Chapter 7 Constructions and Scale Drawings
Section 7.1 Adjacent and Vertical Angles

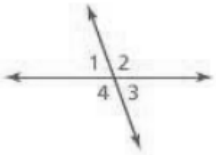
Key Vocabulary
adjacent angles, *p. 272*
vertical angles, *p. 272*
congruent angles, *p. 272*

Key Ideas

Adjacent Angles

Words Two angles are **adjacent angles** when they share a common side and have the same vertex.

Examples

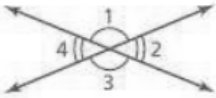


$\angle 1$ and $\angle 2$ are adjacent.
$\angle 2$ and $\angle 4$ are not adjacent.

Vertical Angles

Words Two angles are **vertical angles** when they are opposite angles formed by the intersection of two lines. Vertical angles are **congruent angles**, meaning they have the same measure.

Examples



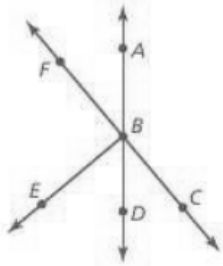
$\angle 1$ and $\angle 3$ are vertical angles.
$\angle 2$ and $\angle 4$ are vertical angles.

EXAMPLE 1 Naming Angles

Use the figure shown.

a. Name a pair of adjacent angles.

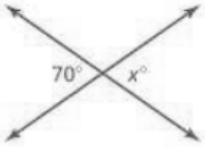
b. Name a pair of vertical angles.



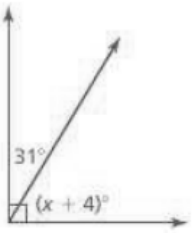
EXAMPLE 2 Using Adjacent and Vertical Angles

Tell whether the angles are *adjacent* or *vertical*. Then find the value of x.

a.



b.



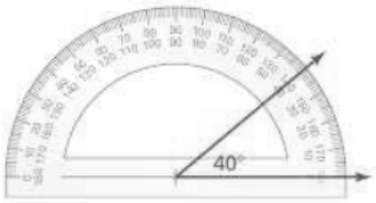
Remember

You can add angle measures. When two or more adjacent angles form a larger angle, the sum of the measures of the smaller angles is equal to the measure of the larger angle.

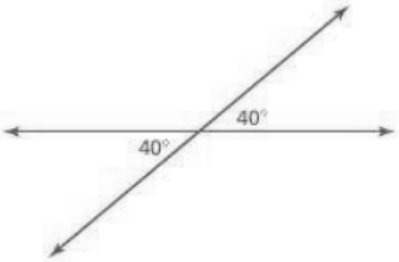
EXAMPLE 3 Constructing Angles

Draw a pair of vertical angles with a measure of 40°.

Step 1: Use a protractor to draw a 40° angle.



Step 2: Use a straightedge to extend the sides to form two intersecting lines.



Chapter 7 Constructions and Scale Drawings
Section 7.2 Complementary and Supplementary

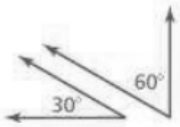
Key Vocabulary
complementary angles, *p. 278*
supplementary angles, *p. 278*

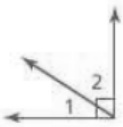
Key Ideas

Complementary Angles

Words Two angles are **complementary angles** when the sum of their measures is 90°.

Examples



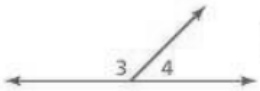


∠1 and ∠2 are complementary angles.

Supplementary Angles

Words Two angles are **supplementary angles** when the sum of their measures is 180°.

Examples

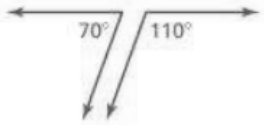


∠3 and ∠4 are supplementary angles.

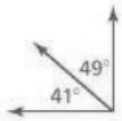
EXAMPLE 1 Classifying Pairs of Angles

Tell whether the angles are *complementary*, *supplementary*, or *neither*.

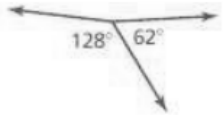
a.



b.



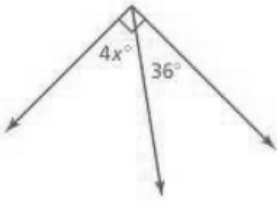
c.



