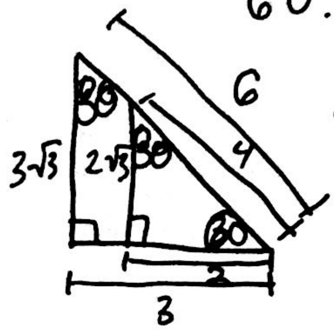
Name: Key Hour: ________ Seat: ________

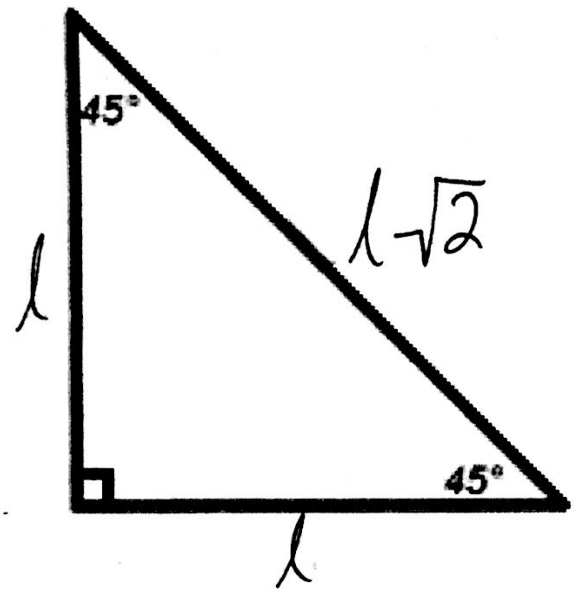
Section 8.4: Trigonometry

$60: \frac{opp}{hyp}$

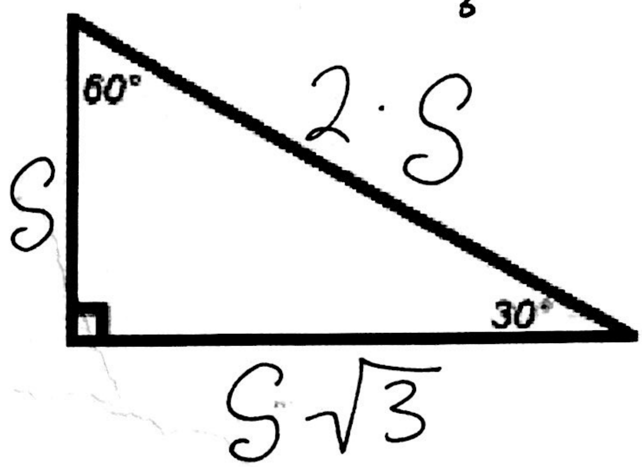
$30: \frac{opp}{hyp}$



Warm Up and Notecard addition: Fill in the side lengths of the triangles



45° - 45° - 90° Triangle



30° - 60° - 90° Triangle

Objectives

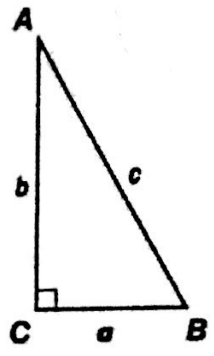
1. Find trigonometric ratios using right triangles
2. Use trigonometric ratios to find angle measures in right triangles

