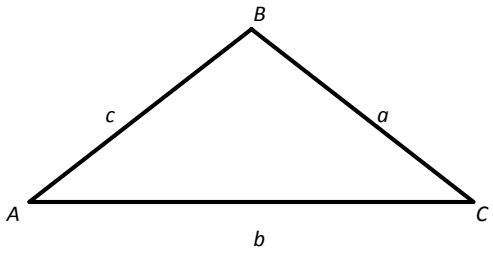
# Law of Cosines

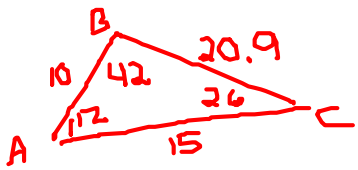
The Law of Cosines is used to solve oblique triangles (triangles that do not have a right angle) when you have SAS or SSS.




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

1. Solve each triangle.

   a) $\measuredangle A = 112^\circ$
   $c = 10$
   $b = 15$




S-A-S

Side a

$a^2 = b^2 + c^2 - 2bc \cdot \cos A$
$a^2 = 15^2 + 10^2 - 2(15)(10)\cos 112$
$a^2 = 437.382$
$a = 20.9$

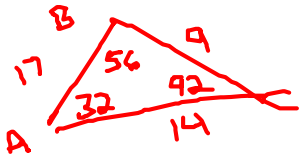
∠B

$\frac{\sin A}{a} = \frac{\sin B}{b}$
$\frac{\sin 112}{20.9} = \frac{\sin B}{15}$
$\frac{20.9}{20.9}\sin B = \frac{15\sin 112}{20.9}$
$\sin B = .6654$
$\angle B = 42$

∠C

$112 + 42 = 154$
$180 - 154 = 26$
$\angle C = 26^\circ$

b) $a = 9$
$b = 14$
$c = 17$




S - S - S

∠A

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

$9^2 = 14^2 + 17^2 - 2(14)(17)\cos A$

$81 = 485 - 476 \cdot \cos A$

$-485 \quad -485$

$\frac{-404}{-476} = \frac{-476\cos A}{-476}$

$\cos A = .8487$

$\angle A = 32°$

∠B

$\frac{\sin A}{a} = \frac{\sin B}{b}$

$\frac{\sin 32}{9} = \frac{\sin B}{14}$

$\frac{14}{9}\sin B = \frac{14\sin 32}{9}$

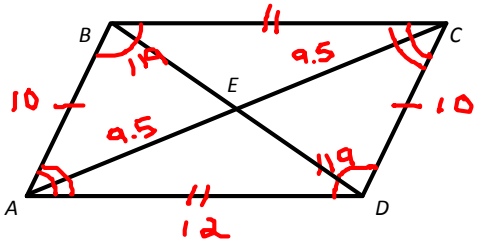
$\sin B = .8243$ $\angle B = 56°$

∠C

$56 + 32 = 88$ $180 - 88 = 92$

$\angle C = 92$

2. Find the missing parts of the parallelogram.




| Given | Find |
|---|---|
| $AB = 10$ | $BC =$ 12 |
| $AD = 12$ | $CD =$ 10 |
| $EC = 9.5$ | $AC =$ 2(9.5) = 19 |
| | $BD =$ 11.3 |
| | $\angle BAD =$ 180 − 119 = 61° |
| | $\angle ABC =$ 119° |
| | $\angle BCD =$ 61° |
| | $\angle CDA =$ 119° |

△ACD Find ∠D

$d^2 = a^2 + c^2 - 2ac \cdot \cos D$

$19^2 = 10^2 + 12^2 - 2(10)(12) \cdot \cos D$

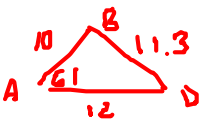
$361 = 244 - 240 \cdot \cos D$

$-244 \quad -244$

$\frac{117}{-240} = \frac{-240\cos D}{-240}$

$\cos D = -.4875$ $\angle D = 119°$

Find BD △ABD




$a^2 = b^2 + d^2 - 2bd \cdot \cos A$

$a^2 = 12^2 + 10^2 - 2(12)(10)\cos 61$

$\sqrt{a^2} = \sqrt{127.646}$

$a = 11.3$