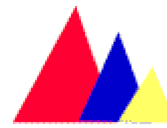
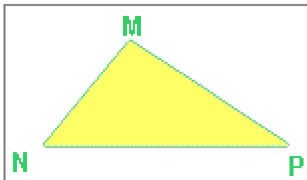
Name: ______________________ Class: ______________ Date: __________

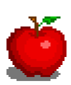
Interior Angles of a Triangles

Theorem: **The sum of the measures of the interior angles of any triangle is 180°.**



	In ΔMNP at the left, $m\angle M + m\angle N + m\angle P = 180°$.

Remember that this theorem works for ANY type of triangle. The sum of the angles in ANY type of triangle is 180°.

	**Examples**

1. In ΔABC, $m\angle A = 42°$ and $m\angle C = 63°$. What is the measure of $\angle B$?

Let $x = m\angle B$.
Add up all three angles and set them equal to 180°.
Solve for x.

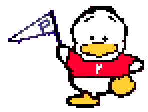
$x + 42 + 63 = 180$
$x + 105 = 180$
$x = 75$

So $m\angle B = 75°$

2. The angles of a triangle are in the ratio of 1:2:3. Find the measure of the smallest angle of the triangle.

Let x = smallest angle
$2x$ = second angle
$3x$ = largest angle

Then:
$x + 2x + 3x = 180$
$6x = 180$
$x = 30$



So the smallest angle measures 30°

3. The vertex angle of an isosceles triangle measures 58° Find the measure of a base angle.

The base angles are the 2 congruent angles in an isosceles triangle. So, let x = a base angle.

Then
$x + x + 58 = 180$
$2x + 58 = 180$
$2x = 122$
$x = 61$

So a base angle measures 61°.

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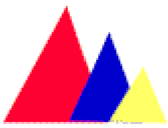
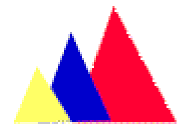
Exterior Angles of Triangles

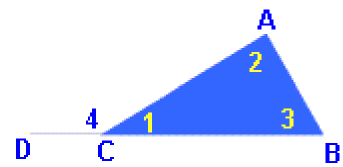


Theorem: **An measure of an exterior angle of a triangle is equal to the sum of the measures of the two non-adjacent interior angles.**



(non-adjacent interior angles may also be referred to as remote interior angles)

An exterior angle is formed by one side of a triangle and the extension of an adjacent side of the triangle.
In the triangle at the right, <4 is an exterior angle.



The theorem above states that if <4 is an exterior angle, its measure is equal to the sum of the measures of the 2 interior angles to which it is not adjacent, namely, <2 and <3.

***m*<4 = *m*<2 + *m*<3**

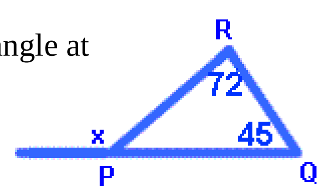
Since the measure of an exterior angle equals the sum of its two non-adjacent interior angles, the exterior angle is also greater than either of the individual non-adjacent interior angles.

***m*<4 > *m*<2** and also ***m*<4 > *m*<3**

Theorem: **The measure of an exterior angle of a triangle is greater than either of its two non-adjacent interior angles.**

Examples

1. In $\triangle PQR$, $m<Q = 45°$, and $m<R = 72°$. 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°.

$x = 45 + 72$
$x = 117$

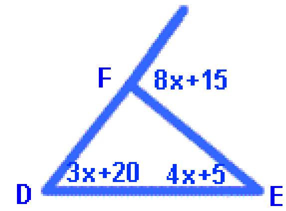
So, an exterior angle at *P* measures 117°.

2. In $\triangle DEF$, an exterior angle at F is represented by $8x + 15$. If the two non-adjacent interior angles are represented by $4x + 5$, and $3x + 20$, find the value of x.

First, draw and label a diagram.

Next, use the first theorem to set up an equation.

Then solve the equation for x.

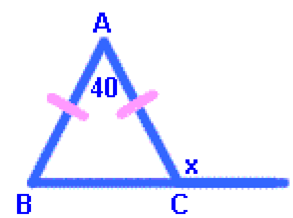


$$8x + 15=(4x + 5)+(3x + 20)$$
$$8x + 15 = 7x + 25$$
$$8x = 7x + 10$$
$$x = 10$$

So, $x = 10$

3. Find the measure of an exterior angle at the base of an isosceles triangle whose vertex angle measures 40°.

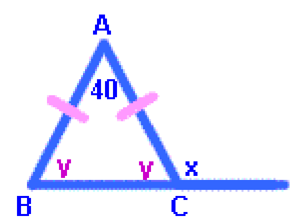
First.....the diagram.
You may choose to place the exterior angle at either vertex B or C. They will have the same measure.



Next, we have to find the measure of a base angle-- -- let's say <B.

Remember that the 2 base angles of an isosceles triangle are equal, so we'll represent each as y.

Then, write an equation, using the fact that there are 180 degrees in a triangle.



$$y + y + 40 = 180$$
$$2y + 40 = 180$$
$$2y = 140$$
$$y = 70$$

Now we can solve for x using the exterior angle theorem. Set the measure of the exterior angle equal to the sum of the measures of the two non-adjacent interior angles.

$$x = 70 + 40$$
$$x = 110$$

So, an exterior angle at the base measures 110°.