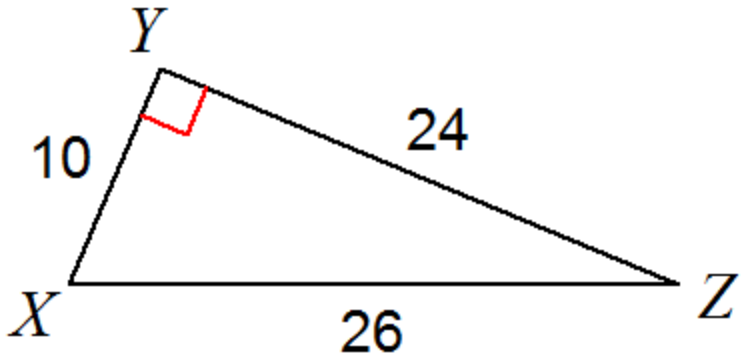
Warm-Up

Write each trig ratio as a fraction. Reduce your answer.

1. Sin X **2. Tan Z** **3. Cos X**



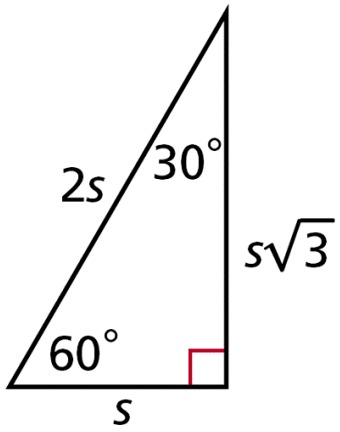
Objectives

Find the sine, cosine, and tangent of an acute angle.

Use trigonometric ratios to find side lengths in right triangles and to solve real-world problems.

Example 2: Finding Trigonometric Ratios in Special Right Triangles

Use a special right triangle to write cos 30° as a fraction.



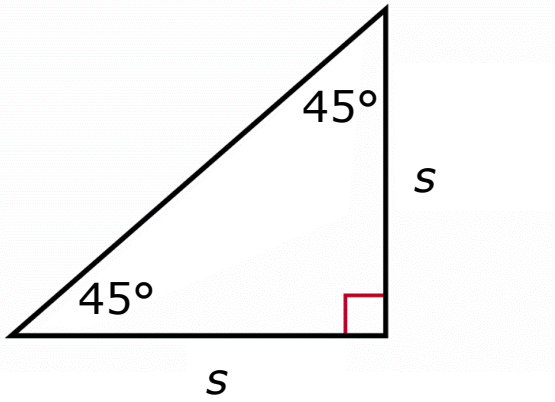
Draw and label a 30º-60º-90º Δ.

$$\cos 30° = \frac{s\sqrt{3}}{2s} = \frac{\sqrt{3}}{2}$$

The cosine of an ∠ is $\frac{\text{adj. leg}}{\text{hyp.}}$.

Check It Out! Example 2

Use a special right triangle to write tan 45° as a fraction.



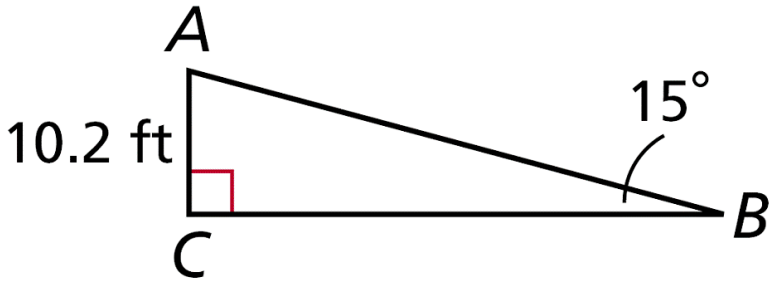
Draw and label a 45º-45º-90º Δ.

$$\tan 45^\circ = \frac{s}{s} = 1$$

The tangent of an ∠ is $\frac{\text{opp. leg}}{\text{adj. leg}}$.

