

Name: _____

Date: _____



EXTERIOR ANGLES OF A TRIANGLE N-GEN MATH[®] 8

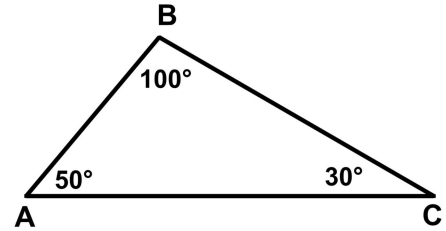


An important concept in geometry is that of an **exterior angle** of a figure. We will illustrate in the first exercise exactly what an **exterior angle** is and how to find its measure.

Exercise #1: Triangle ABC is shown below. We will be constructing the **exterior angles** to it, starting with the exterior angle at vertex C.

- (a) To construct the exterior angle at C, **extend** side \overline{AC} **through** point C to point D. Label D. Then, write in the measure of $\angle BCD$.

$$m\angle BCD =$$



- (b) To construct the exterior angle at B, extend side \overline{CB} through B to point E. Label E. Then, write the measure of $\angle ABE$.
- (c) To construct the exterior angle at A, extend side \overline{BA} through A to point F. Label F. Then, write the measure of $\angle CAF$.

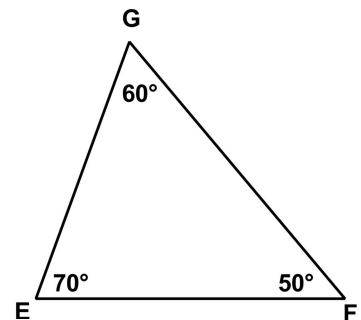
$$m\angle ABE =$$

$$m\angle CAF =$$

- (d) What is the sum of the three exterior angles you found?

Exercise #2: The angles of $\triangle EFG$ have been marked.

- (a) Extend each side and find the measures of the exterior angles.
- (b) Find the sum of the exterior angles.

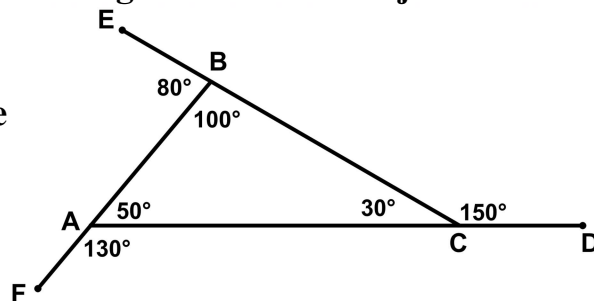


- (c) Is your sum the same as what you found in *Exercise #1* (d)?



One of the truly remarkable facts about the **exterior angles of a triangle** (actually any polygon) is that their sum is always equal to 360° . There is another interesting pattern involving exterior angles.

Exercise #3: In the diagram below, triangle ABC from *Exercise #1* along with its exterior angles is drawn. For every **exterior angle** there are **two interior angles** that are **not adjacent** to it. These are known as the **remote interior angles**.



(a) What are the measures of the two **remote interior angles** to exterior angle $\angle BCD$?

(b) How does the sum of the two angles from (a) compare to the measure of $\angle BCD$?

(c) Verify that this relationship holds for the two other exterior angles.

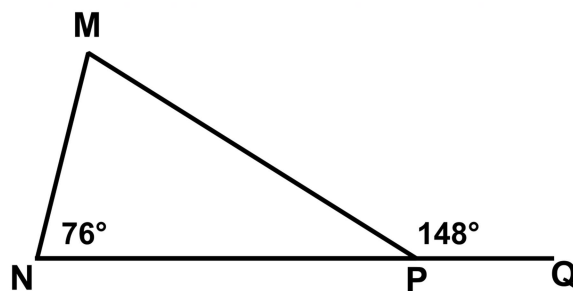
EXTERIOR ANGLE FACTS

- The sum of the measures of all exterior angles of a triangle (or any other polygon) is 360° .
- The measure of any given exterior angle of a triangle is equal to the sum of the measures of its two remote interior angles.

Exercise #4: In the diagram below, side \overline{NP} of $\triangle MNP$ has been extended from P to point Q . It is known that $m\angle MPQ = 148^\circ$ and $m\angle N = 76^\circ$. Find the measure of $\angle M$ two ways.

(a) By using facts about exterior angles and remote interior angles.

(b) By first finding the measure of $\angle MPN$ and then using the sum of the interior angles of a triangle.



