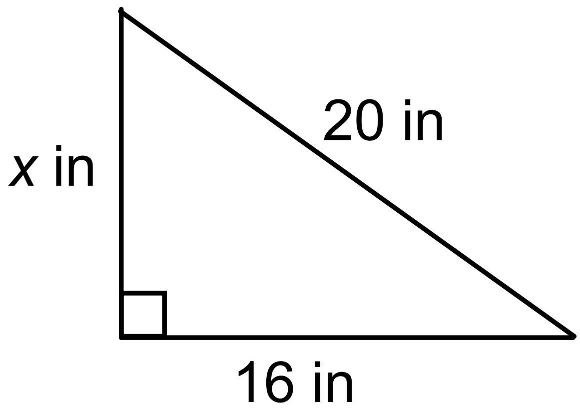
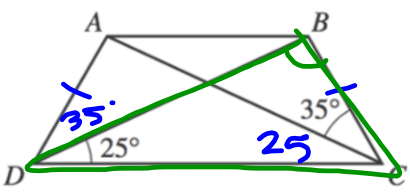
Bellwork: Find the missing side of the triangle using the Pythagorean Theorem



In isosceles trapezoid $ABCD$, $\overline{AB}$ is parallel to $\overline{DC}$, $\angle BDC$ measures 25°, and $\angle BCA$ measures 35°. What is the measure of $\angle DBC$?

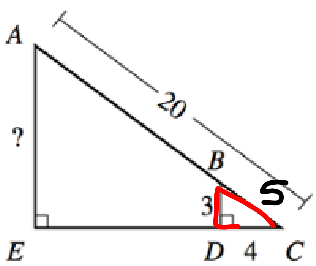
A. 85°
B. 95°
C. 105°
D. 115°
E. 125°



$180 - 85 = 95°$

In right triangle $\triangle ACE$ below, $\overline{BD}$ is parallel to $\overline{AE}$, and $\overline{BD}$ is perpendicular to $\overline{EC}$ at D. The length of $\overline{AC}$ is 20 feet, the length of $\overline{BD}$ is 3 feet, and the length of $\overline{CD}$ is 4 feet. What is the length, in feet, of $\overline{AE}$?

A. 10
B. 12
C. 15
D. 16
E. 17



$a^2 + b^2 = c^2$

$3^2 + 4^2 = c^2$

$\sqrt{25} = \sqrt{c^2}$

$5 = c$

$\frac{20}{5} = 4 = \frac{x}{3}$

Lesson 7.1 Objectives

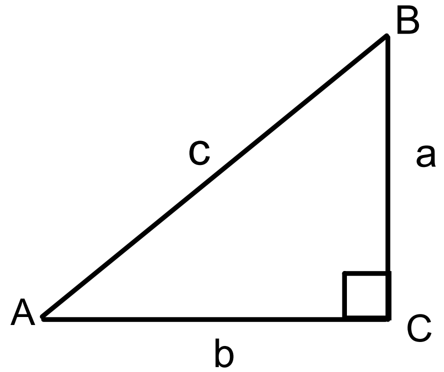
I can use trigonometric ratios to solve problems

I can derive the area of a triangle

Pythagorean Theorem

In a right triangle with legs a and b and hypotenuse c, the following is always true:

$a^2+b^2=c^2$



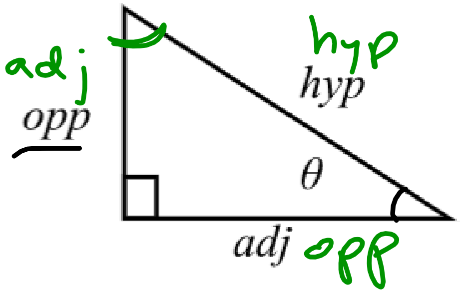
Trigonometric ratios

★ Helpful for finding sides

sine $\sin\theta = \frac{opp}{hyp}$ theta

cosine $\cos\theta = \frac{adj}{hyp}$

tangent $\tan\theta = \frac{opp}{adj}$



SOH CAH TOA

Inverse Trig Ratios

★ used for finding angles

$\sin^{-1}\left(\frac{opp}{hyp}\right) = \theta$

$\cos^{-1}\left(\frac{adj}{hyp}\right) = \theta$

$\tan^{-1}\left(\frac{opp}{adj}\right) = \theta$

$\sin^{-1}[\sin(\theta)] = \theta$

$\cos^{-1}[\cos(\theta)] = \theta$

$\tan^{-1}[\tan(\theta)] = \theta$

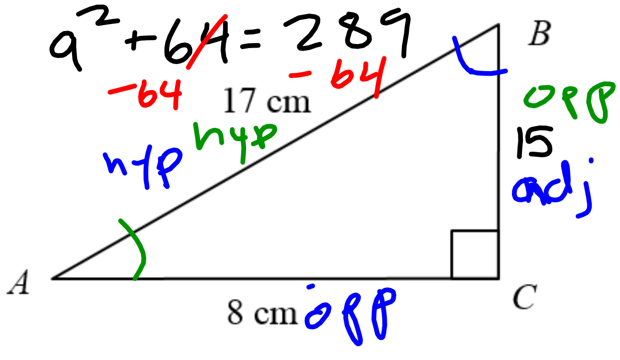
$a^2+b^2=c^2$ SOH CAH TOA

Use the figure to write the values of the six trig ratios at the right.