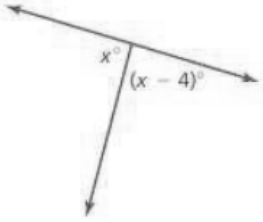
EXAMPLE 2 Using Complementary and Supplementary Angles

Tell whether the angles are *complementary* or *supplementary*. Then find the value of x.

a.



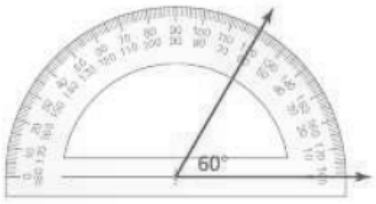
b.



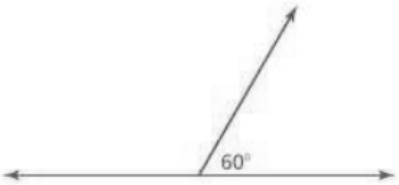
EXAMPLE 3 Constructing Angles

Draw a pair of adjacent supplementary angles so that one angle has a measure of 60°.

Step 1: Use a protractor to draw a 60° angle.



Step 2: Extend one of the sides to form a line.



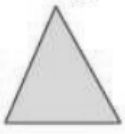
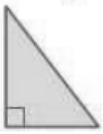
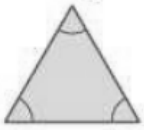
Chapter 7 Constructions and Scale Drawings
Section 7.3 Triangles

Key Vocabulary
congruent sides, *p. 284*

You can use side lengths and angle measures to classify triangles.

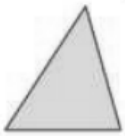
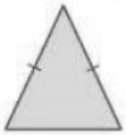
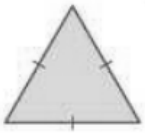
Key Ideas

Classifying Triangles Using Angles

acute triangle	*obtuse* triangle	*right* triangle	*equiangular* triangle
			
all acute angles	1 obtuse angle	1 right angle	3 congruent angles

Classifying Triangles Using Sides

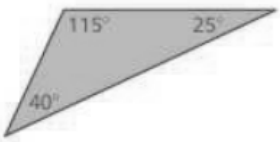
Congruent sides have the same length.

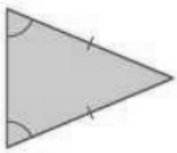
scalene triangle	*isosceles* triangle	*equilateral* triangle
		
no congruent sides	at least 2 congruent sides	3 congruent sides

Reading
Red arcs indicate congruent angles.
Red tick marks indicate congruent sides.

EXAMPLE 1 Classifying Triangles

Classify each triangle.

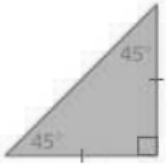
a. 

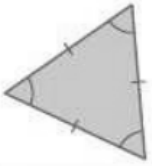
b. 

On Your Own

Now You're Ready
Exercises 6–11

Classify the triangle.

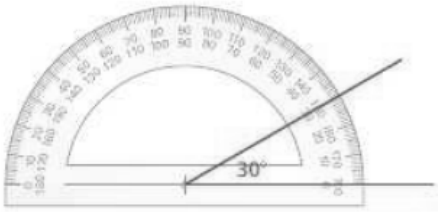
1. 

2. 

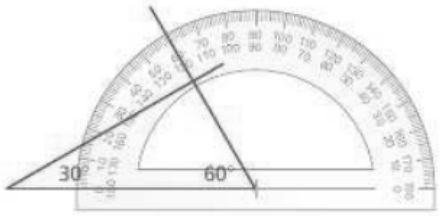
EXAMPLE 2 Constructing a Triangle Using Angle Measures

Draw a triangle with angle measures of 30°, 60°, and 90°. Then classify the triangle.

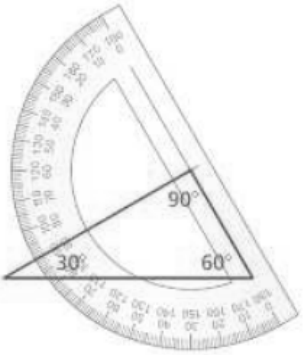
Step 1: Use a protractor to draw the 30° angle.



Step 2: Use a protractor to draw the 60° angle.



Step 3: The protractor shows that the measure of the remaining angle is 90°.



