Turn in your Flashback Friday 003 work into the basket.

Please make sure your other flashback friday returned papers are in your composition notebooks.

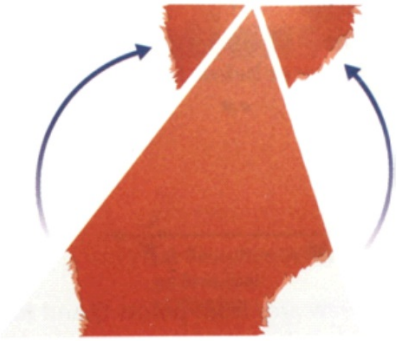
Angles in Triangles

Learn to find unknown angles in triangles.

If you tear off two corners of a triangle and place them next to the third corner, the three angles seem to form a straight line.

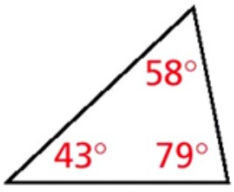
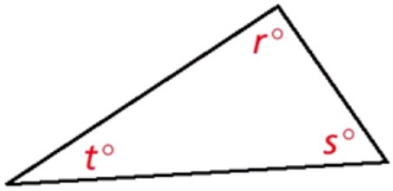
How many degrees are in a straight line?

How many degrees are in a triangle?



The three angles in the triangle can be arranged to form a straight line or 180°.

TRIANGLE SUM THEOREM

Words	Numbers	Algebra
The angle measures of a triangle in a plane add to 180°.	 $43° + 58° + 79° = 180°$	 $r° + s° + t° = 180°$

Classification by Angles

An **acute triangle** has 3 acute angles. A **right triangle** has 1 right angle. An **obtuse triangle** has 1 obtuse angle.

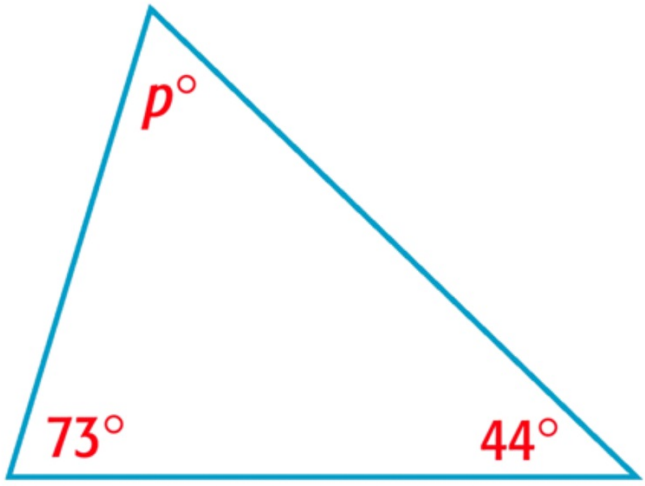
How else can we classify triangles?

Find p in the acute triangle.

Ex. 1) $p + 73 + 44 = 180$

$p + 117 = 180$

$p = 63$

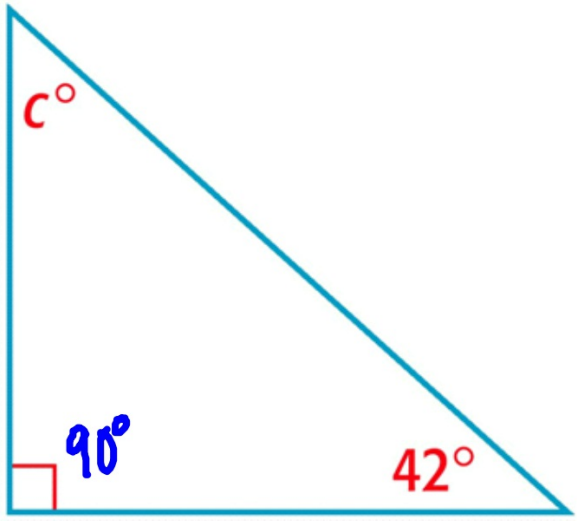


Find c in the right triangle.