KeyConcept

SOH CAH TOA

KeyConcept Trigonometric Ratios

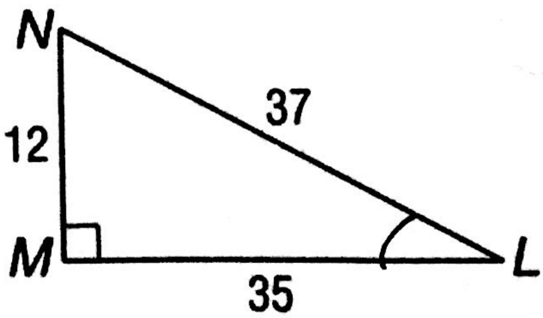
Words	Symbols
If $\triangle ABC$ is a right triangle with acute $\angle A$, then the sine of $\angle A$ (written sin A) is the ratio of the length of the leg opposite $\angle A$ (opp) to the length of the hypotenuse (hyp).	$\sin A = \frac{\text{opp}}{\text{hyp}}$ or $\frac{a}{c}$ $\sin B = \frac{\text{opp}}{\text{hyp}}$ or $\frac{b}{c}$
If $\triangle ABC$ is a right triangle with acute $\angle A$, then the cosine of $\angle A$ (written cos A) is the ratio of the length of the leg adjacent $\angle A$ (adj) to the length of the hypotenuse (hyp).	$\cos A = \frac{\text{adj}}{\text{hyp}}$ or $\frac{b}{c}$ $\cos B = \frac{\text{adj}}{\text{hyp}}$ or $\frac{a}{c}$
If $\triangle ABC$ is a right triangle with acute $\angle A$, then the tangent of $\angle A$ (written tan A) is the ratio of the length of the leg opposite $\angle A$ (opp) to the length of the leg adjacent $\angle A$ (adj).	$\tan A = \frac{\text{opp}}{\text{adj}}$ or $\frac{a}{b}$ $\tan B = \frac{\text{opp}}{\text{adj}}$ or $\frac{b}{a}$



EXAMPLE 1 Find Sine, Cosine, and Tangent Ratios

A. Express sin *L* as a fraction and as a decimal to the nearest hundredth.

$$\sin(L^\circ) = \frac{opp}{hyp} = \frac{12}{37} = 0.32$$



B. Express cos *L* as a fraction and as a decimal to the nearest hundredth.

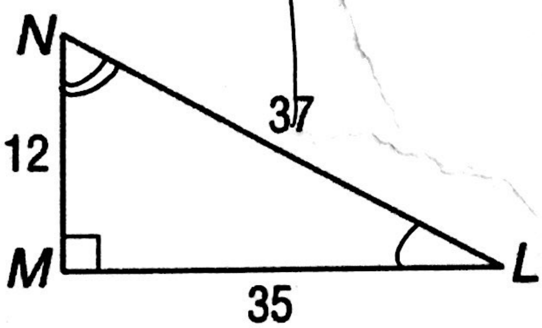
$$\cos(L^\circ) = \frac{adj}{hyp} = \frac{35}{37} = 0.95$$

