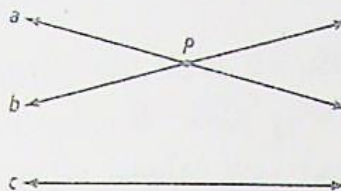


## Topic 2-3 "Parallel Lines and Triangle Angle Sums"

## EXPLORE &amp; REASON

Two parallel lines never intersect. But, can two lines that intersect ever be parallel to the same line?

Draw point  $P$ . Then draw lines  $a$  and  $b$  that intersect at point  $P$  as shown.



- A. Place a pencil below the intersecting lines on your paper to represent line  $c$ . Rotate the pencil so that it is parallel to line  $b$ . Can you rotate the pencil so that it is parallel to line  $a$  at the same time?

No. The pencil cannot be parallel to both lines ( $a$  &  $b$ ) at the same time.

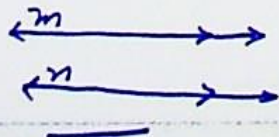
- B. Look for Relationships Can you adjust your drawing of the two intersecting lines so you can rotate the pencil to be parallel to both lines? MR.7

No, no matter how small the angle is between the two intersecting lines ( $a$  &  $b$ ), the pencil can only be parallel to one of those lines at a time. One line will always slant UP and the other line DOWN - so the pencil would have to be oriented that way for each and can't slant both "up" and "down" simultaneously!

## HABITS OF MIND

Look for Relationships Suppose you draw two lines that are parallel. Is it possible to draw a third line that intersects only one of the parallel lines? Explain. MR.7

No. Lines are infinite in length, so the third line



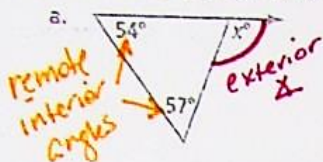


**EXAMPLE 4** Try It! Apply the Triangle Exterior Angle Theorem

4. What is the value of  $x$  in each figure?

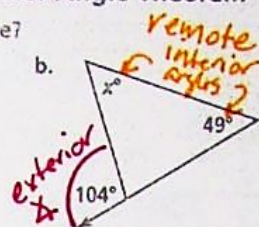
Th<sup>m</sup> 2-12

"An exterior angle of a triangle is equal to the sum of the two remote interior angles"



$$x = 54 + 57$$

$$\boxed{x = 111}$$



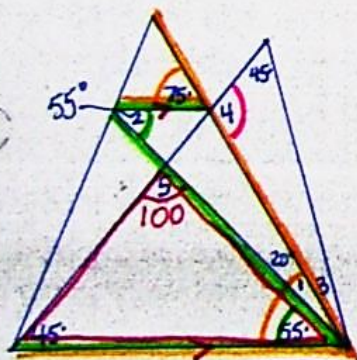
$$x + 49 = 104$$

$$x = 104 - 49$$

$$\boxed{x = 55}$$

**EXAMPLE 5** Try It! Apply the Triangle Theorems

5. What are the measures of  $\angle 4$  and  $\angle 5$ ? Explain.



Exterior Angle  
 $\angle 4 = 45 + (55 + 20)$

$$\angle 4 = 45 + 75$$

$$\boxed{m\angle 4 = 120^\circ}$$

Triangle Sum

$$\angle 5 + 45 + 55 = 180$$

$$\angle 5 + 100 = 180$$

$$\angle 5 = 180 - 100$$

$$\boxed{m\angle 5 = 80^\circ}$$

|| lines  $\rightarrow$  corr.  $\Delta$ 's  $\cong$   
 $\angle 1 + 55 = 75$   
 $\therefore \angle 1 = 20^\circ$

|| lines  $\rightarrow$  alt int  $\Delta$ 's  $\cong$   
 $\angle 2 = 55^\circ$

**HABITS OF MIND**

Look for Relationships How is the Triangle Exterior Angle Theorem related to the Triangle Angle-Sum Theorem? **MP.7**

Each exterior angle is supplementary to an interior angle — which the two remote interior angles are also supplementary to! (Supps of the same  $\Delta$  are  $\cong$ )

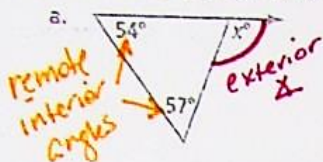


**EXAMPLE 4** Try It! Apply the Triangle Exterior Angle Theorem

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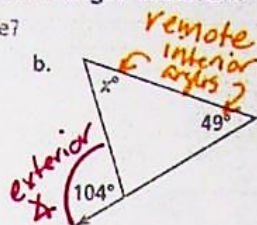
Th<sup>m</sup> 2-12

