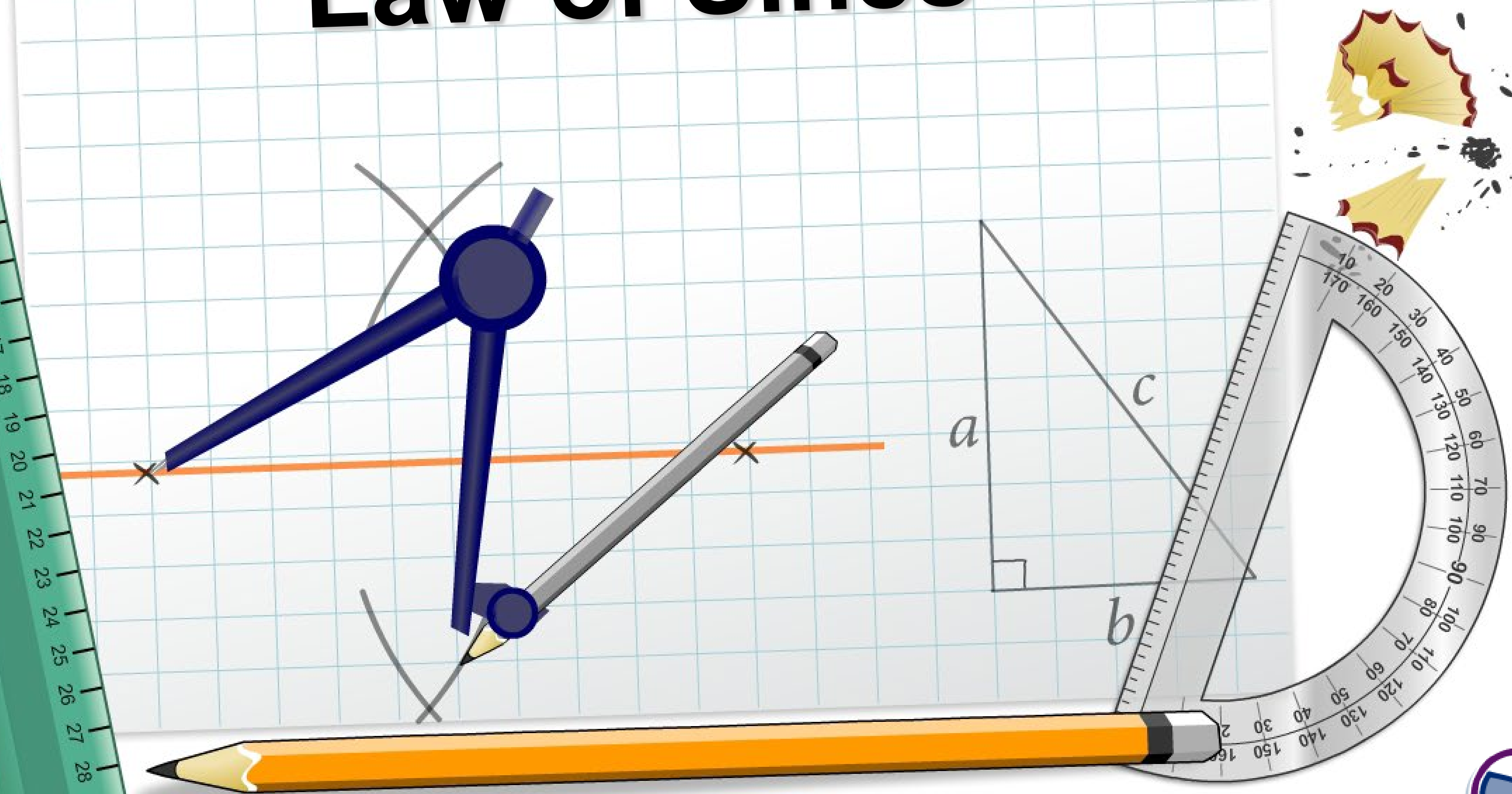
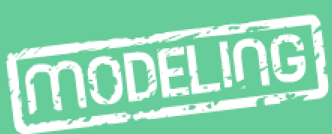
Law of Sines



boardworks

Common core icons

This icon indicates a slide where the Standards for Mathematical Practice are being developed. Details of these are given in the Notes field.



Slides containing examples of mathematical modeling are marked with this stamp.

This icon indicates an opportunity for discussion or group work.

