Section 4.1 Notes
Know when to use the Law of Sines
Solve triangles using the Law of Sines
Solve triangles using the Law of Sines with SSA (ambiguous case)
Applications of the Law of Sines

**Know when to use the Law of Sines**

The Law of Sines:

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

AAS: Angle-Angle-Side Law of Sines

ASA: Angle-Side-Angle Law of Sines

SAS: Side-Angle-Side Law of Cosines

SSS: Side-Side-Side Law of Cosines

**Solve triangles using the Law of Sines**

**AAS or ASA**

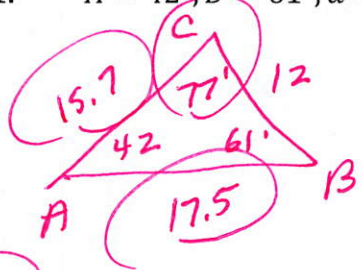
Step 1: Draw a Picture

Step 2: Solve for the missing angle (Sum Angles in triangle = 180°)

Step 3: Use law of Sines to solve for two missing sides.

Use the law of sines to solve the triangle:

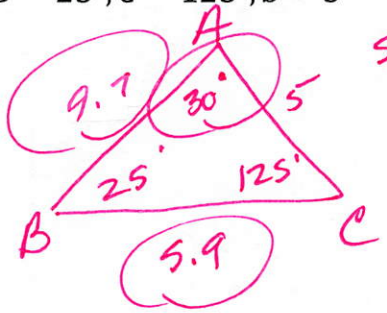
**1.** $A = 42°, B = 61°, a = 12$




$\frac{\sin 42}{12} = \frac{\sin 61}{b}$

$\frac{\sin 42}{12} = \frac{\sin 77}{c}$

**2.** $B = 25°, C = 125°, b = 5$

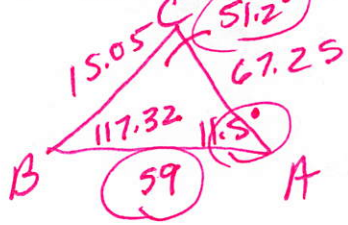



$\frac{\sin 25}{5} = \frac{\sin 125}{c}$

**3.** $A = 110°, C = 32°, b = 12$

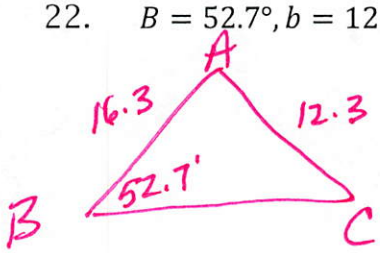
In Exercises 13 to 24, solve the triangles that exist.

24. $B = 117.32°, b = 67.25, a = 15.05$ (only 1 triangle because angle B is obtuse)




