# *Understand* Angles

Think It Through

What is an angle?

Squares, rectangles, and circles are geometric shapes. An **angle** is another geometric shape.

Suppose you have two pencils lying straight across a table. You could put the erasers together to give the pencils a common endpoint. Then if you turned one pencil until it points straight up, you would form a **right angle**.

two pencils   **right angle**
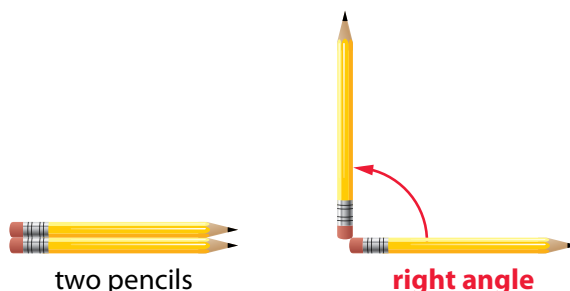
This is the kind of angle you find at the corners of a square or rectangle. Trace the right angle with your finger. Name some right angles you see in your classroom.

### Think You can describe other angles by comparing them to a right angle.

If you stop turning the pencil before it makes a right angle, you would form an **acute angle**. If you keep turning the pencil after it makes a right angle, but stop before it makes a straight line, you would form an **obtuse angle**.

acute angle   **obtuse angle**
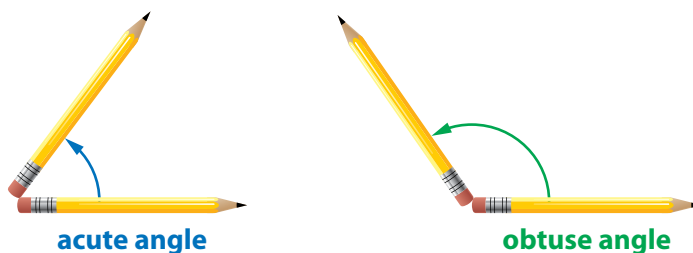
Trace the acute and obtuse angles with your finger. Name some acute and obtuse angles you see in your classroom.

Think Angles and circles are related.

Suppose you turn the pencil clockwise and you keep turning the pencil until it is back at its starting position. If you trace the full turn, you trace a circle.
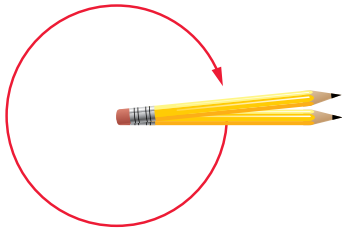
> Two hands on a clock form an angle. The angle changes as the hands turn.

Think about the way a second hand travels around the face of a clock. It turns the same small amount each second. Imagine that you move the pencil like a second hand, except that you make each move so small that it takes 360 turns to go around the full circle. Each turn is an angle that measures one **degree**.

The size of the clock face and the length of the hands do not change the measure of the angle. The measure of the angle describes how wide the angle is open. The length of the sides of the angle does not change this.

▶ Reflect

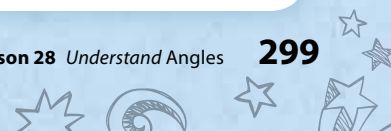**1** Describe and compare the circles and angles in the clocks below.

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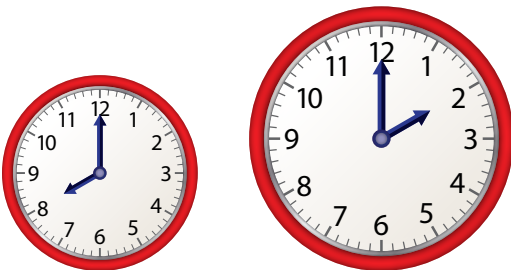
Think About **Measures of Angles**

🔍 **Let's Explore the Idea** **The measure of any angle is equal to the number of one-degree angles one side has turned through.**

