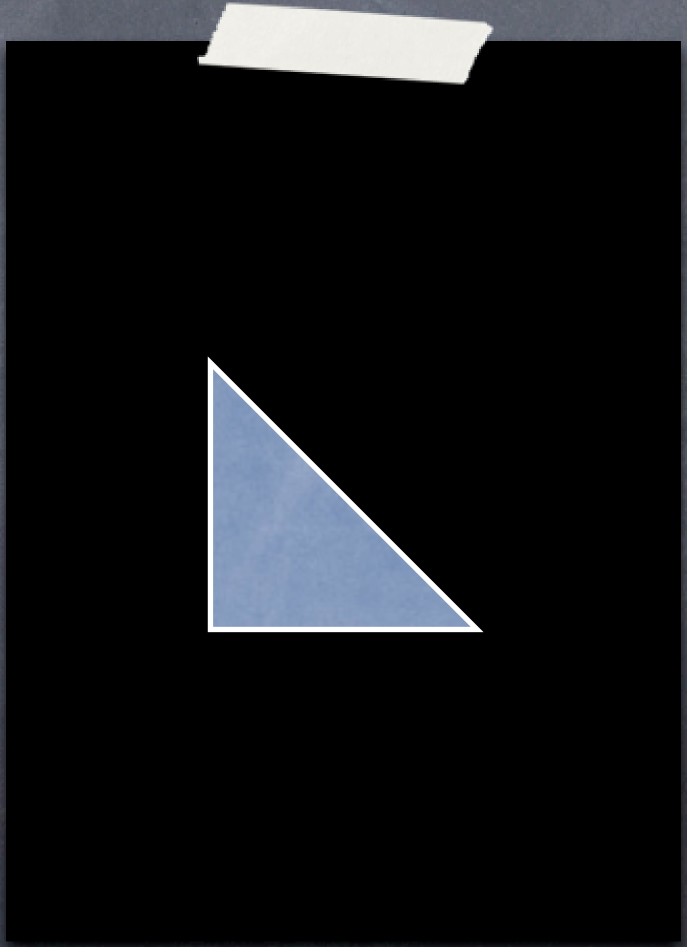
Proof: Triangles → 180°

The sum of the angles of a triangle is 180°.

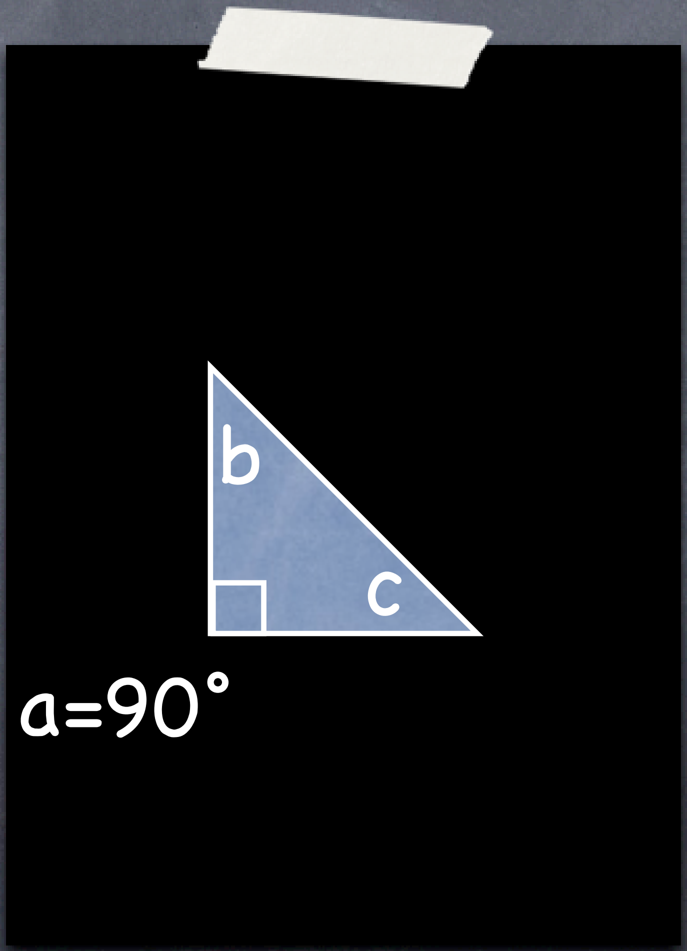
Right Triangles

We will start with right triangles, and then expand our proof later to include all triangles.