Example 4A: Using Trigonometric Ratios to Find Lengths

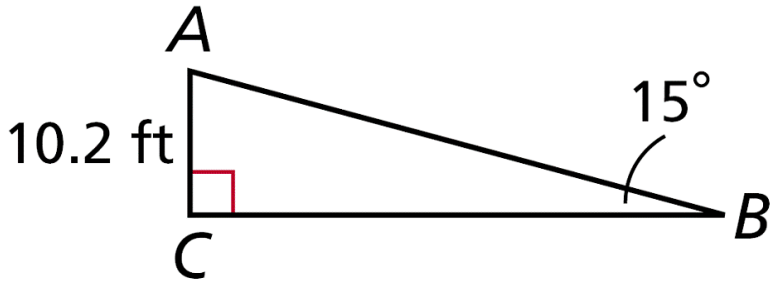
Find the length. Round to the nearest hundredth.



BC

$\overline{BC}$ is adjacent to the given angle, $\angle B$. You are given AC, which is opposite $\angle B$. Since the adjacent and opposite legs are involved, use a tangent ratio.

Example 4A Continued



$$\tan B = \frac{\text{opp. leg}}{\text{adj. leg}} = \frac{AC}{BC}$$ *Write a trigonometric ratio.*

$$\tan 15° = \frac{10.2}{BC}$$ *Substitute the given values.*

$$BC = \frac{10.2}{\tan 15°}$$ *Multiply both sides by BC and divide by tan 15°.*

$BC \approx 38.07$ ft *Simplify the expression.*

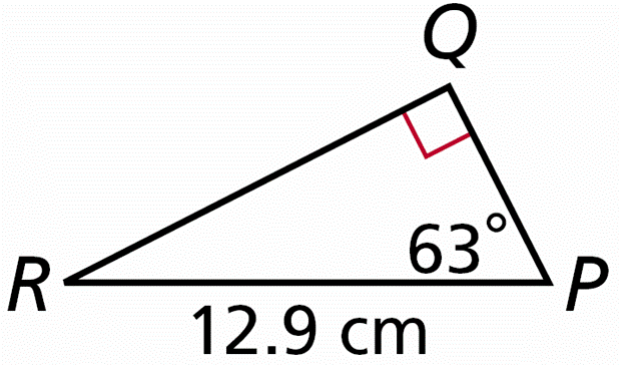
Caution!

Do not round until the final step of your answer. Use the values of the trigonometric ratios provided by your calculator.

Example 4B: Using Trigonometric Ratios to Find Lengths

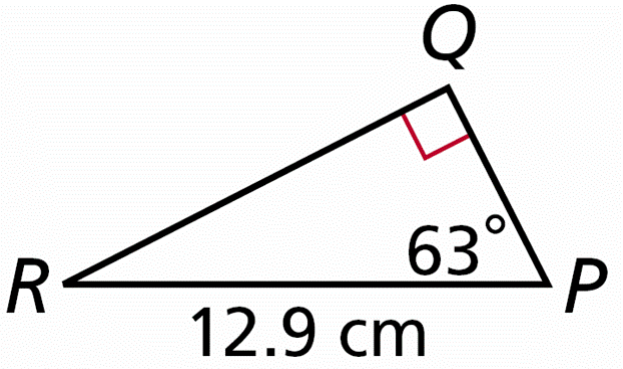
Find the length. Round to the nearest hundredth.

QR



$\overline{QR}$ is opposite to the given angle, $\angle P$. You are given PR, which is the hypotenuse. Since the opposite side and hypotenuse are involved, use a sine ratio.

Example 4B Continued



$\sin P = \frac{\text{opp. leg}}{\text{hyp.}} = \frac{QR}{PR}$ *Write a trigonometric ratio.*

$\sin 63° = \frac{QR}{12.9}$ *Substitute the given values.*

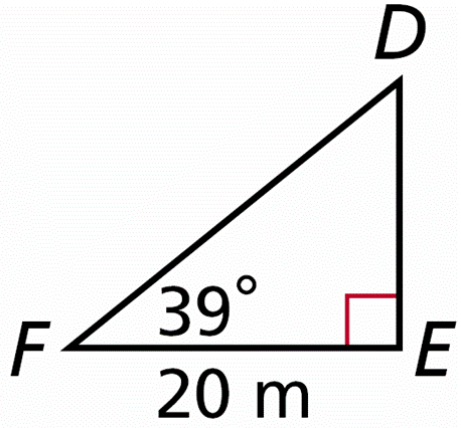
$12.9(\sin 63°) = QR$ *Multiply both sides by 12.9.*