∴ The triangle is a right scalene triangle.

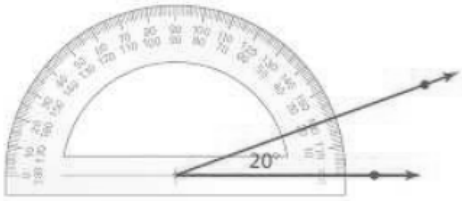
Study Tip

After drawing the first two angles, make sure you check the remaining angle.

EXAMPLE 3 Constructing a Triangle Using Side Lengths

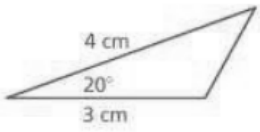
Draw a triangle with a 3-centimeter side and a 4-centimeter side that meet at a 20° angle. Then classify the triangle.

Step 1: Use a protractor to draw a 20° angle.



Step 2: Use a ruler to mark 3 centimeters on one ray and 4 centimeters on the other ray.

Step 3: Draw the third side to form the triangle.



∴ The triangle is an obtuse scalene triangle.

Extension 7.3 Angle Measures of Triangles

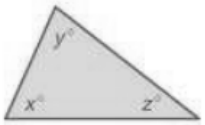
Check It Out
Lesson Tutorials
BigIdeasMath.com

Key Idea

Sum of the Angle Measures of a Triangle

Words The sum of the angle measures of a triangle is 180°.

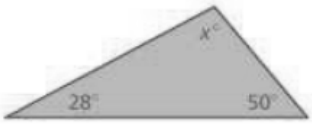
Algebra $x + y + z = 180$



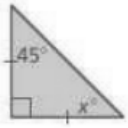
EXAMPLE 1 Finding Angle Measures

Find each value of x. Then classify each triangle.

a.



b.



FLORIDA STANDARDS

Geometry

In this extension, you will

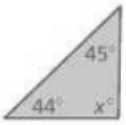
- understand that the sum of the angle measures of any triangle is 180°.
- find missing angle measures in triangles.

Learning Standard
MAFS.7.G.2.5

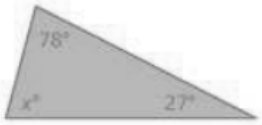
Practice

Find the value of x. Then classify the triangle.

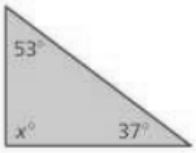
1.



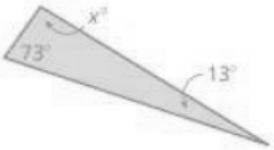
2.



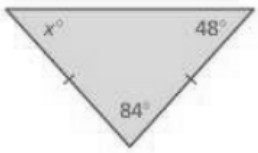
3.



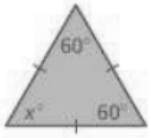
4.



5.



6.



Tell whether a triangle can have the given angle measures. If not, change the first angle measure so that the angle measures form a triangle.

7. 76.2°, 81.7°, 22.1°

8. 115.1°, 47.5°, 93°

9. $5\frac{2}{3}°$, $64\frac{1}{3}°$, 87°

10. $31\frac{3}{4}°$, $53\frac{1}{2}°$, $94\frac{3}{4}°$

EXAMPLE 2 Finding Angle Measures

Math Practice 1

Analyze Givens

What information is given in the problem? How can you use this information to answer the question?

Find each value of x. Then classify each triangle.

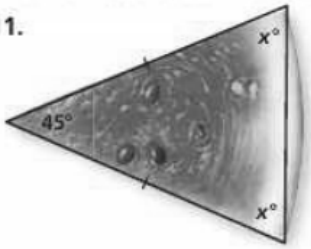
a. Flag of Jamaica

b. Flag of Cuba

Practice

Find the value of x. Then classify the triangle.

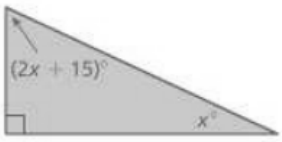
11.



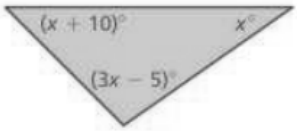
12.

13.

14.



15.