Your Basic Right Triangle

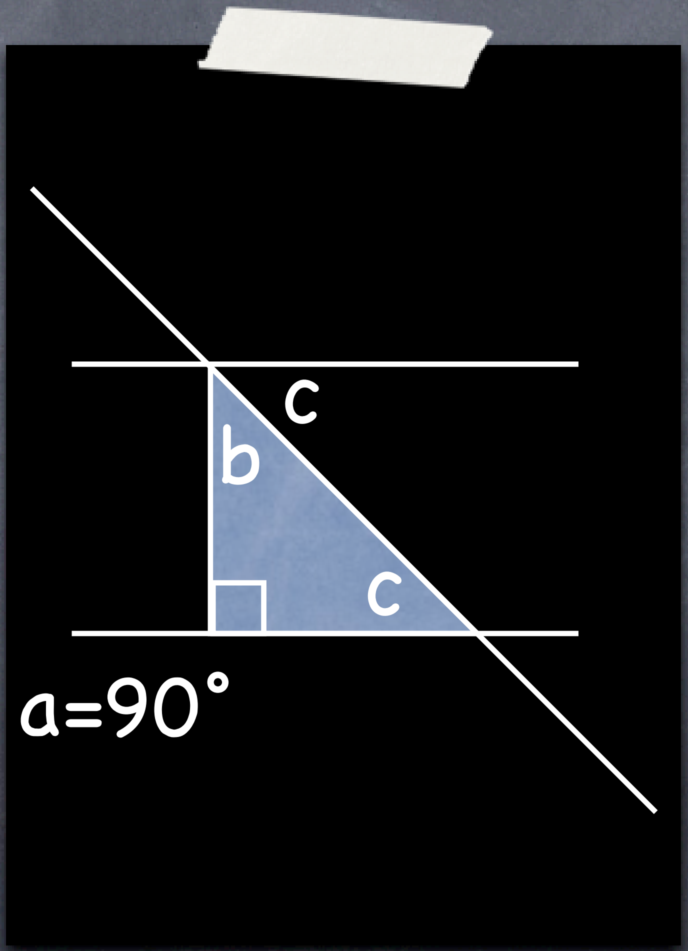
A right triangle has three angles, one of which is 90°.



Sum = 90° + b + c

Two Equal Angles

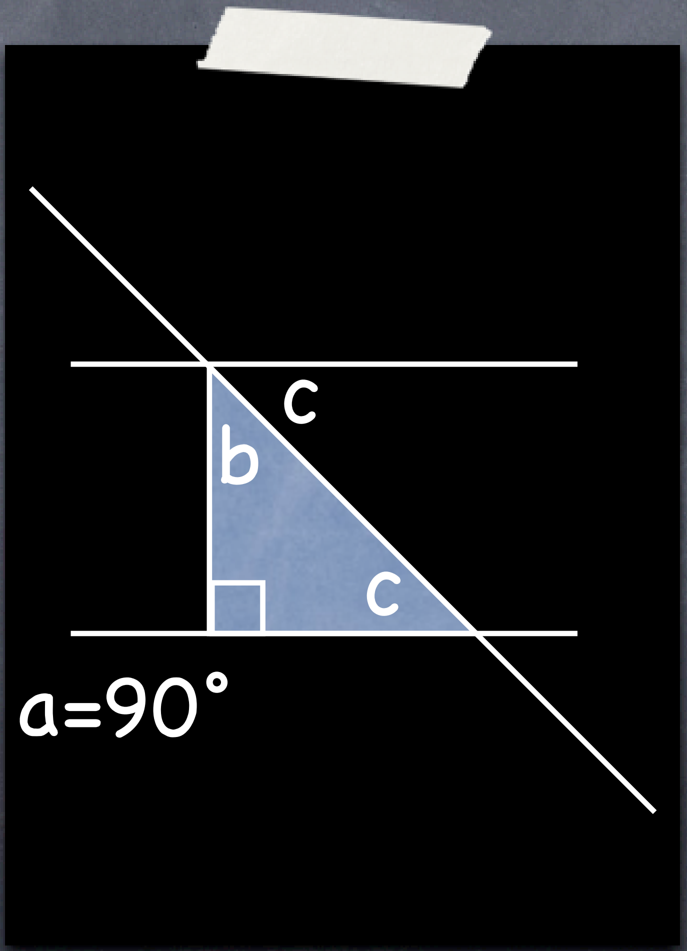
Because they are alternate interior angles, the two angles marked c are equal.