$11.49 \text{ cm} \approx QR$ *Simplify the expression.*

Example 4C: Using Trigonometric Ratios to Find Lengths

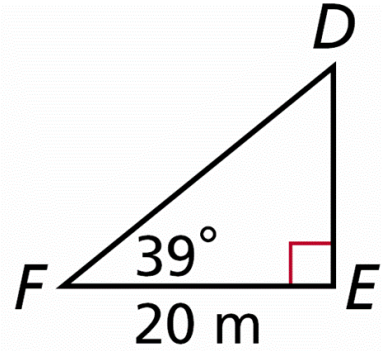
Find the length. Round to the nearest hundredth.

FD



$\overline{FD}$ is the hypotenuse. You are given EF, which is adjacent to the given angle, $\angle F$. Since the adjacent side and hypotenuse are involved, use a cosine ratio.

Example 4C Continued



$$\cos F = \frac{\text{adj. leg}}{\text{hyp}} = \frac{EF}{FD}$$

Write a trigonometric ratio.

$$\cos 39° = \frac{20}{FD}$$

Substitute the given values.

$$FD = \frac{20}{\cos 39°}$$

Multiply both sides by FD and divide by cos 39°.

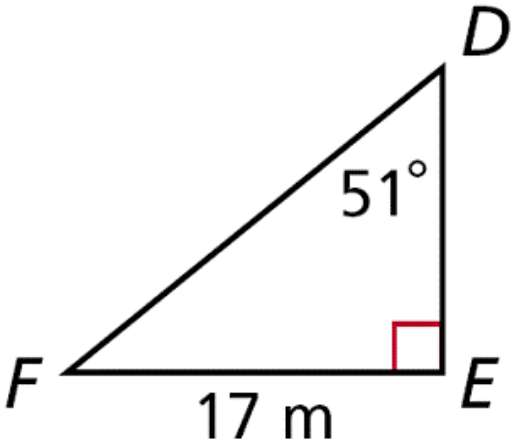
$FD \approx 25.74$ m

Simplify the expression.

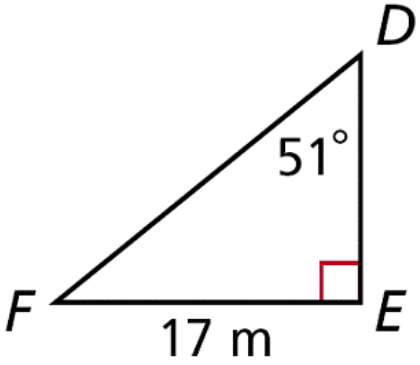
Check It Out! Example 4a

Find the length. Round to the nearest hundredth.

DF



Check It Out! Example 4a Continued



$$\sin D = \frac{\text{opp. leg}}{\text{hyp}} = \frac{EF}{DF}$$ *Write a trigonometric ratio.*

$$\sin 51° = \frac{17}{DF}$$ *Substitute the given values.*

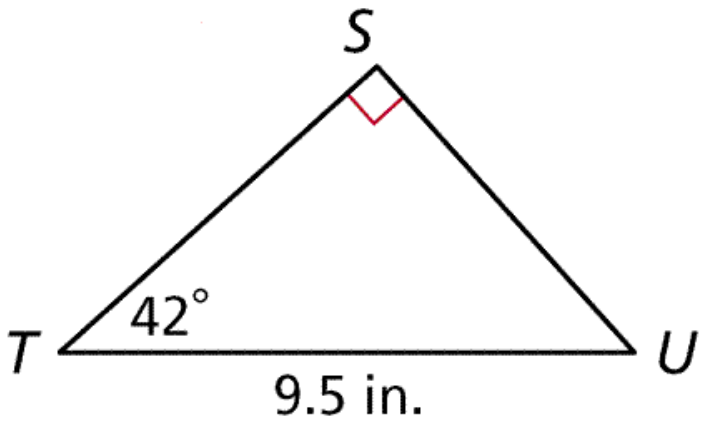
$$DF = \frac{17}{\sin 51°}$$ *Multiply both sides by DF and divide by sin 51°.*

