TOPIC: THE LAW OF SINES

Intro to Law of Sines

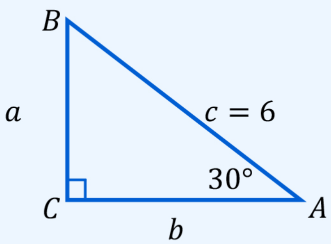
◆ Unlike right triangles, you __________ solve sides in *non-right* triangles using SOH-CAH-TOA & Pythag. Theorem.

- Instead, use the **Law of Sines**, which compares ratios of _________ to __________.

EXAMPLE Solve for side length $\boldsymbol{a}$ in the the following triangles.

Recall SOH-CAH-TOA in Right Triangles	**New** Law of Sines in Non-Right Triangles

Recall: SOH-CAH-TOA in Right Triangles



SOH – CAH – TOA? ▢

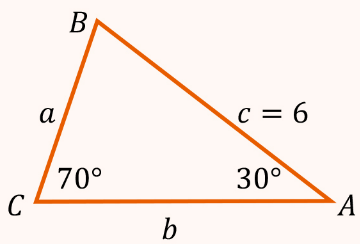
$a^2 + b^2 = c^2$? ▢

$$\sin(30°) = \frac{a}{c}$$

$$a = 6 \cdot \sin(30°)$$

$$a = 3$$

New: Law of Sines in Non-Right Triangles



_____ = _____ = _____

$\angle A^*$ is opposite side a

$\angle B^*$ is opposite side b

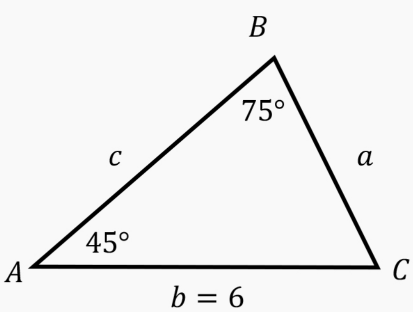
$\angle C^*$ is opposite side c

**You may see* α, β, γ

SOH – CAH – TOA? ▢

$a^2 + b^2 = c^2$? ▢

PRACTICE Use the **Law of Sines** to find the length of side $\boldsymbol{a}$ to the nearest tenth of a degree.



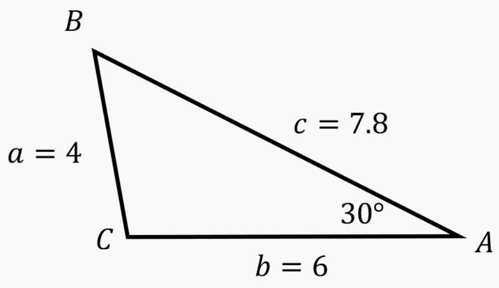
Recall

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

(*Law of Sines*)

TOPIC: THE LAW OF SINES

PRACTICE Use the **Law of Sines** to find the angle $\boldsymbol{B}$ to the nearest tenth of a degree.



Recall

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

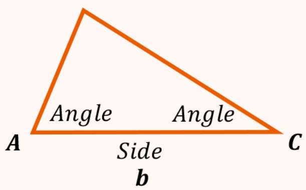
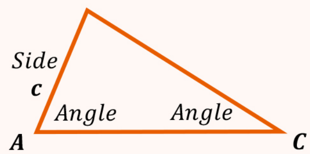
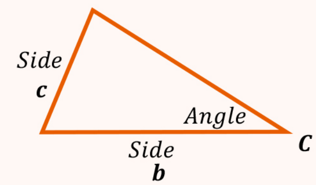
(*Law of Sines*)

TOPIC: THE LAW OF SINES

Solving ASA & SAA Triangles

Law of Sines			Law of Cosines	
ASA	SAA	SSA	SAS	SSS

◆ Use the **Law of Sines** to solve these types of triangles in which you're given:

Angle-Side-Angle (ASA)	Side-Angle-Angle (SAA)	Side-Side-Angle (SSA)
		
▸ 2 angles & side between them *Example:* A, C, b	▸ 2 angles & side adjacent to either *Example:* A, C, c	▸ 2 sides & angle adjacent to either *Example:* b, c, C

EXAMPLE Classify the following triangle, then solve.

$$A = 30°, C = 70°, c = 6$$

HOW TO: Solve ASA & SAA Triangles

1) Draw triangle, label given side & angles

2) Use $A + B + C = 180°$ to solve 3rd angle

3) Use **Law of Sines** to solve remaining sides

Recall

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

(*Law of Sines*)

$$A + B + C = 180°$$

(*Angle Sum Formula*)

TOPIC: THE LAW OF SINES

PRACTICE Classify the triangle, then solve.