Sum = 90° + b + c

$b + c = 90°$

Angles b and c together form another right angle. Or, $b + c = 90°$.



Sum = $90° + b + c$

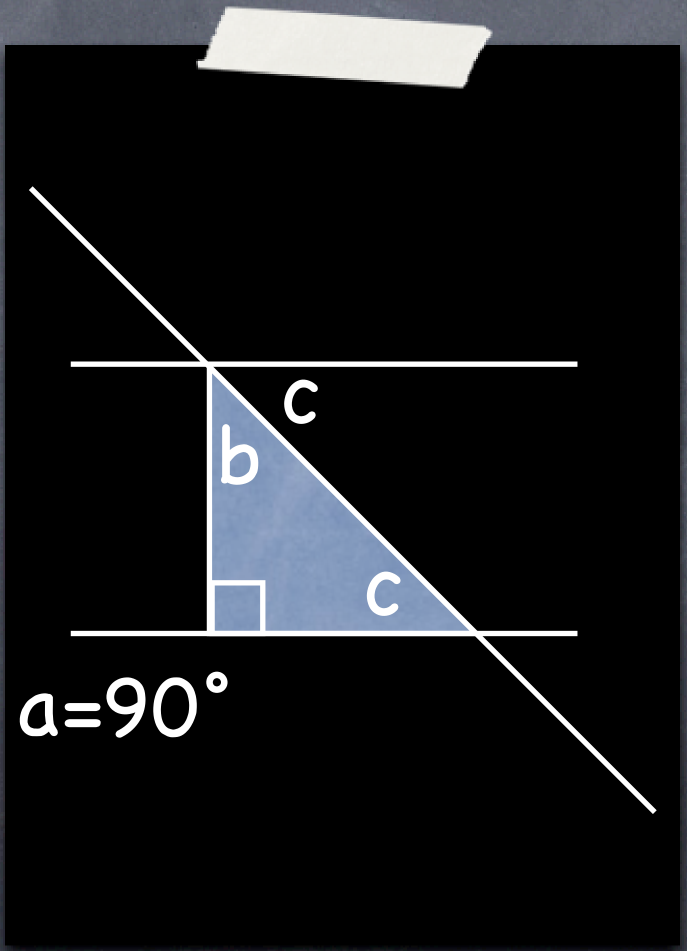
$$a + b + c = 180°$$

$b + c = 90°$, so let's substitute that into our sum equation.

Sum $= 90° + b + c$

Sum $= 90° + 90°$

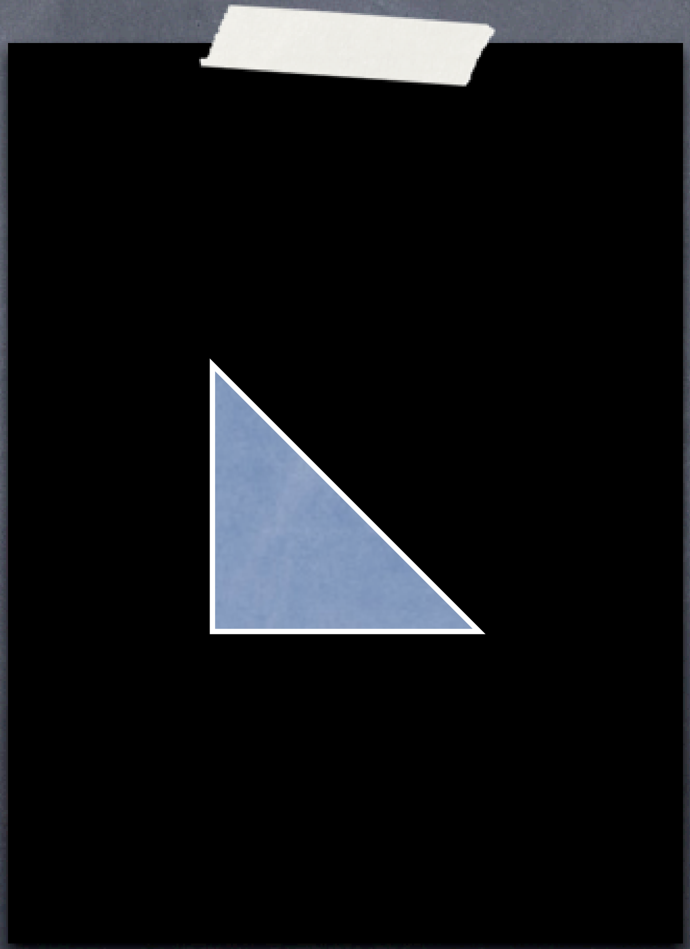
Sum $= 180°$



Sum $= 90° + b + c$

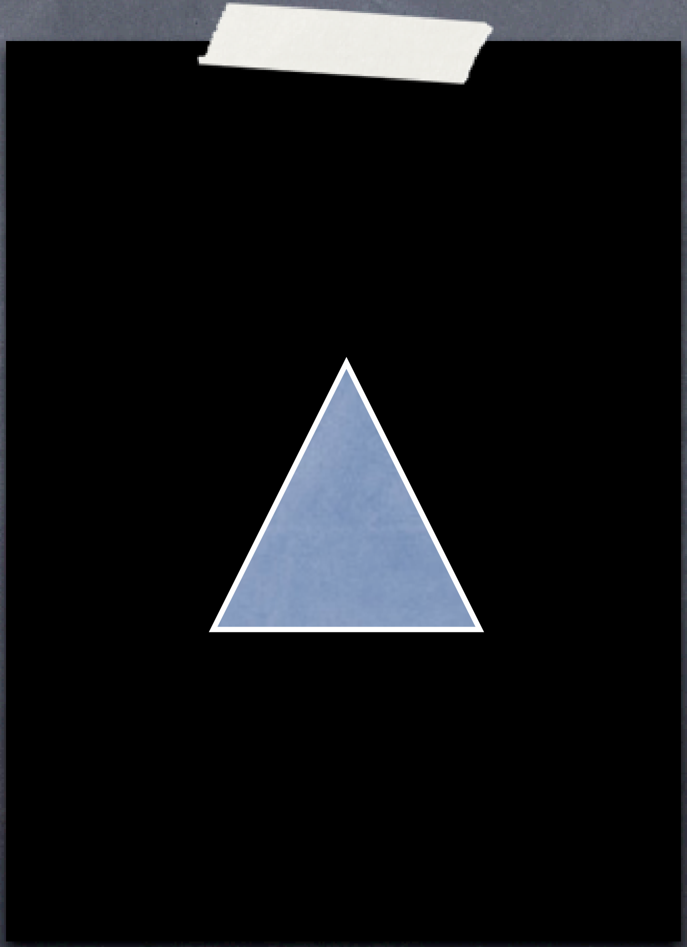
Ta Da!

We have proven that the sum of the angles of a RIGHT triangle add up to 180°.



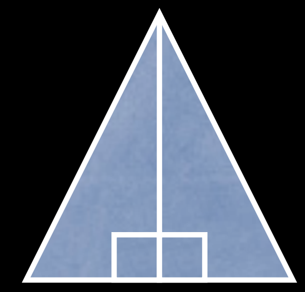
Your Basic Triangle

What about other triangles that may not be right triangles?



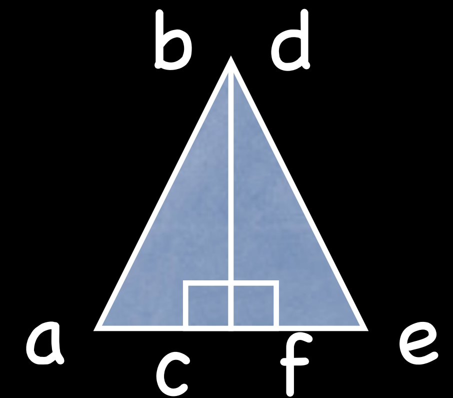
Two Right Triangles

Any triangle can be split up into two right triangles.



Sum of 360°

The angles of those two RIGHT triangles each sum to 180°, for a grand total of 360°.

