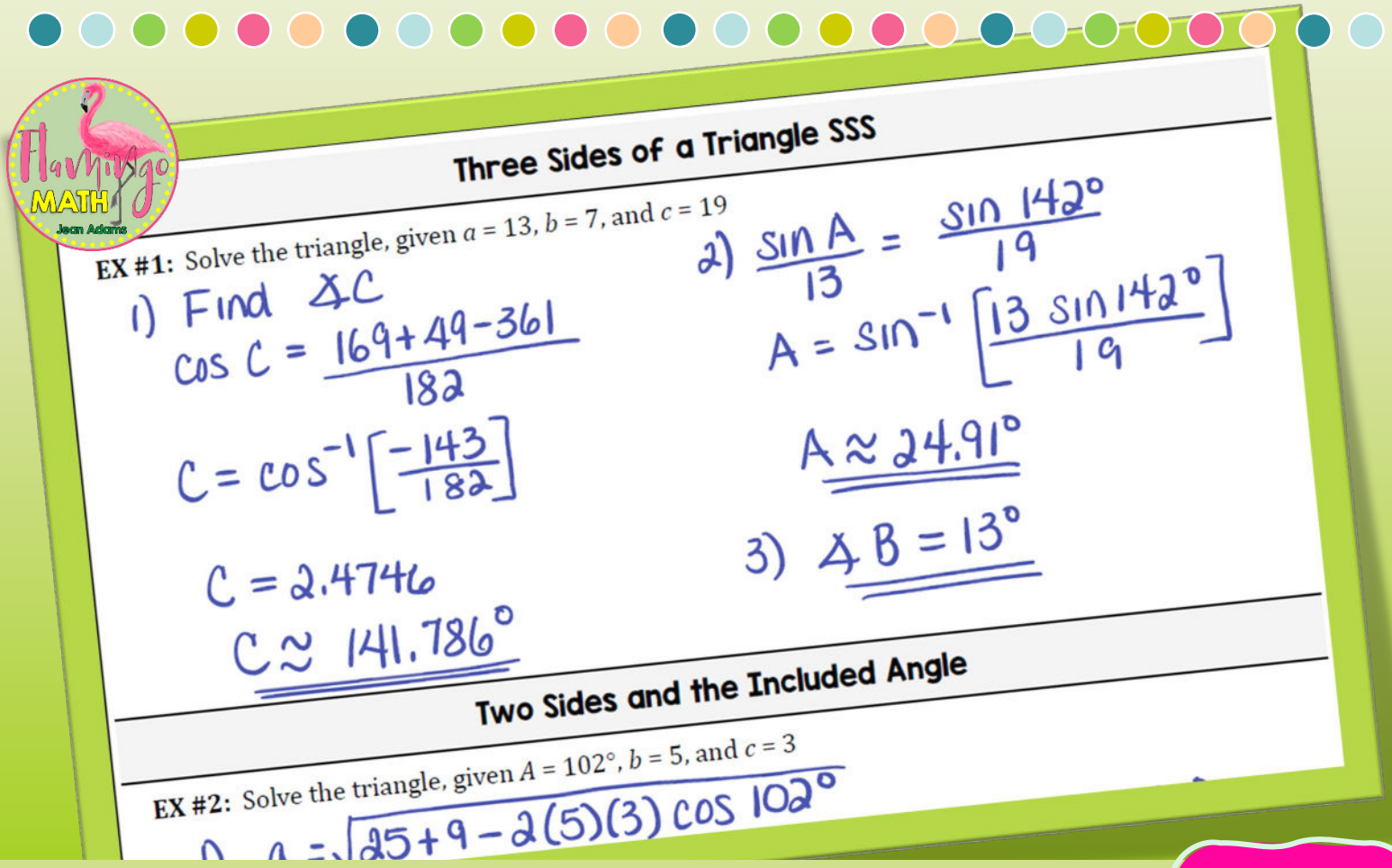
Precalculus Honors

Law of Cosines



Flamingo MATH Jean Adams

Completely Editable

5.6

Lesson 6: Law of Cosines

In our previous lesson, we used the **Law of Sines** to solve triangles, given AAS, SSA, and ASA. Now we will need the **Law of Cosines** to solve triangles, given SAS and SSS.

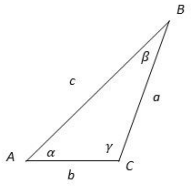
The Law of Cosines

Given the following triangle with sides a, b, and c, and angles α , β , and γ , we can set up three equal ratios. These proportions are known as the Law of Cosines. The square of one side of a triangle equals the sum of the squares of the other two sides minus twice their product times the cosine of their included angle.

