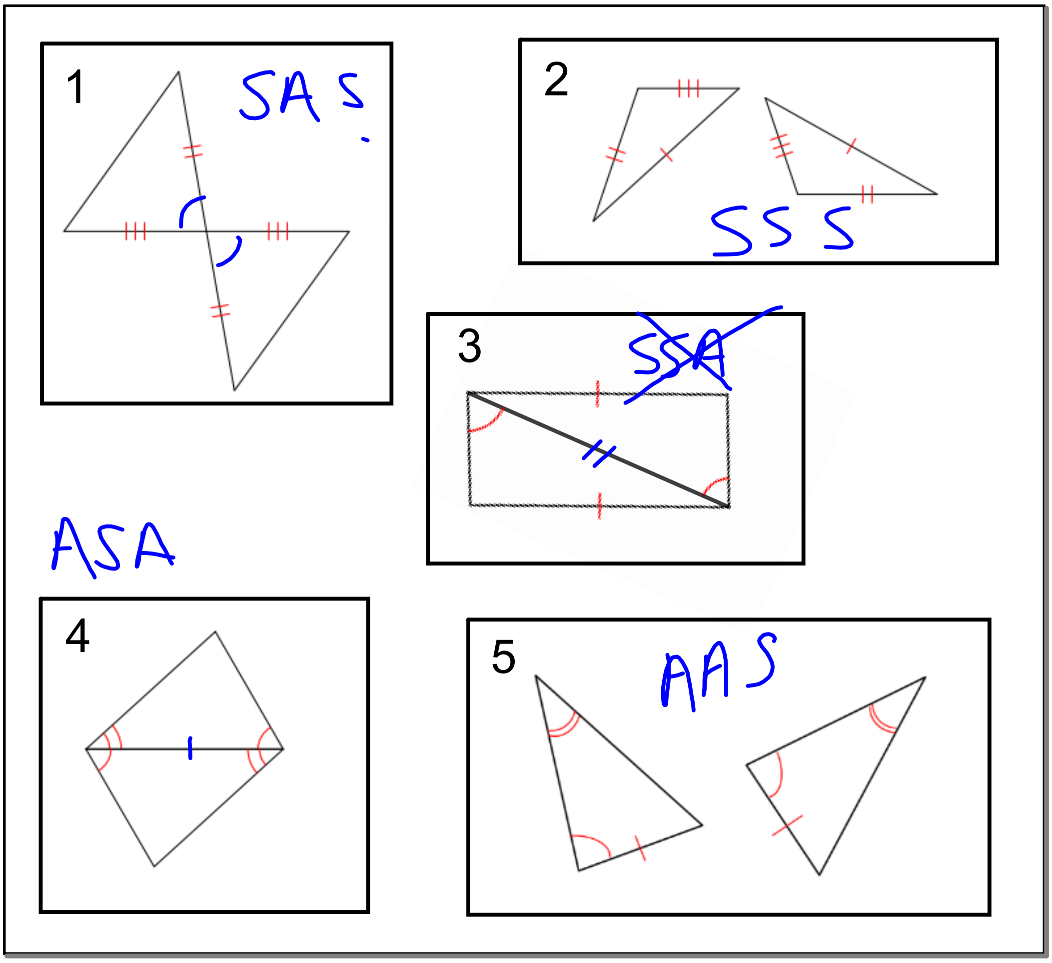
Warm Up

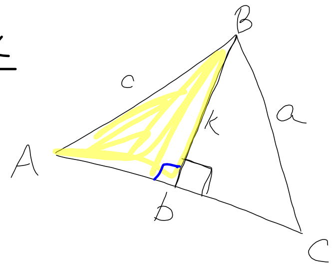
FLASH BACK to Geometry......

Determine if the two triangles are congruent. If they are, state the reason.



(3) $\sin A = \frac{k}{c}$

$\sin C = \frac{k}{a}$



(4) $k = c \sin A$

$k = a \sin C$

(5) $a \sin C = c \sin A$

(6) $\frac{\sin C}{c} = \boxed{\frac{\sin A}{a}}$

(12) $\boxed{\frac{\sin A}{a}} = \frac{\sin B}{b}$

(13) $\frac{\sin B}{b} = \frac{\sin C}{c}$

6.1: Law of Sines

Recall: **"Solving" a triangle means finding the measures of all sides and angles.**

In Chapter 4, we solved right triangles using right triangle trigonometry (SOH-CAH-TOA). Today, we'll learn a method that can be used to solve an *oblique* triangle.

Oblique Triangles: triangles that have no right angles

Law of Sines: 1.) Two angles and any side (AAS or ASA)

2.) Two sides and an angle opposite one of them (SSA)

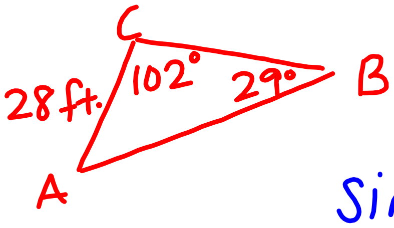
Law of Sines: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$ ***OR*** $\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$

Use the Law of Sines to solve the triangle.