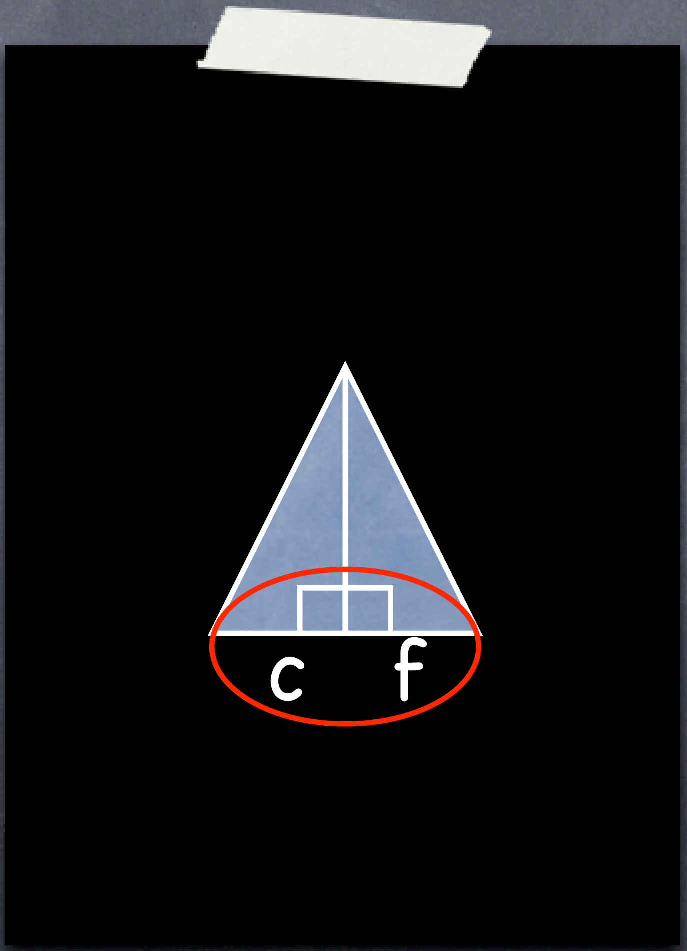


$a + b + c = 180°$
$d + e + f = 180°$

Sum = $a + b + c + d + e + f = 360°$

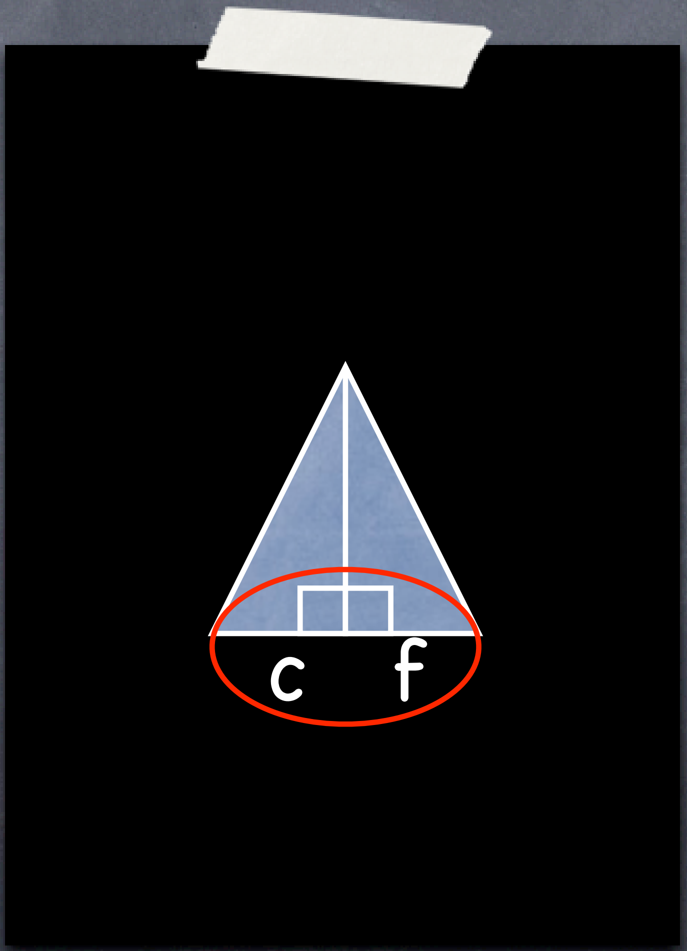
c and f Don't Count!

We added angles c and f into our sum, but they aren't actually angles of the triangle.



Subtract 180°

Angles c and f make a straight line, which is 180°. We have to subtract that from our original sum of 360°.



Sum = 360° - c - f = 360° - 180° = 180°

The End

We have now proved that the sum of the angles in ANY triangle is 180°.