Standard Form . . . need a side. . .	Alternative Form . . . need an angle. . .
$a^2 = b^2 + c^2 - 2bc\cos A$	$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$
$b^2 = a^2 + c^2 - 2ac\cos B$	$\cos B = \frac{a^2 + c^2 - b^2}{2ac}$
$c^2 = a^2 + b^2 - 2ab\cos C$	$\cos C = \frac{a^2 + b^2 - c^2}{2ab}$

Techniques for Solving SSS Triangles

1. Find the angle opposite the **longest side first.**
2. Use the LAW OF SINES to find any missing angle.
3. Find third angle A + B + C = 180°



Techniques for Solving SAS Triangles

1. Find the side opposite the given angle.
2. Find angle opposite the shorter of the two given sides.
3. Find third angle A + B + C = 180°

Three Sides of a Triangle SSS

EX #1: Solve the triangle, given a = 13, b = 7, and c = 19

Two Sides and the Included Angle

EX #2: Solve the triangle, given A = 102°, b = 5, and c = 3

Application

EX #3: Two airplanes leave an airport at the same time on different runways. One flies directly north at 420 miles per hour. The other airplane flies on a bearing of N75°E at 375 miles per hour. How far apart will the airplanes be after two hours?

Heron's Formula

$$s = \frac{1}{2}(a + b + c)$$

$$A = \sqrt{s(s-a)(s-b)(s-c)}$$

EX #4: Find the area of the triangle with a = 7 meters, b = 16 meters, and c = 18 meters. Round answer to the nearest square meter.

EX #5: A 120-foot tower is leaning. A 160-foot guy wire has been anchored 82 feet from the base of the tower. How far from vertical is the tower leaning?

NOTES

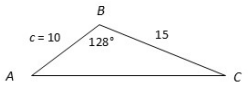
5.6 **Law of Cosines Homework**

Name _____

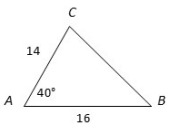
Date _____ Period _____

Problems 1 – 8, Solve each triangle, if possible. Express your answer to nearest hundredth.

1.



2.



3. $\angle A = 56°$, $b = 15$, $c = 8$

4. $\angle B = 34°$, $a = 40$, $c = 17$

5. $a = 12$, $b = 20$, $\angle C = 92°$

6. $a = 2$, $b = 6$, $c = 4$

7. $\angle A = 57°$, $b = 12$, $c = 9$

8. $\angle B = 70.6°$, $a = 9.5$, $c = 8.2$

Problems 9 – 10, Find the area of the triangle.

9. $\angle A = 48°$, $b = 34$ in., $c = 20$ in.

10. $\angle C = 110°$, $a = 2.4$ ft., $b = 5.6$ ft.

Problems 11 – 14, Decide whether a triangle can be formed with the given side lengths. If so, use Heron's formula to find the area of the triangle.

11. $a = 6$, $b = 6$, $c = 10$

12. $a = 3$, $b = 5$, $c = 9$

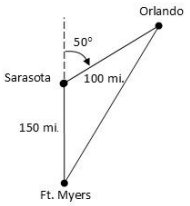
13. $a = 18.7$, $b = 21.6$, $c = 32$

14. $a = 17.4$, $b = 16.2$, $c = 12.3$

Problems 15 – 18, Solve each problem.

15. A jet plane flies 150 miles, from Ft. Myers, FL to Sarasota, FL, and then turns 50° towards the east heading to Orlando, FL which is a distance of 100 miles.

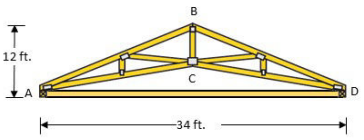
A) How far is the return trip from Orlando to Ft. Myers?



B) Through what angle should the pilot turn at Orlando to return to Ft. Myers?

17. A truss company is designing the truss for a new home shown below.

A) If $m\angle CAD = 10°$, find the measure of $\angle BAC$.



B) Find the length of AB.

C) Find the length of AC.

18. A Major League baseball diamond is actually a square whose sides measure 90 feet. The pitching mound is 60.5 feet from home plate on a line that joins home plate and second base.

A) Find the distance from the pitching mound to first base.

B) How far is it from the pitching mound to second base?

Practice Sets

Lesson Warm-Ups

3. Find the area of the triangle to the nearest square unit.
$a = 7$ ft, $b = 12$ ft, $c = 13$ ft

Name _____ Date _____ Period _____

Lesson 5.6: Law of Cosines **Warm-Up # 2**

1. Solve the triangle, round lengths and angles to the nearest unit.
$A = 103°, b = 6, c = 4$

2. Solve the triangle, round angles to the nearest degree.
$a = 10, b = 11, c = 20$

3. Find the area of the triangle to the nearest square unit.
$a = 5$ ft, $b = 13$ ft, $c = 17$ ft

Daily Lesson Quiz

5.6 Law of Cosines **Form A**

Name _____

Date _____ Period _____

1. Solve the triangle, round lengths and angles to nearest unit. $A = 104°, b = 6, c = 4$

2. Solve the triangle, round angles to nearest degree. $a = 7, b = 13, c = 18$

3. Find area of the triangle to nearest square unit. $a = 8ft., b = 13ft., c = 14ft.$

Grade:

5.6 Law of Cosines **Form B**

Name _____

Date _____ Period _____

1. Solve the triangle, round lengths and angles to nearest unit. $A = 108°, b = 8, c = 5$

2. Solve the triangle, round angles to nearest degree. $a = 14, b = 9, c = 19$

3. Find area of the triangle to nearest square unit. $a = 6ft., b = 14ft., c = 18ft.$

Grade: