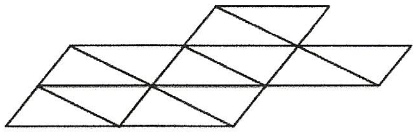
Lesson 2.1.4
Angles in a Triangle

Name *Notes*

- So far in this chapter, you have investigated the angle relationships created when two lines intersect, forming vertical angles. You have also investigated the relationships created when a transversal intersects two parallel lines. Today you will study the angle relationships that result when three non-parallel lines intersect, forming a triangle. Explore also using either of the following eTools: Angles in a Triangle(html5) or *Angles in a Triangle*(Flash).

- **2-37.** Marcos decided to change his tiling from problem 2-14 by drawing diagonals in each of the parallelograms. Find his pattern, shown below, on the Lesson 2.1.4 Resource Page.



a. Copy one of Marcos's triangles onto tracing paper. Use a colored pen or pencil to shade one of the triangle's angles on the tracing paper. Then use the same color to shade every angle on the resource page that is equal to the shaded angle.

b. Repeat this process for the other two angles of the triangle, using a different color for each angle in the triangle. When you are done, every angle in your tiling should be shaded with one of the three colors.

c. Now examine your colored tiling. What relationship can you find between the three different-colored angles? You may want to focus on the angles that form a straight angle. What does this tell you about the angles in a triangle? Write a conjecture in the form of a conditional statement or an arrow diagram. If you write a conditional statement, it should begin, "*If a polygon is a triangle, then the measure of its angles…*".

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d. How can you convince yourself that your conjecture is true for all triangles? That is, given parallel lines (since the tiling was generated by translating parallelograms), why does $a = d$ and $c = e$ in the diagram at below? If technology is available, use it to test many different angle measures.

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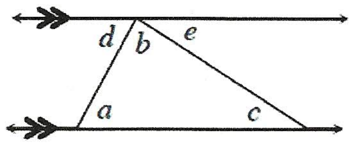
$d + b + e = 180°$

$\angle d \cong \angle a \rightarrow$ Alt. Int $\angle s$

$\angle e \cong \angle c \rightarrow$ Alt. Int $\angle s$

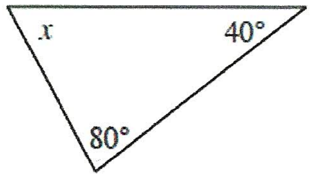


$\therefore\ b + a + c = 180°$

Then add this angle relationship to your Angle Relationships Toolkit from Lesson 2.1.3. This will be referred to as the **Triangle Angle Sum Theorem**. (A theorem is a statement that has been proven.)

- **2-38.** Use your theorem from problem 2-37 about the angles in a triangle to find x in each diagram below. Show all work.

a.

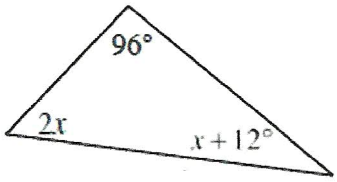


$x + 40 + 80 = 180$

$x + 120 = 180$

$\boxed{x = 60°}$

b.



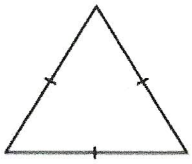
$2x + 96 + x + 12 = 180$

$3x + 108 = 180$

$\frac{3x}{3} = \frac{72}{3}$

$\boxed{x = 24}$

- **2-39.** What can the Triangle Angle Sum Theorem help you learn about special triangles?

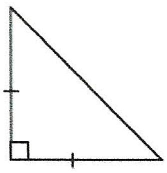


$\frac{180}{3} = \boxed{60°}$

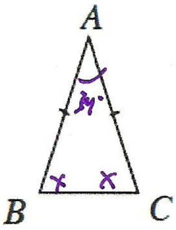
a. Find the measure of each angle in an equilateral triangle. Justify your conclusion.

b. Consider the isosceles right triangle (also sometimes referred to as a "half-square") below. Find the measures of all the angles in a half-square.

$180 - 90 = \frac{90}{2} = \boxed{45°}$



c. What if you only know one angle of an isosceles triangle? For example, if $m\angle A = 34°$, what are the measures of the other two angles?



$x+x+34=180$

$\frac{2x}{2}=\frac{146}{2}$

$\boxed{x=73^\circ}$

2-40. TEAM REASONING CHALLENGE

How much can you figure out about the figure at right using your knowledge of angle relationships? Work with your team to find the measures of all the labeled angles in the diagram below. Justify your solutions with the name of the angle relationship you used. Carefully record your work as you go and be prepared to share your reasoning with the rest of the class.