

Section 7.3

The Law of Cosines

Case 3: Two sides and the included angle are known (SAS).

Case 4: Three sides are known (SSS).

Theorem

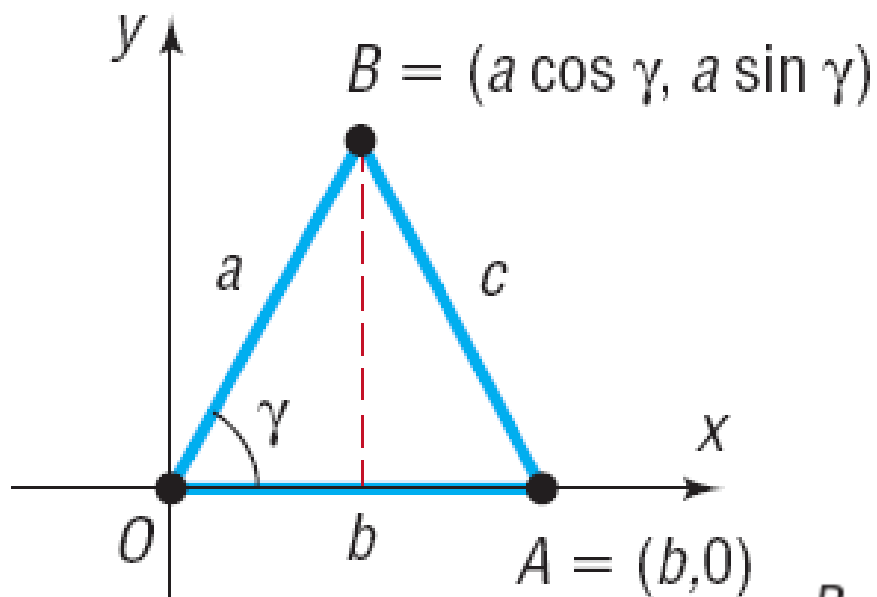
Law of Cosines

For a triangle with sides a, b, c and opposite angles α, β, γ , respectively,

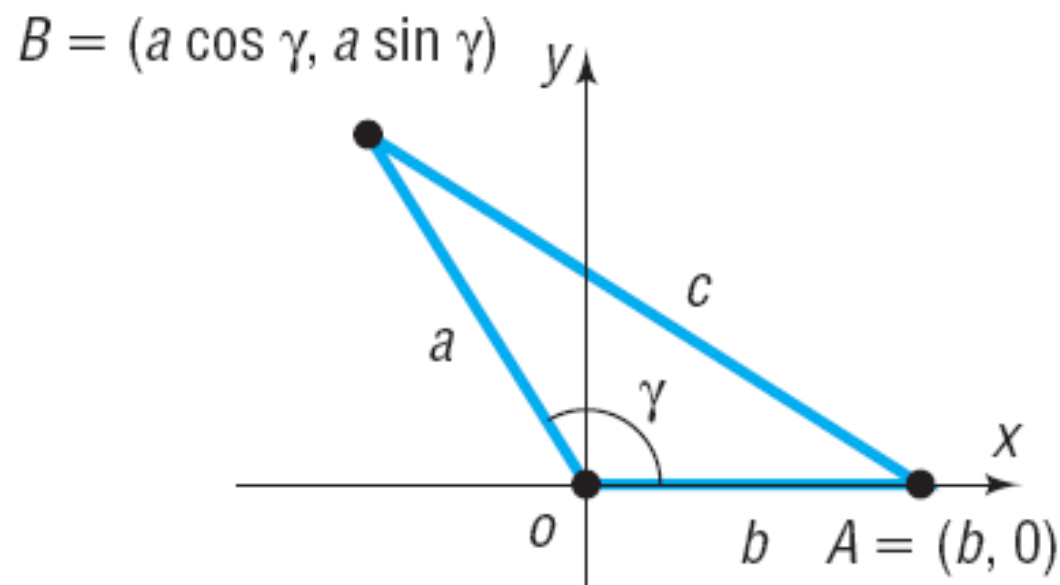
$$c^2 = a^2 + b^2 - 2ab \cos \gamma$$

$$b^2 = a^2 + c^2 - 2ac \cos \beta$$

$$a^2 = b^2 + c^2 - 2bc \cos \alpha$$



(a) Angle γ is acute



(b) Angle γ is obtuse

Theorem

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.

