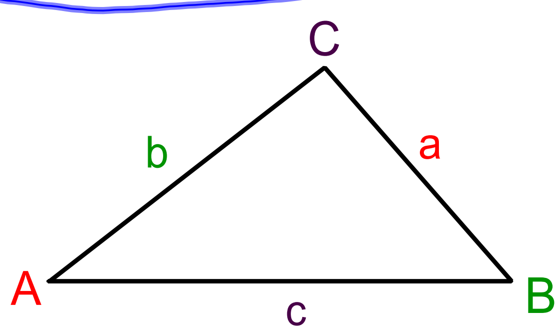
The Law of Cosines:

*Used to find missing parts when we are not able to use the Law of Sines.

$$a^2 = b^2 + c^2 - 2bc(\cos A)$$

$$b^2 = a^2 + c^2 - 2ac(\cos B)$$

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



The Law of Cosines can be used to solve a triangle in the following cases:

*You know the measures of two sides and the included angle of a triangle (SAS)

* You know the measure of all three sides (SSS)

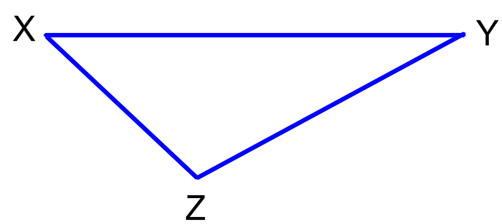
The Law of Sines can be used to solve a triangle in the following cases:

* AAS, ASA, or SSA

When solving a triangle you can use any combination of methods.

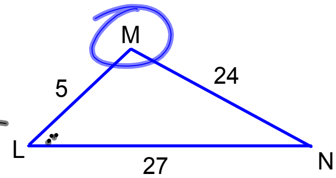
- *Trig Ratios (sin, cos, tan)
- *Law of Sines
- *Law of Cosines

Example 1: Find x if y=11, z=23, and m∠X=45° .



<u>Example 2:</u> Find m∠M.

$24^2 = 5^2 + 27^2 - 2(5)(27)\cos L$



$m^2 = n^2 + l^2 - 2nl\cos M$

$27^2 = 5^2 + 24^2 - 2(5)(24)\cos M$

$729 = 25 + 576 - 240\cos M$

$729 = 601 - 240\cos M$

$-601 \quad -601$

$128 = -240\cos M$

$\frac{128}{-240} = \frac{-240\cos M}{-240}$

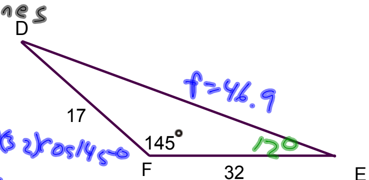
$-0.5\bar{3} = \cos M$

$M \approx \cos^{-1}(-0.5\bar{3})$

$M \approx 122.2^\circ$

<u>Example 3:</u> Determine whether the Law of Sines or the Law of Cosines should be used first to solve ΔDEF. Then solve ΔDEF. Round angle measures to nearest degree and side measurements to the nearest tenth.

Law of cosines



f = 46.9

12°

① $f^2 = 17^2 + 32^2 - 2(17)(32)\cos 145^\circ$

$f^2 = 1313 - 1088\cos 145^\circ$

$f = \sqrt{2204.237424}$

$f = 46.9$

② Find the smaller angle

$\frac{\sin E}{17} = \frac{\sin 145^\circ}{46.9}$

$\frac{46.9\sin E}{46.9} = \frac{17\sin 145^\circ}{46.9}$

$\sin E = 0.207906171$

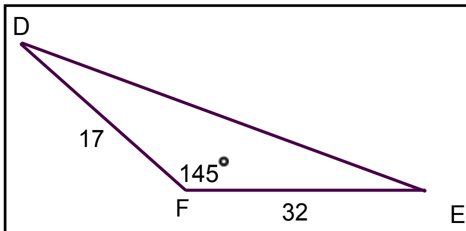
$E = \sin^{-1}(0.207906171)$

$E \approx 11.999$

$E \approx 12^\circ$

③ $m\angle D = 180 - (145 + 12)$

$\angle D \approx 23^\circ$



<u>Example 4:</u> Find the perimeter of the quadrilateral shown below. Round to the nearest tenth meter.