$a^2+8^2=17^2$ $\sqrt{a^2}=\sqrt{225}$

$a^2+64=289$

-64 -64



sin A = $15/17$ sin B = $8/17$

cos A = $8/17$ cos B = $15/17$

tan A = $15/8$ tan B = $8/15$

reciprical

Find the measure of the following:

$\tan A = \frac{1}{2}$

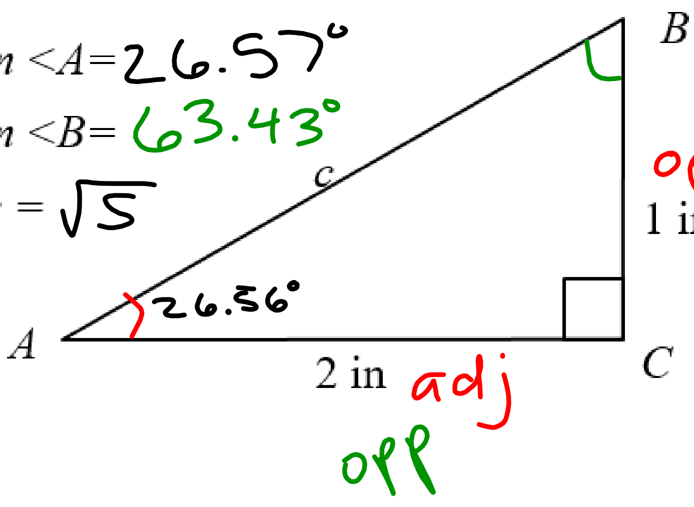
$A = \tan^{-1}\left(\frac{1}{2}\right)$

$m\angle A = 26.57°$

$m\angle B = 63.43°$

$c = \sqrt{5}$

$\tan^{-1}\left(\frac{2}{1}\right)$



$a^2+b^2=c^2$

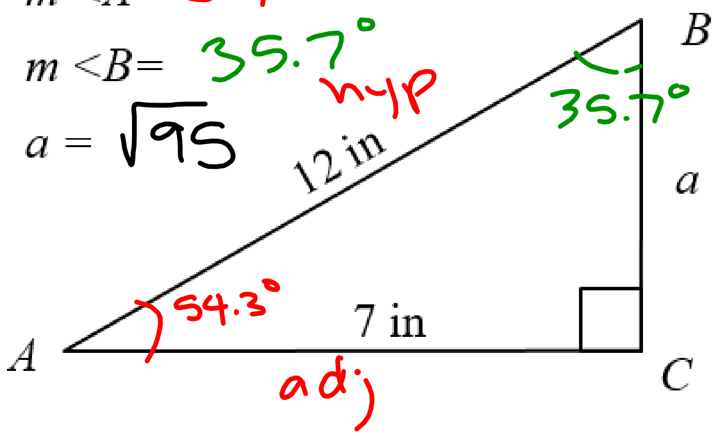
$1^2+2^2=c^2$

$\sqrt{5}=\sqrt{c^2}$

$m\angle A = 54.3^\circ$

$m\angle B = 35.7^\circ$

$a = \sqrt{95}$



$\cancel{\cos^{-1}}\ \cancel{\cos} A \overset{\cos^{-1}}{=} \frac{7}{12}$

$A = \cos^{-1}\left(\frac{7}{12}\right)$

$a^2 + b^2 = c^2$

$7^2 + b^2 = 12^2$

$-7^2 \qquad -7^2$

$\sqrt{b^2} = \sqrt{95}$

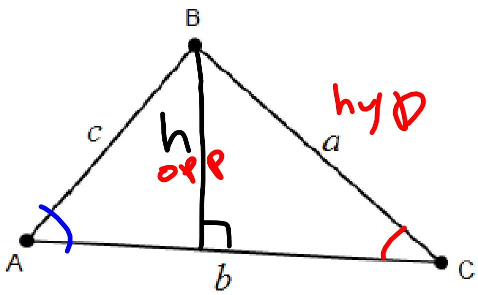
5 19

Deriving the area of a triangle

$A = \frac{1}{2}bh$

$a\sin(C) = \frac{h}{\cancel{a}} \cdot \cancel{a}$

$h = a\sin(C)$

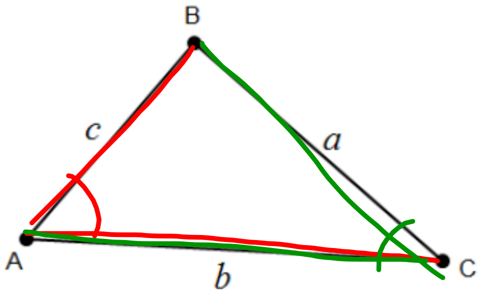


$A = \frac{1}{2}a \cdot b \cdot \sin(C)$

$A = \frac{1}{2}bc\sin A$

Area of a Triangle Given Two Sides and the Included Angle

The area of a triangle is half the product of the lengths of two sides and the sine of the included angle.



$$\text{Area} = \frac{1}{2}bc(\sin A)$$

$$\text{Area} = \frac{1}{2}ac(\sin B)$$

$$\text{Area} = \frac{1}{2}ab(\sin C)$$

Find the area of a triangle with sides b=13, c=7, in and m $\angle$A= 43°. Round your answer to the nearest thousandth.

$$A = \frac{1}{2}bc\sin A$$

$$\frac{1}{2}(13)(7)\sin(43)$$

$$\boxed{= 31.03 \text{ in}^2}$$