$DF \approx 21.87$ cm *Simplify the expression.*

Check It Out! Example 4b

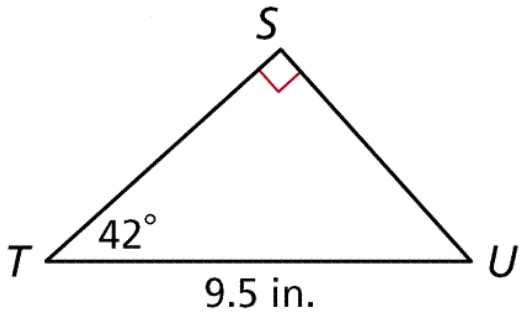
Find the length. Round to the nearest hundredth.

ST



$\overline{ST}$ is a leg. You are given *TU*, which is the hypotenuse. Since the adjacent side and hypotenuse are involved, use a cosine ratio.

Check It Out! Example 4b Continued



$$\cos T = \frac{\text{adj. leg}}{\text{hyp}} = \frac{ST}{TU}$$ *Write a trigonometric ratio.*

$$\cos 42° = \frac{ST}{9.5}$$ *Substitute the given values.*

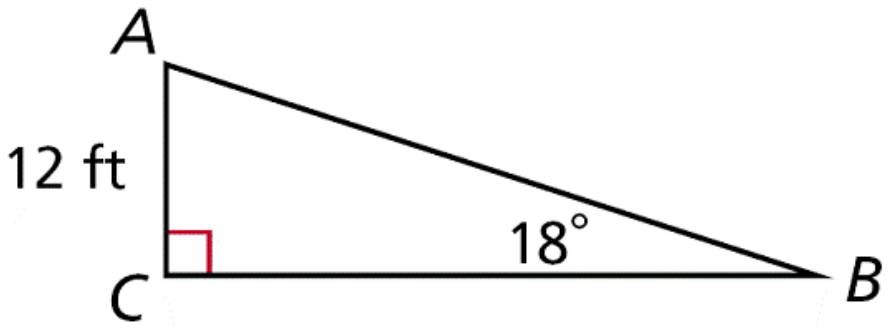
$ST = 9.5(\cos 42°)$ *Multiply both sides by 9.5.*

$ST \approx 7.06$ in. *Simplify the expression.*

Check It Out! Example 4c

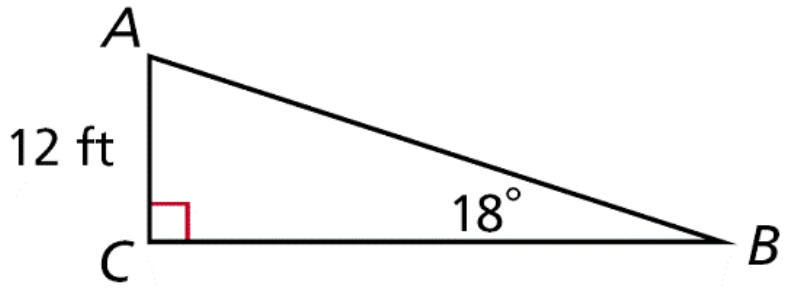
Find the length. Round to the nearest hundredth.

BC



$\overline{BC}$ is a leg. You are given AC, which is the opposite side to given angle, $\angle B$. Since the opposite side and adjacent side are involved, use a tangent ratio.

