Law of Cosines Video Lecture

Section 8.3

Course Learning Objectives:
Demonstrate an understanding of trigonometric functions and their applications.

Weekly Learning Objectives:
1) Solve SAS Triangles.
2) Solve SSS Triangles.
3) Solve applied problems.

Law of Cosines

The Law of Sines cannot be used to "solve" a triangle if we know two sides of a triangle and the angle between them or if we know the three sides of a triangle. These are cases 3 & 4 from the previous section. In these two situations we can use the Law of Cosines to "solve" the triangle. SAS and SSS
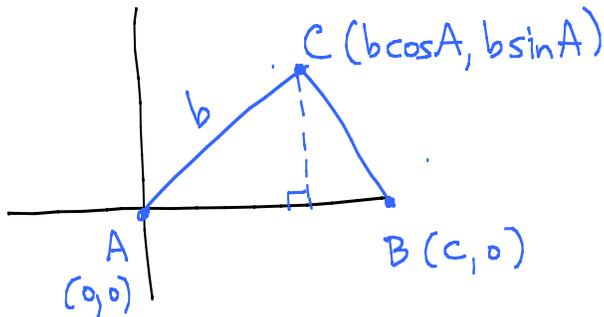
The Law of Cosines states that in any $\triangle ABC$, the square of any side of the triangle is equal to the sum of the squares of the other two sides minus twice the product of those two sides times the cosine of the included angle. Symbolically, the Law of Cosines is represented as
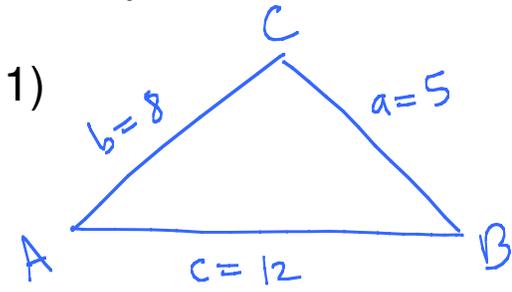
$$a^2 = b^2 + c^2 - 2bc \cos A$$
$$b^2 = a^2 + c^2 - 2ac \cos B$$
$$c^2 = a^2 + b^2 - 2ab \cos C$$

Proof:

$C\ (b\cos A,\ b\sin A)$

b

$A\ (0,0)$

$B\ (c,0)$

Examples:

1)

C

$b = 8$

$a = 5$

A

$c = 12$

B

2) $a = 2, c = 1, \beta = 10°$

3) An airplane flies from city A to city B, a distance of 150 miles, then turns through an angle of $50°$ and flies to city C, a distance of 100 miles.

a) How far is it from city A to city C?

b) Through what angle should the pilot turn at city C to return to city A

4) A 125-foot tower is located on the side of a mountain that is inclined $32°$ to the horizontal. A guy wire is to be attached to the top of the tower and anchored at a point 55 feet downhill from the base of the tower. Find the shortest length of wire needed.