2 There are _____ one-degree angles in a full circle.

3 An angle showing a full turn through a circle measures _____ degrees.

The drawing below shows an angle that turns through several one-degree angles. Use the drawing to answer problems 4 and 5.
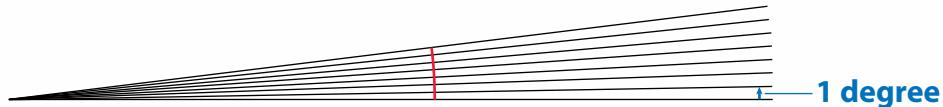
1 degree

4 The angle shows a turn through 7 _____ -degree angles.

5 The angle measures _____ degrees.

Now try these two problems.

6 An angle shows a turn through 19 one-degree angles. What is the measure of

the angle? _____

7 An angle measures 275 degrees. How many one-degree angles does the angle

show a turn through? _____

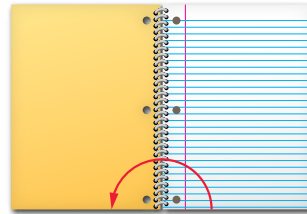## Let's Talk About It

Solve the problems below as a group.

8 Why is it reasonable to use the same units to describe circles and measures of angles? _____

_____

9 Mari lays a notebook flat on a table and opens it, as shown at the right.

How many one-degree angles did Mari turn the front cover through? _____

Think about the angle formed by the bottom edges of the front and back covers of the notebook. What does the angle look like? _____

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10 A second hand takes 60 equal turns to make a full circle around a clock face. How could you find the number of degrees the second hand turns through in one turn?
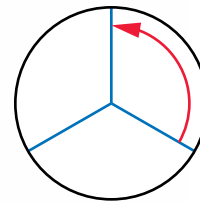
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▶ **Try It Another Way**   **Work with your group to show the connection between fractions of a circle and angle measure. All three sections of the circle are the same size.**

11 The angle shows a turn through $\dfrac{1}{\boxed{}}$ of the circle.

12 The angle shows a turn through $\dfrac{1}{\boxed{}}$ of 360 degrees.

13 The angle shows a turn through $\dfrac{1}{\boxed{}} \times$ _____ = _____ degrees.

14 The angle measures _____ degrees.

Talk through these problems as a class, then write your answers below.

15 Infer Mr. Smith said, "Last week, Julia was against starting a Recreation Club at school. But, now she has done a 180." Use math terms to explain what Mr. Smith probably means.

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16 Explain Mark says that an angle showing a turn through $\frac{1}{4}$ of a circle that is 10 inches across is two times the measure of an angle showing a turn through $\frac{1}{4}$ of a circle that is 5 inches across. Is Mark correct? Explain your answer.

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17 Compare Which is greater: An angle showing a turn through $\frac{1}{6}$ of a circle or an angle showing a turn through $\frac{1}{5}$ of a circle? Explain your answer.
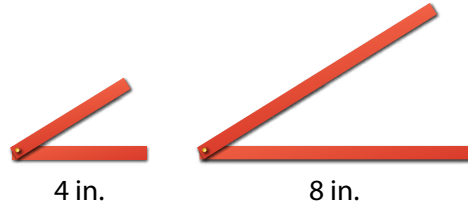
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Apply **Ideas About Angle Measures**

18 **Put It Together**   Use what you have learned to complete this task.

Part A Use two 4-inch strips of cardboard, two 8-inch strips of cardboard, and two brass fasteners to make the "angle explorers" shown below.

Angle explorers on this page are not life-sized.

4 in.   8 in.

Part B Use the 8-inch explorer to make an angle that turns through $\frac{1}{4}$ of a circle. Use the 4-inch explorer to make an angle that turns through $\frac{1}{2}$ of a circle. You can use the corner and edges of a piece of paper to help make the angles.

Describe the relationship between the measures of the two angles.

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Part C Explain how you found your answer.

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