The **Standards for Mathematical Practice** outlined in the Common Core State Standards for Mathematics describe varieties of expertise that mathematics educators at all levels should seek to develop in their students.

These are:

1) Make sense of problems and persevere in solving them.

2) Reason abstractly and quantitatively.

3) Construct viable arguments and critique the reasoning of others.

4) Model with mathematics.

5) Use appropriate tools strategically.

6) Attend to precision.

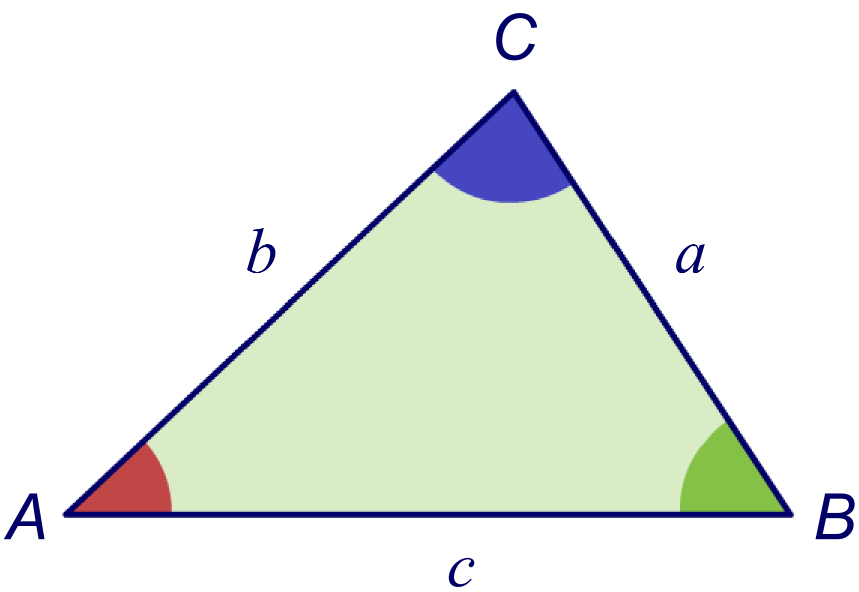
7) Look for and make use of structure.

8) Look for and express regularity in repeated reasoning.

This icon indicates that the slide contains activities created in Flash. These activities are not editable.

This icon indicates teacher's notes in the Notes field.

Here is a non-right angled triangle, $\triangle ABC$.



a is the length of the side opposite angle A.

b is the length of the side opposite angle B.

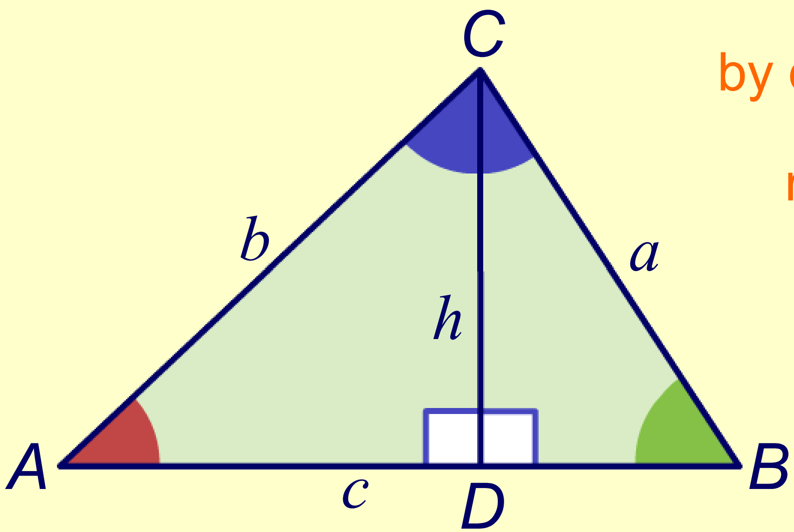
c is the length of the side opposite angle C.