Ex. 2) $c + 90 + 42 = 180$

$c + 132 = 180$

$c = 48$

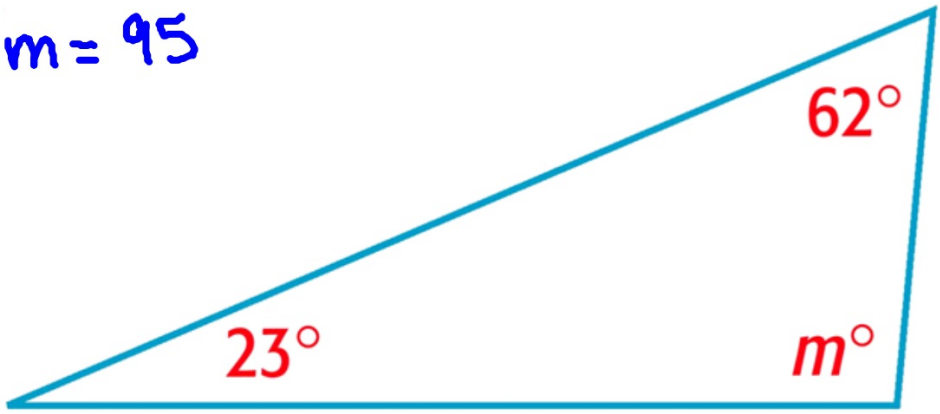


Find *m* in the obtuse triangle.

Ex.3) $m + 62 + 23 = 180$

$m + 85 = 180$

$m = 95$



Classification by Sides

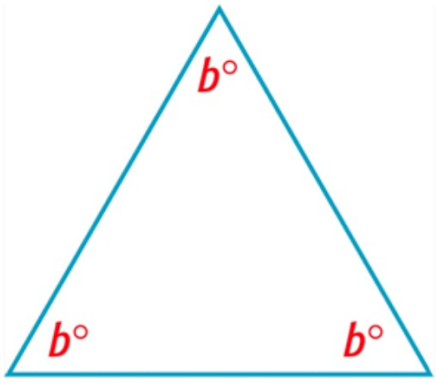
An **equilateral triangle** has 3 congruent sides and 3 congruent angles. An **isosceles triangle** has at least 2 congruent sides and 2 congruent angles. A **scalene triangle** has no congruent sides and no congruent angles.

Find angle measures in the equilateral triangle.

Ex.4) $b + b + b = 180$

$3b = 180$

$b = 60$



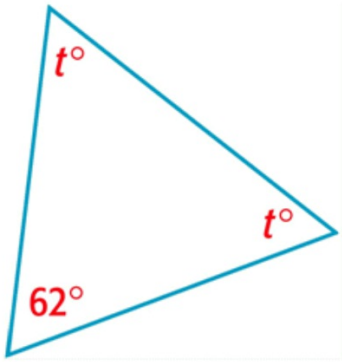
Find angle measures in the isosceles triangle.

Ex.5) $t + t + 62 = 180$

$2t + 62 = 180$

$2t = 118$

$t = 59$



Find angle measures in the scalene triangle.

Ex. 6) $5x + 3x + 2x = 180$

$10x = 180$

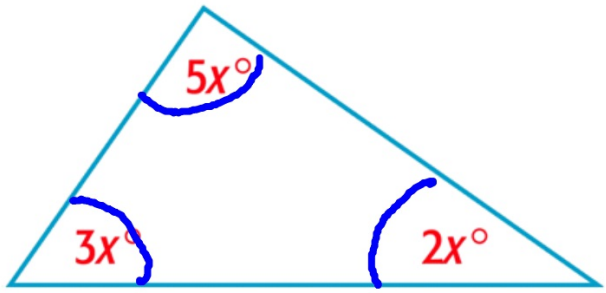
$x = 18$

$5(18) = 90$

$3(18) = 54$

$2(18) = 36$

$36°, 54°, 90°$



Ex. 7)

The second angle in a triangle is six times as large as the first. The third angle is half as large as the second. Find the angle measures and draw a possible picture.

1st $\angle \rightarrow x$

2nd $\angle \rightarrow 6x$

3rd $\angle \rightarrow 3x$

$x + 6x + 3x = 180$

$10x = 180$

$x = 18$

$18^\circ, 54^\circ, 108^\circ$

1st $\angle = 18^\circ$

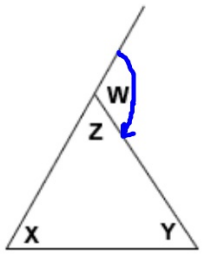
2nd $\angle = 6(18) = 108^\circ$

3rd $\angle = 3(18) = 54^\circ$

Exterior Angles

Definition

At each vertex of a triangle, an exterior angle of the triangle may be formed by extending ONE SIDE of the triangle. See picture below.