1.) $C = 102^\circ$

$B = 29^\circ$

$b = 28\ feet$



$A = 49^\circ$

$a = 43.59\ ft$

$c = 56.49\ ft.$

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

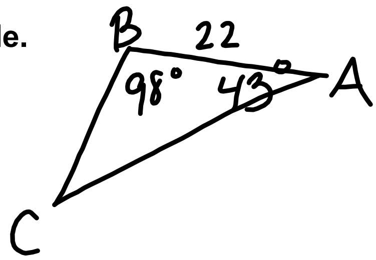
$$\frac{\sin 29^\circ}{28} = \frac{\sin 49^\circ}{a}$$

$$\frac{a \sin 29^\circ}{\sin 29^\circ} = \boxed{\frac{28 \sin 49^\circ}{\sin 29^\circ}} = a$$

$$\frac{\sin 29^\circ}{28} = \frac{\sin 102^\circ}{c}$$

$$c = \frac{28 \sin 102^\circ}{\sin 29^\circ}$$

Use the Law of Sines to solve the triangle.



2.) $A = 43^\circ$ $a = 23.84$

$c = 22$ $C = 39^\circ$

$B = 98^\circ$ $b = 34.62$

$$\frac{\sin 39^\circ}{22} = \frac{\sin 43^\circ}{a} \qquad a = \frac{22 \sin 43^\circ}{\sin 39^\circ}$$

$$\frac{\sin 39^\circ}{22} = \frac{\sin 98^\circ}{b} \qquad b = \frac{22 \sin 98^\circ}{\sin 39^\circ}$$

The Ambiguous Case - SSA

Three possible situations can occur:

1.) No such triangle exists

2.) One triangle exists

3.) Two triangles exist

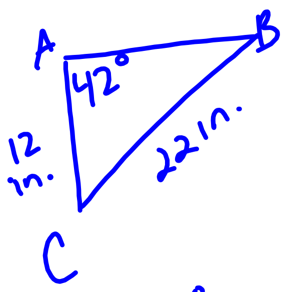
Use the Law of Sines to solve the triangle.

3.) $a = 22\ inches$
$b = 12\ inches$
$A = 42^\circ$

$c = 29.40$ in.
$B = 21.41^\circ$
$C = 116.59^\circ$

3.) $a = 22\ inches$
$b = 12\ inches$
$A = 42^\circ$

c =
B = 158.59°
C =



$$\frac{\sin 42^\circ}{22\text{ in}} = \frac{\sin B}{12}$$

$$\frac{12 \sin 42^\circ}{22} = \sin B$$

$\sin B = 0.36498$

$B = 21.41^\circ$ OR 158.59°

$$\frac{\sin 42^\circ}{22} = \frac{\sin 116.59^\circ}{c}$$

$$c = \frac{22 \sin 116.59^\circ}{\sin 42^\circ}$$

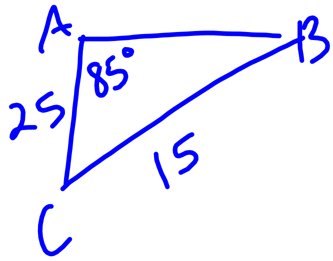
Use the Law of Sines to solve the triangle.

4.) $a = 15$

$b = 25$

$A = 85^\circ$

No Solution



$$\frac{\sin 85^\circ}{15} = \frac{\sin B}{25}$$

$$\sin B = \frac{25 \sin 85^\circ}{15}$$

$$\sin B = 1.6\ldots > 1$$

Use the Law of Sines to solve the triangle.

5.) $a = 12$ *meters*

$b = 31$ *meters*

$A = 20.5^\circ$

$B = 64.78^\circ$

$C = 94.72^\circ$

$c = 34.15\text{m}$

5.) $a = 12$ *meters*

$b = 31$ *meters*

$A = 20.5^\circ$

$B = 115.22^\circ$

$C = 44.28^\circ$

$c = 23.92\text{m}$

$$\frac{\sin 20.5^\circ}{12} = \frac{\sin B}{31}$$

$$\sin B = \frac{31 \sin 20.5^\circ}{12}$$

$$\sin B = 0.9047$$

$$B = 64.78^\circ \text{ OR } 115.22^\circ$$

$$\frac{\sin 20.5^\circ}{12} = \frac{\sin 94.72^\circ}{c}$$

$$c = \frac{12 \sin 94.72^\circ}{\sin 20.5^\circ}$$

$$\frac{\sin 20.5^\circ}{12} = \frac{\sin 44.28^\circ}{c}$$

$$c = \frac{12 \sin 44.28^\circ}{\sin 20.5^\circ}$$

Use the Law of Sines to solve the triangle.

6.) $c = 29$

$b = 46$

$C = 31^\circ$

7.) The course for a boat race starts at point *A* in Figure 6.9 and proceeds in the direction S 52° W to point *B*, then in the direction S 40° E to point *C*, and finally back to *A*. Point *C* lies 8 kilometers directly south of point *A*. Approximate the total distance of the race course.