The law of sines:

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

Proving the law of sines

Prove the law of sines by drawing a perpendicular line segment from any side to the opposite vertex.



by definition: $\sin A = \frac{h}{b}$ $\quad \sin B = \frac{h}{a}$

rearrange for h: $h = b \sin A$ $\quad h = a \sin B$

equating: $b \sin A = a \sin B$

divide both sides of the equation by $\sin A \cdot \sin B$: $\frac{b}{\sin B} = \frac{a}{\sin A}$

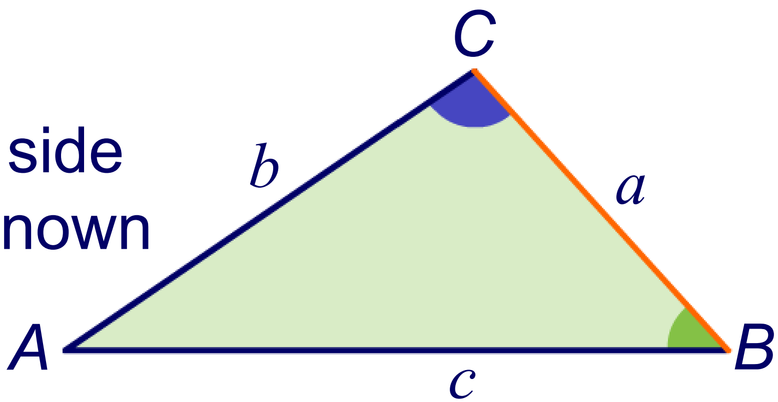
if we had chosen the perpendicular line segment from A to a, we would have found that: $\frac{b}{\sin B} = \frac{c}{\sin C}$

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

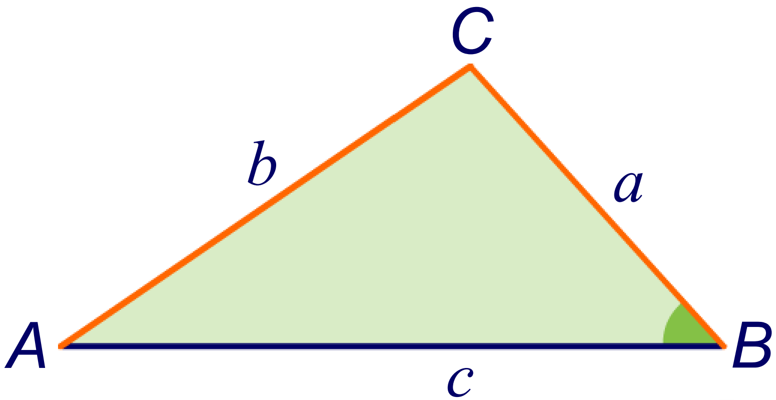
When should we use the law of sines?

The law of sines can be used if:

- two angles and the length of a side opposite one of the angles is known



- or if the length of two sides and the angle opposite one of these sides is known.



If we do not have this information, we must use a different method or a different law.

Finding lengths

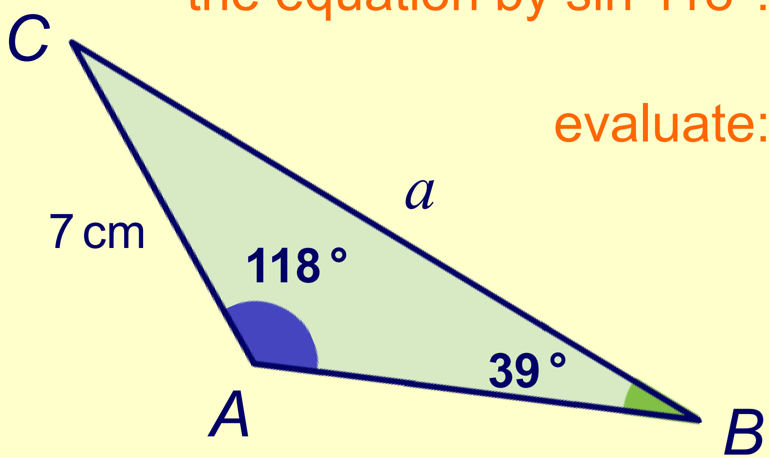
Use the law of sines to find the length of side *a*.