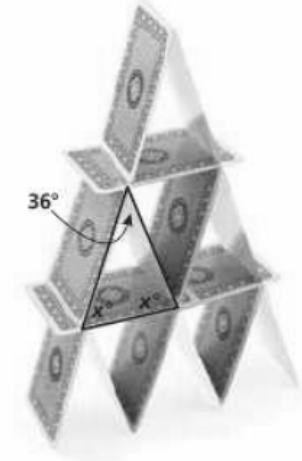


16. REASONING Explain why all triangles have at least two acute angles.

17. CARDS One method of stacking cards is shown.

a. Find the value of x.

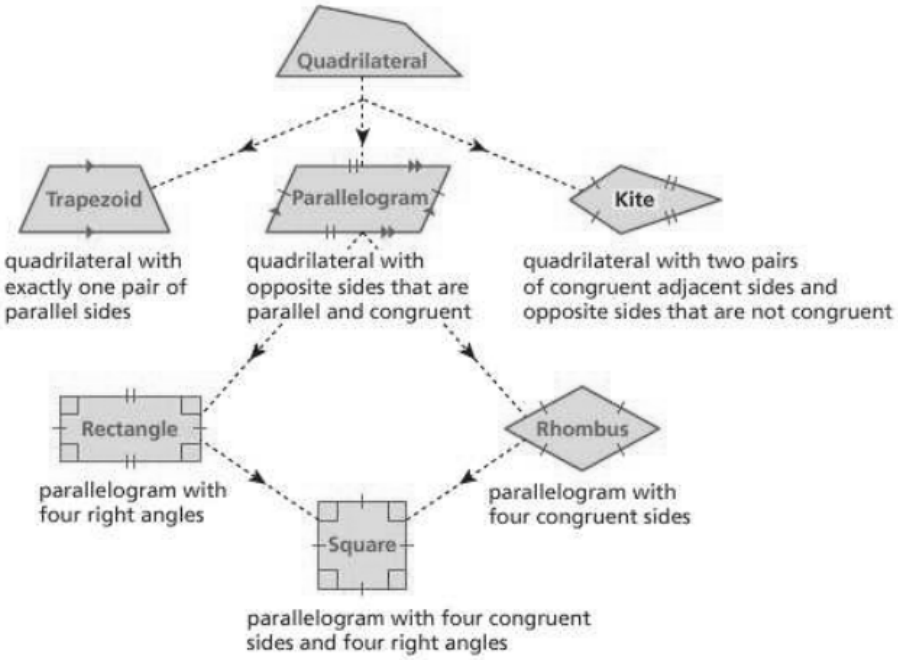
b. Describe how to stack the cards with different angles. Is the value of x limited? If so, what are the limitations? Explain your reasoning.



Chapter 7 Constructions and Scale Drawings
Section 7.4 Quadrilaterals

Key Vocabulary
kite, *p. 294*

A quadrilateral is a polygon with four sides. The diagram shows properties of different types of quadrilaterals and how they are related. When identifying a quadrilateral, use the name that is most specific.



Reading

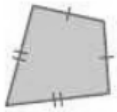
Red arrows indicate parallel sides.

EXAMPLE 1 Classifying Quadrilaterals

Classify the quadrilateral.

a.

b.



Study Tip

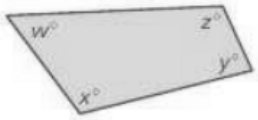
In Example 1(a), the square is also a parallelogram, a rectangle, and a rhombus. Square is the most specific name.

Key Idea

Sum of the Angle Measures of a Quadrilateral

Words The sum of the angle measures of a quadrilateral is 360°.

Algebra $w + x + y + z = 360$



EXAMPLE 2 Finding an Angle Measure of a Quadrilateral

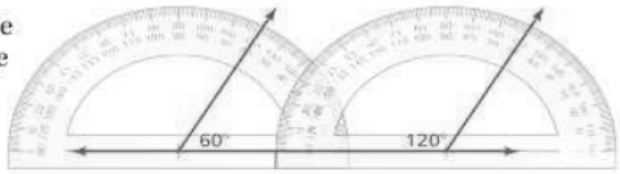
Find the value of x.

EXAMPLE 3 Constructing a Quadrilateral

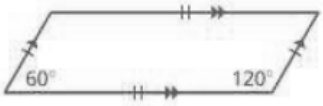
Draw a parallelogram with a 60° angle and a 120° angle.

Step 1: Draw a line.