Check It Out! Example 4c Continued



$$\tan B = \frac{\text{opp. leg}}{\text{adj. leg}} = \frac{AC}{BC}$$ *Write a trigonometric ratio.*

$$\tan 18° = \frac{12}{BC}$$ *Substitute the given values.*

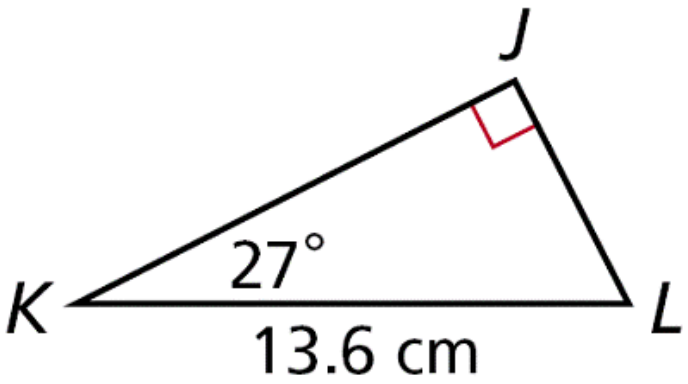
$$BC = \frac{12}{\tan 18°}$$ *Multiply both sides by BC and divide by tan 18°.*

$BC \approx 36.93$ ft *Simplify the expression.*

Check It Out! Example 4d

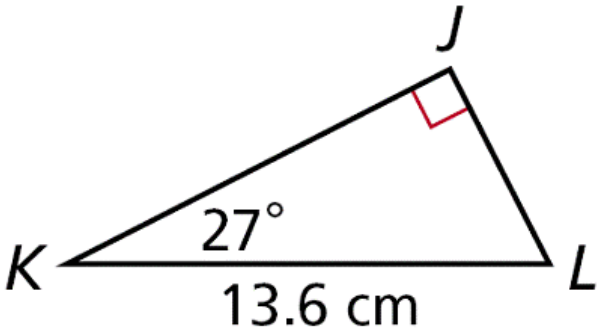
Find the length. Round to the nearest hundredth.

JL



$\overline{JL}$ is the opposite side to the given angle, $\angle K$. You are given KL, which is the hypotenuse. Since the opposite side and hypotenuse are involved, use a sine ratio.

Check It Out! Example 4d Continued



$$\sin K = \frac{\text{opp. leg}}{\text{hyp}} = \frac{JL}{KL}$$ *Write a trigonometric ratio.*

$$\sin 27° = \frac{JL}{13.6}$$ *Substitute the given values.*

$JL = 13.6(\sin 27°)$ *Multiply both sides by 13.6.*

$JL \approx 6.17$ cm *Simplify the expression.*

Lesson Quiz: Part I

Use a special right triangle to write each trigonometric ratio as a fraction.

1. sin 60° $\frac{\sqrt{3}}{2}$

2. cos 45° $\frac{\sqrt{2}}{2}$

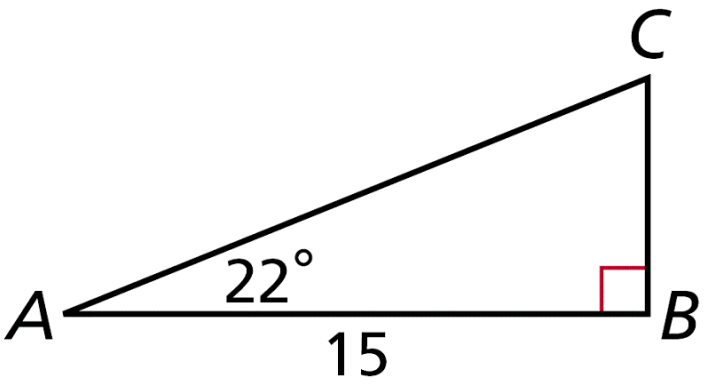
Use your calculator to find each trigonometric ratio. Round to the nearest hundredth.

3. tan 84° 9.51

4. cos 13° 0.97

Lesson Quiz: Part II

Find each length. Round to the nearest tenth.



5. *CB* 6.1

6. *AC* 16.2

Use your answers from Items 5 and 6 to write each trigonometric ratio as a fraction and as a decimal rounded to the nearest hundredth.

7. $\sin A \quad \frac{6.1}{16.2} \approx 0.38$ **8.** $\cos A \quad \frac{15}{16.2} \approx 0.93$ **9.** $\tan A \quad \frac{6.1}{15} \approx 0.41$

HOMEWORK

WS 8.2B – Trig – Missing Sides