$A = 60°, B = 15°, c = 6$

HOW TO: Solve ASA & SAA Triangles

1) Draw triangle, label given side & angles

2) Use $A + B + C = 180°$ to solve 3rd angle

3) Use **Law of Sines** to solve remaining sides

Recall

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

(*Law of Sines*)

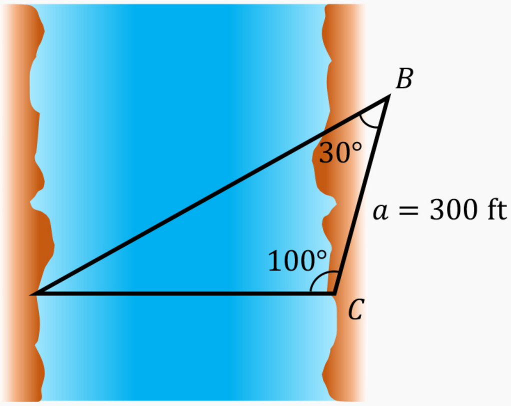
$$A + B + C = 180°$$

(*Angle Sum Formula*)

TOPIC: THE LAW OF SINES

PRACTICE

An engineer wants to measure the distance to cross a river. If $B = 30°, a = 300\text{ ft}, C = 100°$, find the shortest distance (in ft) you'd have to travel to cross the river.



HOW TO: Solve ASA & SAA Triangles

1) Draw triangle, label given side & angles

2) Use $A + B + C = 180°$ to solve 3rd angle

3) Use **Law of Sines** to solve remaining sides

Recall

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

(*Law of Sines*)

$$A + B + C = 180°$$

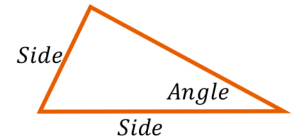
(*Angle Sum Formula*)

TOPIC: THE LAW OF SINES

Solving SSA Triangles ("Ambiguous" Case)

Law of Sines			Law of Cosines	
ASA	SAA	SSA	SAS	SSS

- When solving an **SSA** triangle, you either get ____; _____; or ______ solution(s).
  - Always first use the **Law of Sines** to find a 2nd __________.



EXAMPLE Solve for each ANGLE in the triangle.

$$a = 6, b = 8, \& A = 41°$$

HOW TO: Solve SSA Triangles

1) Use **Law of Sines** to set up $\sin(\angle) = \#$

If $\# > 1$ → **[NO | 1 | 2] sol'n(s)**

If $\# \le 1$ → Step 2

2) Use $\sin^{-1}$ to solve for 2 possible*∠'s:

$\angle_1 = \sin^{-1}(\#)$; $\angle_2 = 180° - \angle_1$

*If $\sin(\angle) = 1$, $\angle_1 \& \angle_2 = 90°$ → **[NO | 1 | 2] sol'n(s)**

3) For $\angle_2$ in **Step 2**, add to given angle

If sum $\ge 180°$, 2nd △? ▢ → **[NO | 1 | 2] sol'n(s)**

If sum $< 180°$, 2nd △? ▢ → **[NO | 1 | 2] sol'n(s)**

4) Solve remaining angles & sides of all possible △

Recall

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

(*Law of Sines*)

$$A + B + C = 180°$$

(*Angle Sum Formula*)

TOPIC: THE LAW OF SINES

EXAMPLE Solve the triangle: $a = 1,\ b = 4,\ A = 30°$

HOW TO: Solve SSA Triangles

1) Use **Law of Sines** to set up $\sin(\angle) = \#$

If $\# > 1$ → **[NO | 1 | 2] sol'n(s)**

If $\# \leq 1$ → Step 2

2) Use $\sin^{-1}$ to solve for 2 possible* ∠'s:

$\angle_1 = \sin^{-1}(\#)\ \ ;\ \ \angle_2 = 180° - \angle_1$

*If $\sin(\angle) = 1,\ \angle_1 \& \angle_2 = 90°$ → **[NO | 1 | 2] sol'n(s)**

3) For $\angle_2$ in **Step 2**, add to given angle

If sum ≥ $180°$, 2nd △? ▢ → **[NO | 1 | 2] sol'n(s)**

If sum < $180°$, 2nd △? ▢ → **[NO | 1 | 2] sol'n(s)**

4) Solve remaining angles & sides of all possible △

Recall

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

(*Law of Sines*)

$$A + B + C = 180°$$

(*Angle Sum Formula*)

EXAMPLE Solve the triangle: $b = 4,\ c = 2,\ B = 29°$

HOW TO: Solve SSA Triangles

1) Use **Law of Sines** to set up $\sin(\angle) = \#$

If $\# > 1$ → **[NO | 1 | 2] sol'n(s)**

If $\# \leq 1$ → Step 2

2) Use $\sin^{-1}$ to solve for 2 possible* ∠'s:

$\angle_1 = \sin^{-1}(\#)\ \ ;\ \ \angle_2 = 180° - \angle_1$

*If $\sin(\angle) = 1,\ \angle_1 \& \angle_2 = 90°$ → **[NO | 1 | 2] sol'n(s)**

3) For $\angle_2$ in **Step 2**, add to given angle

If sum ≥ $180°$, 2nd △? ▢ → **[NO | 1 | 2] sol'n(s)**

If sum < $180°$, 2nd △? ▢ → **[NO | 1 | 2] sol'n(s)**

4) Solve remaining angles & sides of all possible △

Recall

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

(*Law of Sines*)

$$A + B + C = 180°$$

(*Angle Sum Formula*)