Step 2: Draw a 60° angle and a 120° angle that each have one side on the line.



Step 3: Draw the remaining side. Make sure that both pairs of opposite sides are parallel and congruent.



Chapter 7 Constructions and Scale Drawings
Section 7.5 Scale Drawings

Key Vocabulary
scale drawing, *p. 300*
scale model, *p. 300*
scale, *p. 300*
scale factor, *p. 301*

Key Ideas

Scale Drawings and Models

A **scale drawing** is a proportional, two-dimensional drawing of an object.
A **scale model** is a proportional, three-dimensional model of an object.

Scale

The measurements in scale drawings and models are proportional to the measurements of the actual object. The **scale** gives the ratio that compares the measurements of the drawing or model with the actual measurements.

$\frac{1 \text{ in.}}{10 \text{ mi}}$ ← drawing distance / actual distance

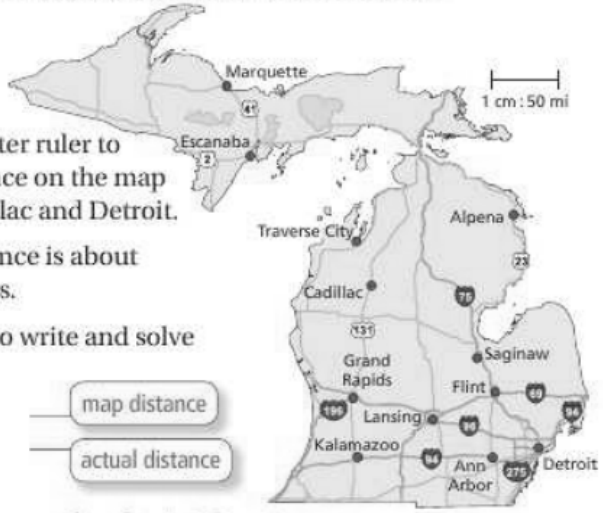
1 in. : 10 mi
drawing : actual

Study Tip

Scales are written so that the drawing distance comes first in the ratio.

EXAMPLE 1 Finding an Actual Distance

What is the actual distance *d* between Cadillac and Detroit?



Step 1: Use a centimeter ruler to find the distance on the map between Cadillac and Detroit.

The map distance is about 3.5 centimeters.

Step 2: Use the scale to write and solve a proportion.

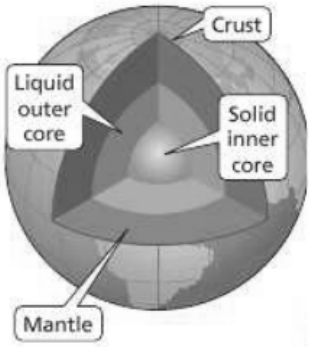
map distance
actual distance

Cross Products Property

Multiply.

EXAMPLE 2 Finding a Distance in a Model

The liquid outer core of Earth is 2300 kilometers thick. A scale model of the layers of Earth has a scale of 1 in. : 500 km. How thick is the liquid outer core of the model?



Ⓐ 0.2 in. Ⓑ 4.6 in. Ⓒ 0.2 km Ⓓ 4.6 km

A scale can be written without units when the units are the same. A scale without units is called a **scale factor**.

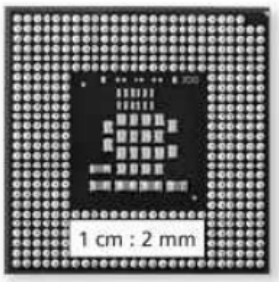
EXAMPLE 3 Finding a Scale Factor

A scale model of the Sergeant Floyd Monument is 10 inches tall. The actual monument is 100 feet tall.

a. What is the scale of the model?

b. What is the scale factor of the model?

EXAMPLE 4 Finding an Actual Perimeter and Area



The scale drawing of a computer chip helps you see the individual components on the chip.

a. Find the perimeter and the area of the computer chip in the scale drawing.

b. Find the actual perimeter and area of the computer chip.

c. Compare the ratios $\frac{\text{drawing perimeter}}{\text{actual perimeter}}$ and $\frac{\text{drawing area}}{\text{actual area}}$ to the scale factor.

Study Tip

The ratios tell you that the perimeter of the drawing is 5 times the actual perimeter, and the area of the drawing is $5^2 = 25$ times the actual area.