C. Express tan *L* as a fraction and as a decimal to the nearest hundredth.

$\tan(L°) = \frac{opp}{adj} = \frac{12}{35} = 0.34$

D. Express sin *N* as a fraction and as a decimal to the nearest hundredth.

$\sin(N°) = \frac{35}{37} = 0.95$



E. Express cos *N* as a fraction and as a decimal to the nearest hundredth.

$\cos(N°) = \frac{adj}{hyp} = \frac{12}{37} = 0.32$

F. Express tan *N* as a fraction and as a decimal to the nearest hundredth.

$\tan(N°) = \frac{opp}{adj}$

$= \frac{35}{12} = 2.92$

EXAMPLE 1 **Check Your Progress**

A. Find sin *A*.

$\frac{O}{H} = \frac{3}{5}$

B. Find cos *A*.

$\frac{A}{H} = \frac{4}{5}$

C. Find tan *A*.

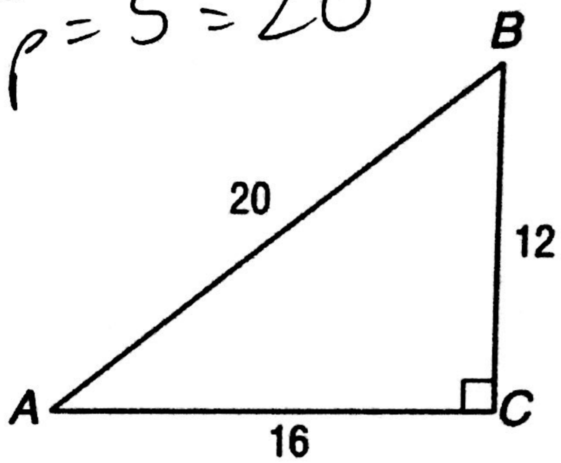
$\frac{O}{A} = \frac{3}{4}$

$\angle A^\circ$

opp = 3 = 12

adj = 4 = 16

hyp = 5 = 20



D. Find sin *B*.

$\frac{O}{H} = \frac{4}{5}$

E. Find cos *B*.

$\frac{A}{H} = \frac{3}{5}$

F. Find tan *B*.

$\frac{O}{A} = \frac{4}{3}$

$\angle B^\circ$

opp = 4 = 16

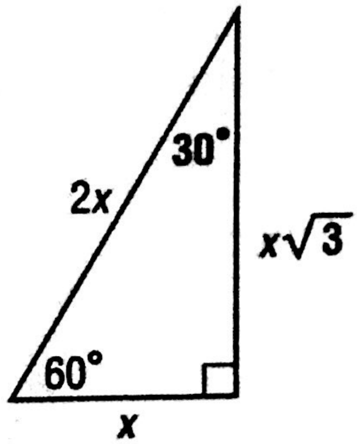
adj = 3 = 12

hyp = 5 = 20

EXAMPLE 2 Use Special Right Triangles to Find Trigonometric Ratios

Use a special right triangle to express the cosine of 60° as a fraction and as a decimal to the nearest hundredth.

$$\cos(60^\circ) = \frac{\cancel{x}}{2\cancel{x}} = \frac{1}{2} = 0.5$$



EXAMPLE 2 Check Your Progress

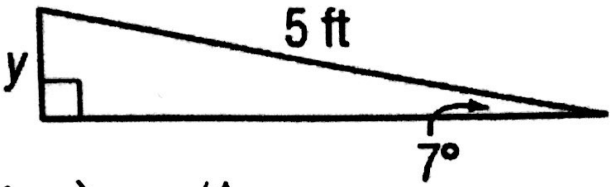
CheckPoint

Use a special right triangle to express the tangent of 60° as a fraction and as a decimal to the nearest hundredth.

$$\tan(60^\circ) = \frac{\cancel{x}\sqrt{3}}{\cancel{x}} = \frac{\sqrt{3}}{1} = 1.73$$

Real-World Example 3 Estimate Measures Using Trigonometry

EXERCISING A fitness trainer sets the incline on a treadmill to 7°. The walking surface is 5 feet long. Approximately how many inches did the trainer raise the end of the treadmill from the floor?



$\sin(7°) = \frac{y}{5}$

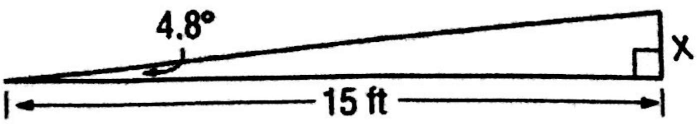
$5 \cdot \sin(7°) = y$

$y = 7.3\ in$

Real-World Example 3 Check Your Progress

CheckPoint

CONSTRUCTION The bottom of a handicap ramp is 15 feet from the entrance of a building. If the angle of the ramp is about 4.8°, about how high does the ramp rise off the ground to the nearest inch?