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EXTERIOR ANGLES OF A TRIANGLE

N-GEN MATH[®] 8 HOMEWORK

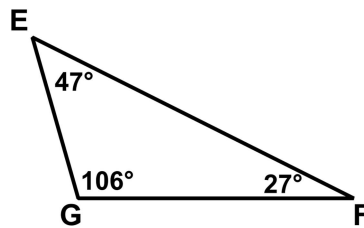
FLUENCY

1. The sum of all the measures of the exterior angles of a triangle is equal to

- (1) 90° (3) 270°
 (2) 180° (4) 360°

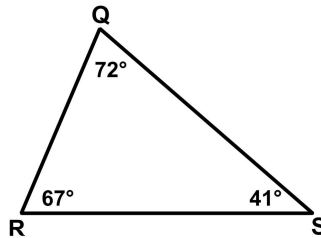
2. For triangle EFG shown below, what is the measure of the exterior angle at vertex G?

- (1) 27° (3) 74°
 (2) 47° (4) 94°



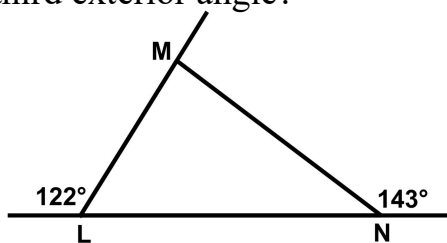
3. How many degrees greater is the external angle at S than the internal angle at R in $\triangle QRS$ shown below?

- (1) 26° (3) 108°
 (2) 72° (4) 124°



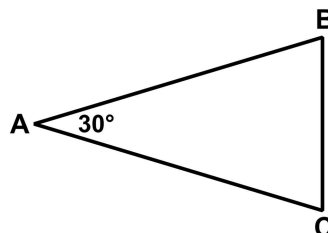
4. The diagram below shows the measures of the two exterior angles of $\triangle LMN$. Which of the following is the measure of the third exterior angle?

- (1) 95° (3) 110°
 (2) 105° (4) 115°



5. In triangle ABC below, the measures of $\angle B$ and $\angle C$ are equal. What is the measure of the exterior angle at C?

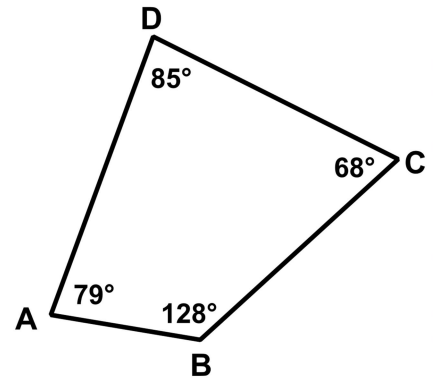
- (1) 100° (3) 125°
 (2) 105° (4) 150°





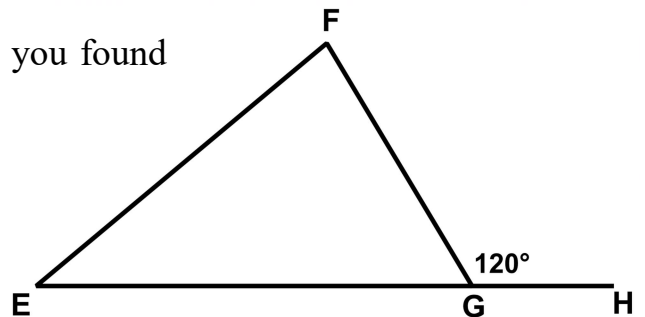
6. For quadrilateral ABCD shown below do the following:

- Extend each side of the quadrilateral to create a single exterior angle at each vertex.
- Find and label the measure of each exterior angle on the diagram.
- Find the sum of the exterior angles below.



7. In $\triangle EFG$ below, side \overline{EG} has been extended through point G to point H . The measure of $\angle FGH$ is equal to 120° . It is known that the measure of $\angle F$ is twice that of $\angle E$.

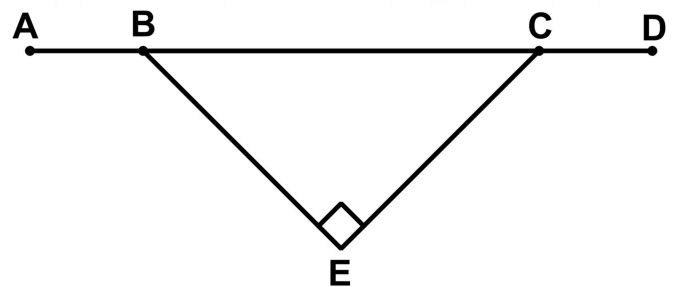
Find the measure of $\angle E$. Show or explain how you found your answer.



USING YOUR MATH

8. A right triangular brace is hanging from a beam in a ceiling. Right triangle BEC has equal base angles, i.e. $m\angle ECB = m\angle EBC$.

What is the measure of exterior angle $\angle ABE$?



REASONING

9. In triangle ABC shown, the measures of $\angle 1$ and $\angle 2$ are equal. Explain why the measure of exterior $\angle 3$ must be twice the measure of $\angle 1$.