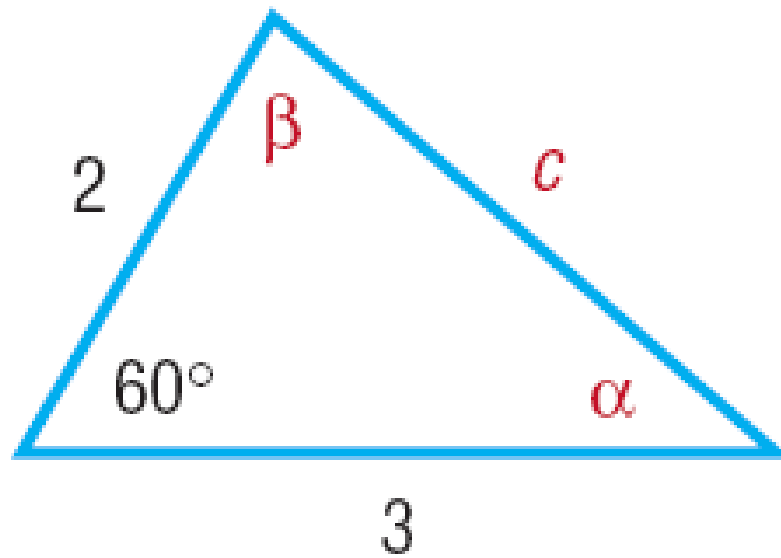
OBJECTIVE 1

- 1 ✓ **Solve SAS Triangles**

EXAMPLE

Using the Law of Cosines to Solve a SAS Triangle

Solve the triangle: $a = 2$, $b = 3$, $\gamma = 60^\circ$



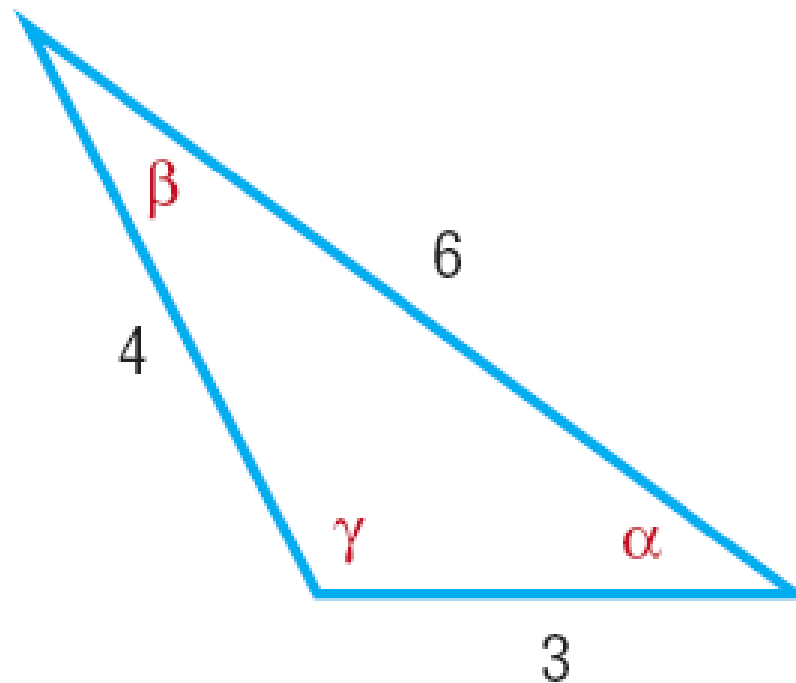
OBJECTIVE 2

2 ✓ Solve SSS Triangles

EXAMPLE

Using the Law of Cosines to Solve a SSS Triangle

Solve the triangle: $a = 4$, $b = 3$, $c = 6$



OBJECTIVE 3

3 ✓ **Solve Applied Problems**

EXAMPLE

Correcting a Navigational Error

A motorized sailboat leaves Naples, Florida, bound for Key West, 150 miles away. Maintaining a constant speed of 15 miles per hour, but encountering heavy crosswinds and strong currents, the crew finds, after 4 hours, that the sailboat is off course by 20° .

- How far is the sailboat from Key West at this time?
- Through what angle should the sailboat turn to correct its course?
- How much time has been added to the trip because of this? (Assume that the speed remains at 15 miles per hour.)

