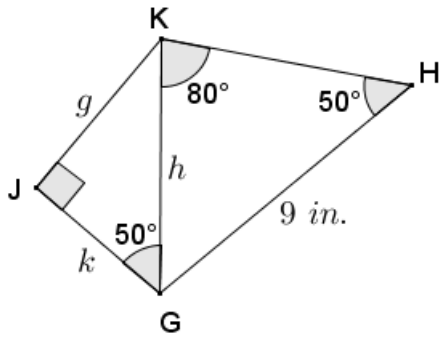
$$\frac{\sin\angle A}{a} = \frac{\sin 90}{c} \qquad \frac{\sin\angle B}{b} = \frac{\sin 90}{c}$$

$$\frac{\sin\angle A}{a} = \frac{\quad}{c} \qquad \frac{\sin\angle B}{b} = \frac{\quad}{c}$$

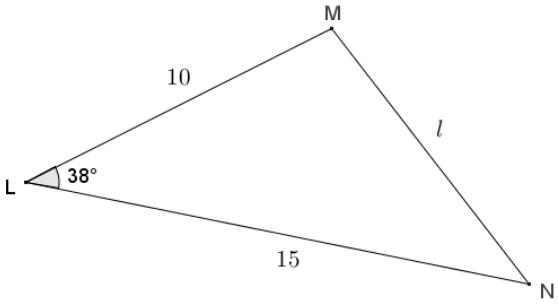
$$\sin\angle A = \frac{\quad}{c} \qquad \sin\angle B = \frac{\quad}{c}$$

   What conclusions can we draw?

4. Given quadrilateral $GHKJ$, $\angle H = 50°$, $\angle HKG = 80°$, $\angle KGJ = 50°$, $\angle J$ is a right angle and $GH = 9$ in., use the law of sines to find the length of GK, and then find the lengths of $\overline{GJ}$ and $\overline{JK}$ to the nearest tenth of an inch.



5. Given triangle LMN, $LM = 10$, $LN = 15$, and $\angle L = 38°$, use the law of cosines to find the length of $\overline{MN}$ to the nearest tenth.



6. Given triangle ABC, $AC = 6$, $AB = 8$, and $\angle A = 78°$. Draw a diagram of triangle ABC, and use the law of cosines to find the length of $\overline{BC}$.

   Calculate the area of triangle ABC.