Section 8.3

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

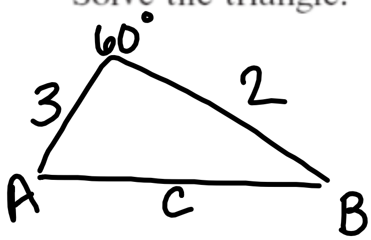
For a triangle with sides a, b, c and opposite angles A, B, C, respectively,

$$c^2 = a^2 + b^2 - 2ab \cos C$$
$$b^2 = a^2 + c^2 - 2ac \cos B$$
$$a^2 = b^2 + c^2 - 2bc \cos A$$

1 Solve SAS Triangles

EXAMPLE **Using the Law of Cosines to Solve an SAS Triangle**

Solve the triangle: $a = 2$, $b = 3$, $C = 60°$



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

$c^2 = 2^2 + 3^2 - 2(2)(3)\cos 60°$

$c^2 = \sqrt{13 - 12\cos 60}$

$c = 2.65$ c

$2^2 = 3^2 + c^2 - 2(3)(c)\cos A$

$4 = 9 + 7 - 15.87\cos A$

$4 = 16 - 15.87\cos A$

$-12 = -15.87\cos A$

$A = \cos^{-1}\frac{-12}{-15.87}$

$A = 40.9°$

$180 - 60 - 40.9 = \angle B$

$79.1° = B$

2 Solve SSS Triangles

EXAMPLE Using the Law of Cosines to Solve an SSS Triangle

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

$4^2 = 3^2 + 6^2 - 2(3)(6)\cos A$

$16 = 45 - 36\cos A$

$-29 = -36\cos A$

$A = \cos^{-1}\frac{-29}{-36}$

$A = 36.34^\circ$

$3^2 = 4^2 + 6^2 - 2(4)(6)\cos B$

$9 = 52 - 48\cos B$

$-43 = -48\cos B$

$B = \cos^{-1}\frac{-43}{-48}$

$B = 26.38^\circ$

$180 - 36.34 - 26.38 = 117.28^\circ = C$

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