write the law of sines: $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

substitute for the given values: $\dfrac{a}{\sin 118°} = \dfrac{7}{\sin 39°}$

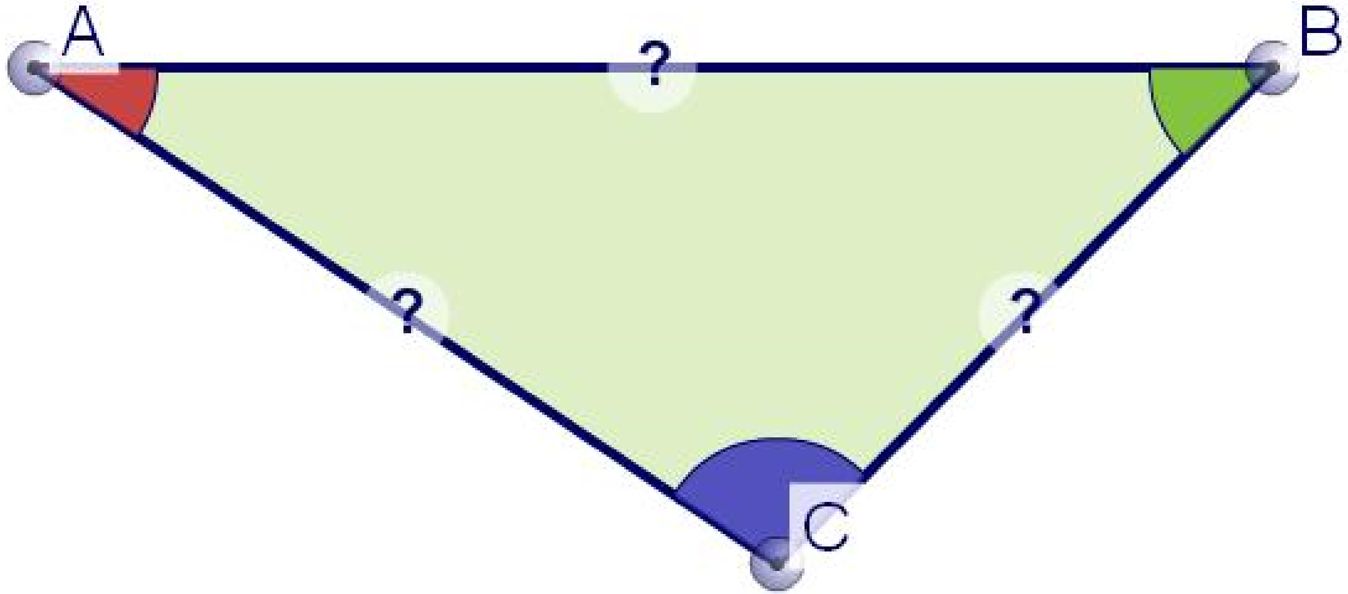
multiply each side of the equation by sin 118°: $a = \dfrac{7 \sin 118°}{\sin 39°}$

evaluate: a = **9.82 in** (to the nearest hundredth)



Lengths practice

Press the question marks and angle markers to reveal the values of the side lengths and angles. Choose an angle or side and calculate it using the law of sines. Drag the points to change the triangle.



Use the law of sines to find $m\angle B$.

write the law of sines:

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

substitute for the given values:

$$\frac{\sin B}{8} = \frac{\sin 46°}{6}$$

multiply each side of the equation by 8:

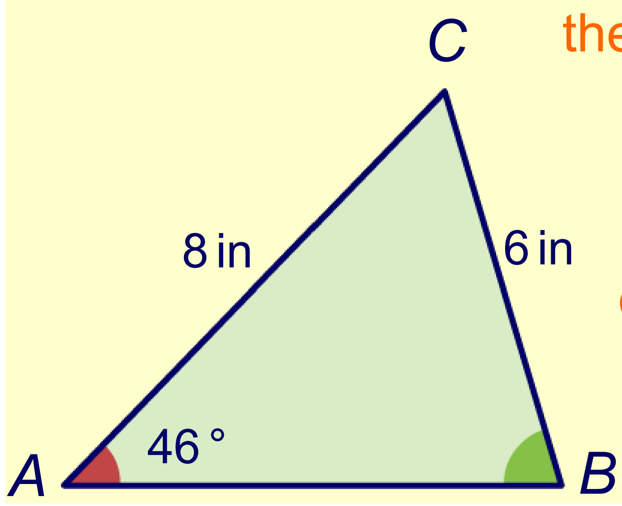
$$\sin B = \frac{8 \sin 46°}{6}$$

find the inverse for each side of the equation:

$$m\angle B = \sin^{-1} \frac{8 \sin 46°}{6}$$

evaluate:

$m\angle B$ = **73.56°** (to the nearest hundredth)



The ambiguous case

The ambiguous case of the law of sines applies to triangles where the length of two sides, a and b, and a non-included angle have been given.

Press the **start** button to work through the explanation one step at a time. Use the forward and backward arrows to move through the activity.

start