$\frac{\sin 117.32}{67.27} = \frac{\sin A}{15.05} = \frac{\sin 51.2}{C}$

22. $B = 52.7°, b = 12.3, c = 16.3$



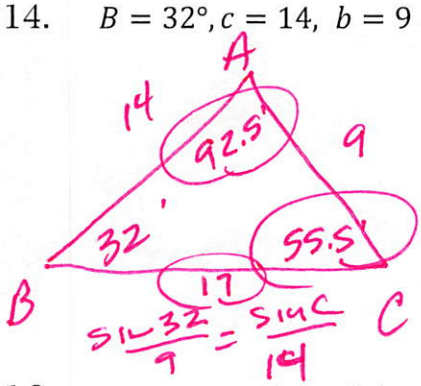

$12.3 < 16.3$ check height $h = 16.3 \sin 52.7°$

$h = 13$

not possible

No triangle

14. $B = 32°, c = 14, b = 9$

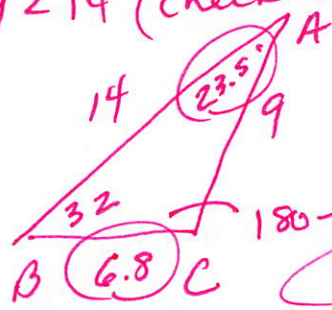



$\frac{\sin 32}{9} = \frac{\sin C}{14}$

$9 < 14$ (check height) $h = 14 \sin 32 = 7.4$

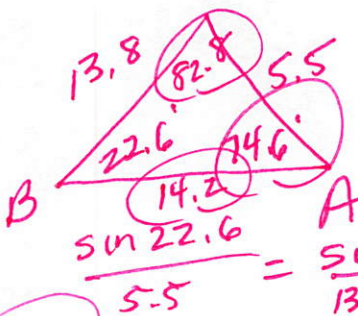
possible height

2 triangles




$180 - 55.5° = 124.5°$

18. $B = 22.6°, b = 5.5, a = 13.8$

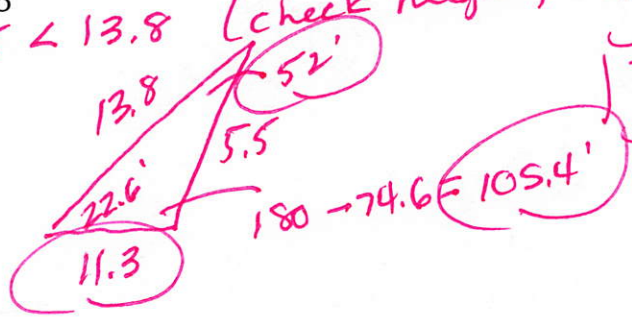



$\frac{\sin 22.6}{5.5} = \frac{\sin A}{13.8}$

$5.5 < 13.8$ (check height) $h = 13.8 \sin 22.6 = 5.3$

possible height

2 triangles




$180 - 74.6 = 105.4°$

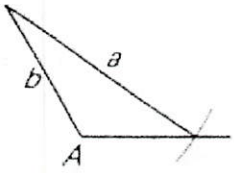
13. $A = 37°, c = 40, a = 28$

15. $C = 65°, b = 10, c = 8$

**Solve triangles using the Law of Sines with SSA (ambiguous case)**

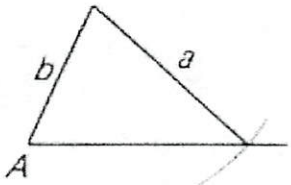
**Possible Triangles in the SSA case:**

**Obtuse**




a > b

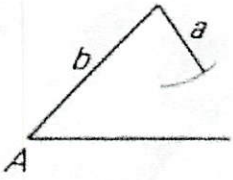
**Acute**




a > b

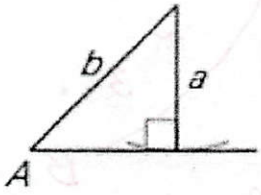
***if a > b*** one solution

***if a < b*** **Need to solve for the height** h = b sin A



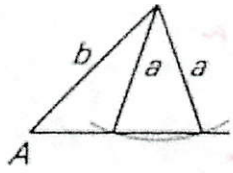

h > a

no triangle




h = a

one right triangle




h < a < b

Two triangles

("a" is always the side given with given angle)

**If a > b**

one triangle

**If a < b (Solve for h)**

If a = h one right triangle

If a > h Two triangles

If a < h No solution

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**Solve triangles using the Law of Sines**

**AAS or ASA**

Step 1:

Step 2:

Step 3:

Use the law of sines to solve the triangle:

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**2.** $\boldsymbol{B = 25°, C = 125°, b = 5}$

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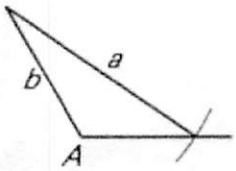
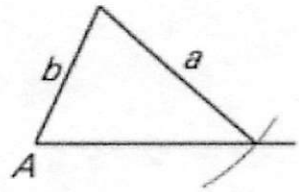
**Possible Triangles in the SSA case:**

**Obtuse**




$a > b$

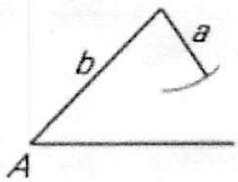
**Acute**




$a > b$

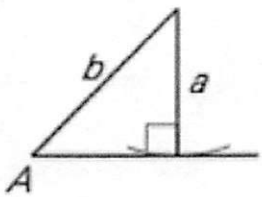
***if*** $a > b$ _____

***if*** $a < b$ **Need to solve for the height** h = _____



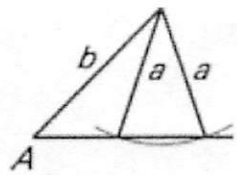

$h > a$

_____




$h = a$

_____




$h < a < b$

_____

(**"a"** is always the side given with given angle)

## If a > b

_____

## If a < b (Solve for h)

If a = h _____

If a > h _____

If a < h _____