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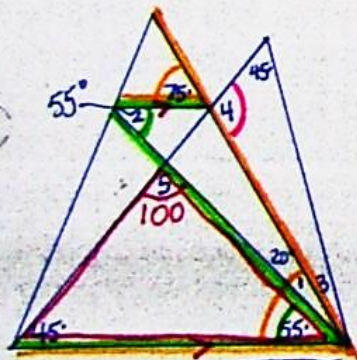
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**EXAMPLE 5** Try It! Apply the Triangle Theorems

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**HABITS OF MIND**

Look for Relationships How is the Triangle Exterior Angle Theorem related to the Triangle Angle-Sum Theorem? **MP.7**

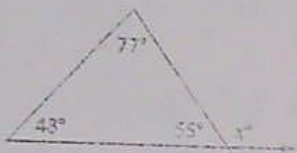
Each exterior angle is supplementary to an interior angle — which the two remote interior angles are also supplementary to! (Supps of the same  $\Delta$  are  $\cong$ )



### Do You UNDERSTAND?

1. What is true about the interior and exterior angle measures of any triangle?
- The sum of the interior angles of any triangle is  $180^\circ$ .
  - An exterior angle of a triangle is always equal to the sum of the measures of the two remote interior angles.

2. **Error Analysis** Chiang determined that the value of  $x$  is 103 and the value of  $y$  is 132 in the figure below. What mistake did Chiang make? @ MP3



$\angle x$  and  $\angle y$  are vertical angles, so they are congruent. They are both exterior angles whose sum equals the sum of  $48 + 77 = 125^\circ$ .

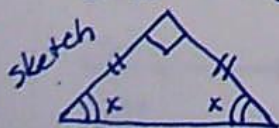
3. **Vocabulary** The word remote means distant or far apart. What parts of a figure are remote interior angles distant from?

They are "distant" from an exterior angle.

4. **Look for Relationships** Use the Triangle Angle-Sum Theorem to answer the following questions. Explain your answers.

- What are the measures of each angle of an equilateral triangle?  $180 \div 3 = 60^\circ$
- If one of the angle measures of an isosceles triangle is  $90^\circ$ , what are the measures of the other two angles? @ MP7

Process info { isosceles - 2 congruent sides (at least)  
 $90^\circ$  - right angle



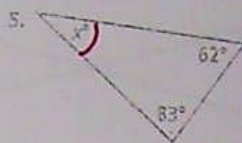
$$90 + 2x = 180$$

$$2x = 90$$

$$x = 45^\circ$$

### Do You KNOW HOW?

What is the value of  $x$  in each figure?

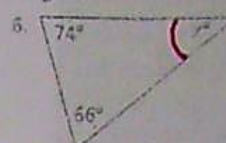


$$x + 83 + 62 = 180$$

$$x + 145 = 180$$

$$x = 180 - 145$$

$$x = 35$$



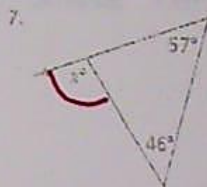
$$x + 74 + 66 = 180$$

$$x + 140 = 180$$

$$x = 180 - 140$$

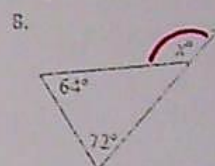
$$x = 40$$

What is the value of  $x$  in each figure?



$$x = 46 + 57$$

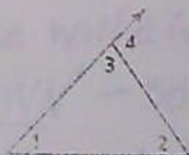
$$x = 103$$



$$x = 64 + 72$$

$$x = 136$$

9. Write an equation relating the measures of  $\angle 1$ ,  $\angle 2$ , and  $\angle 3$ . Write another equation relating the measures of  $\angle 1$ ,  $\angle 2$ , and  $\angle 4$ .



$$\angle 1 + \angle 2 + \angle 3 = 180 \text{ (}\Delta \text{ Sum)}$$

$$\angle 3 + \angle 4 = 180 \text{ (Ext } \Delta \text{ Thm)}$$

$$\therefore \angle 1 + \angle 2 + \angle 3 = \angle 3 + \angle 4$$

Transitive Property

$$- \angle 3 \quad - \angle 3$$

Subtraction Property

$$\angle 1 + \angle 2 = \angle 4$$

Sum of remote interior angles = Exterior Angle