$\tan(4.8°) = \frac{x}{15}$

$15 \cdot \tan(4.8°) = x$

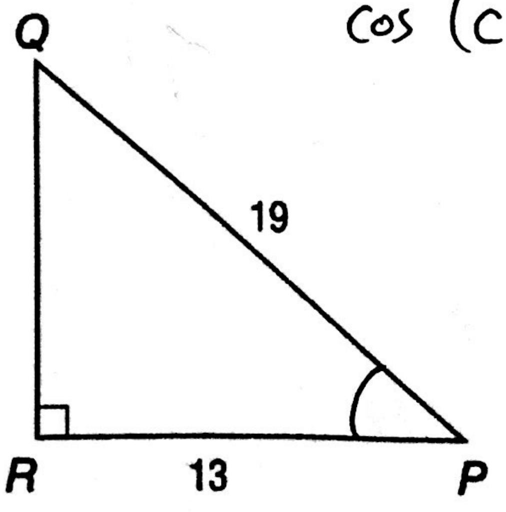
$x = 15\ in$

KeyConcept Inverse Trigonometric Ratios

Words	If $\angle A$ is an acute angle and the sine of A is x, then the inverse sine of x is the measure of $\angle A$.	
Symbols	If $\sin A = x$, then $\sin^{-1} x = m\angle A$.	$\sin^{-1}\left(\frac{opp}{hyp}\right) = A^\circ$
Words	If $\angle A$ is an acute angle and the cosine of A is x, then the inverse cosine of x is the measure of $\angle A$.	
Symbols	If $\cos A = x$, then $\cos^{-1} x = m\angle A$.	$\cos^{-1}\left(\frac{adj}{hyp}\right) = A^\circ$
Words	If $\angle A$ is an acute angle and the tangent of A is x, then the inverse tangent of x is the measure of $\angle A$.	
Symbols	If $\tan A = x$, then $\tan^{-1} x = m\angle A$.	$\tan^{-1}\left(\frac{opp}{adj}\right) = A^\circ$

EXAMPLE 4 Find Angle Measures Using Inverse Trigonometric Ratios

Use a calculator to find the measure of $\angle P$ to the nearest tenth.



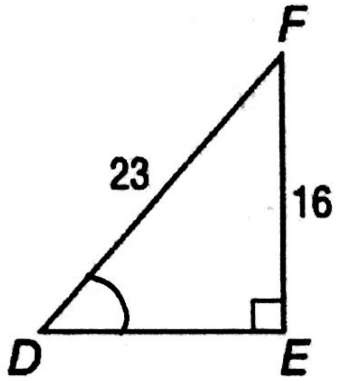
$\cos^{-1}(\cos(P^\circ)) = \left(\frac{13}{19}\right)\cos^{-1}$

$P^\circ = \cos^{-1}\left(\frac{13}{19}\right)$

$\angle P^\circ \approx 46.8^\circ$

EXAMPLE 4 **Check Your Progress** CheckPoint

Use a calculator to find the measure of $\angle D$ to the nearest tenth.



$\sin(D^\circ) = \frac{16}{23}$

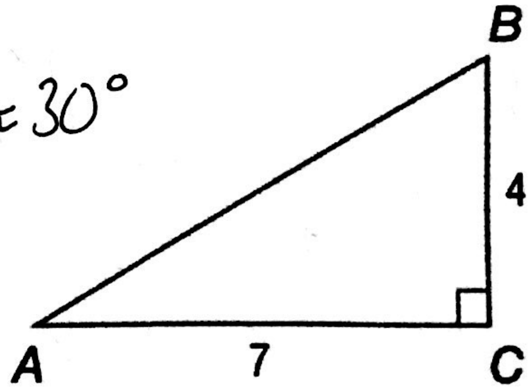
$D^\circ = \sin^{-1}\left(\frac{16}{23}\right)$

$\approx 44.1^\circ$

Answer: 44.1 = A

EXAMPLE 5 Solve a Right Triangle

Solve the right triangle. Round side measures to the nearest hundredth and angle measures to the nearest degree.



$\measuredangle A$: $\tan A = \frac{4}{7} \approx$ $A \approx 30^\circ$

$\measuredangle B$: $B = 60^\circ$

hyp: $7^2 + 4^2 = (AB)^2$

$AB = \sqrt{65}$

$AB \approx 8.06$