Find the area of a triangle with sides a=5, b=5,cm and m∠C= 60°. Round your answer to the nearest thousandth.

$$\text{Area} = \frac{1}{2}(5)(5)\sin(60)$$

$$\boxed{10.8 \text{ cm}^2}$$

$\sqrt{384}$

4 96

4 24

4 6

2 3 2 3

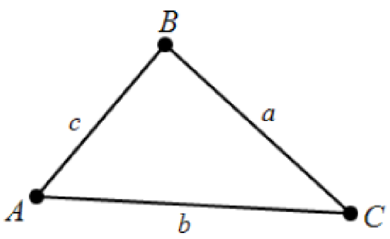
$8\sqrt{6}$

$\frac{10}{8\sqrt{6}}$

$\boxed{\frac{5}{4\sqrt{6}}}$

The Law of Sines

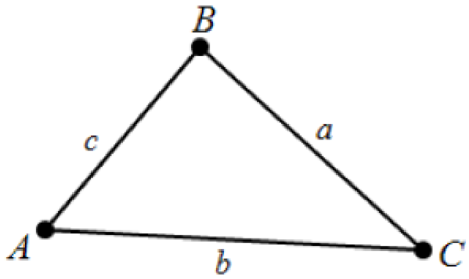
For any $\triangle ABC$, the Law of Sines relates the sine of each angle to the length of the side opposite the angle.



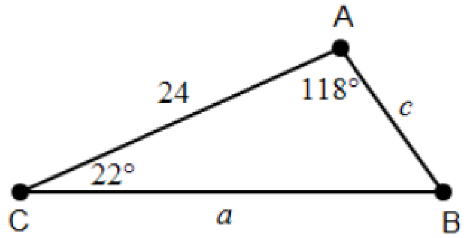
$$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$$

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

Deriving the Law of Sines from the area of a triangle

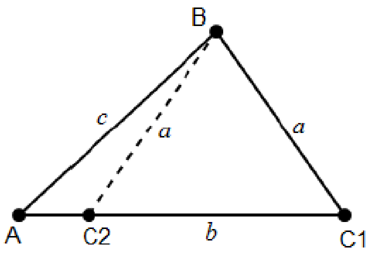


Use the Law of Sines to solve the triangle. Round your answers to three decimal places.



The Ambiguous Case (SSA)

If you are given two angles and one side (ASA or AAS), the Law of Sines will easily provide ONE solution for a missing side. However, the Law of Sines has a problem dealing with SSA. If you are given two sides and one angle, where you must find an angle, the Law of Sines could possibly provide you with one or more solutions or even no solution at all.



If you find an angle, you must use the following test to see if there is more than one solution:

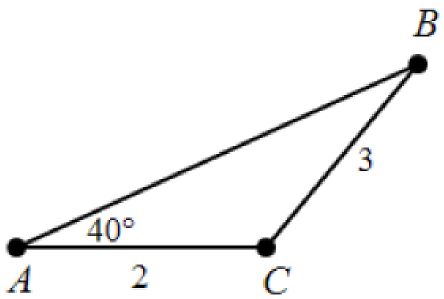
TEST

180°
- (the found angle)

Answer
+ (given angle)

If sum > 180° there is only one triangle
If sum < 180° there are two triangles

Use the Law of Sines to solve the triangle.



Use the Law of Sines to solve the triangle.
Triangle ABC with sides $a = 6$, $b = 8$, and $m\angle A = 35°$