$w = x + y$

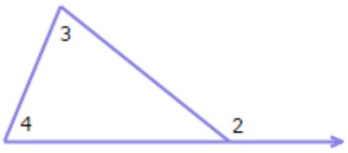
$x + y + z = 180$

$w + z = 180$

$x + y + z = w + z$

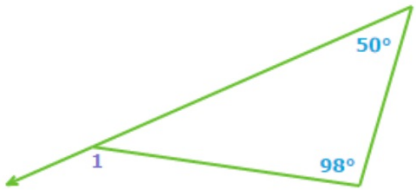
$x + y = w$

The measure of an exterior angle of a triangle equals the sum of the two remote interior angle measures.



$m\angle 2 = m\angle 3 + m\angle 4$

$\angle 1$ is an exterior angle of the triangle. The two remote interior angles measure 50° and 98°.



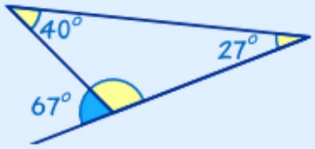
To find the exterior angle measure, add the two remote interior angle measures.

$m\angle 1 = 50^\circ + 98^\circ$

$= 148^\circ$ *Add*

So, $m\angle 1 = 148^\circ$.

Example:



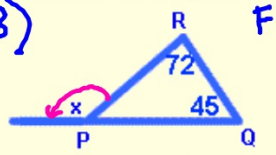
The exterior angle is **40° + 27° = 67°**

1. In $\triangle PQR$, $m\angle Q = 45°$ and $m\angle R = 72°$. Find the measure of an exterior angle at P.

It is always helpful to draw a diagram and label it with the given information.

Then, using the first theorem above, set the exterior angle (x) equal to the sum of the two non-adjacent interior angles which are 45° and 72°.

Ex.8)



Find x

$x = 45 + 72$

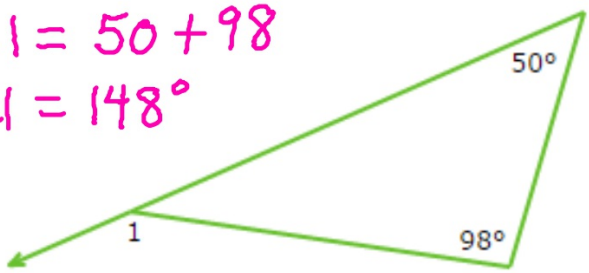
$x = 117$

So, the exterior angle at P measures 117°.

Ex.9) What is $m\angle 1$?

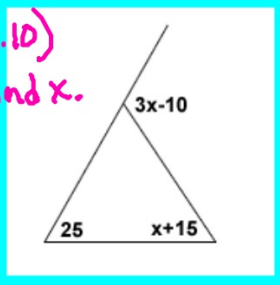
$m\angle 1 = 50 + 98$

$m\angle 1 = 148°$



If the measure of the exterior angle is (3x - 10) degrees, and the measure of the two remote interior angles are 25 degrees and (x + 15) degrees, find x.

Ex. 10)
Find x.



$3x-10 = 25 + x + 15$
$3x-10 = 40+x$
$2x-10 = 40$
$2x = 50$
$x = 25$

To solve, we use the fact that W = X + Y. Note that here I'm referring to the angles W, X, and Y as shown in the first image of this lesson. Their names are not important. What is important is that an exterior angle equals the sum of the remote interior angles.

We equate and solve for x.

exterior angle = interior angle + other interior angle
(3x - 10) = (25) + (x + 15)
3x - 10 = x + 40
3x = x + 50
2x = 50
x = 25

Remember that "x" is not the answer here. We need the angles themselves, which are calculated as (3x-10), 25, and (x+15). The angles, then, are 65, 25, and 40 degrees.

The exterior angle given is 110 degrees. Two remote interior angles measure 50 and (2x + 30). Find x.

Remember: exterior = sum of remote interior angles

We're given the exterior angle (110). We equate 110 to (2x + 30) + 50 and solve for x.

110 = 2x + 30 + 50
110 = 2x + 80
30 = 2x
15 = x

HW Interior Angles and Exterior Angles of Triangles