

# Angles

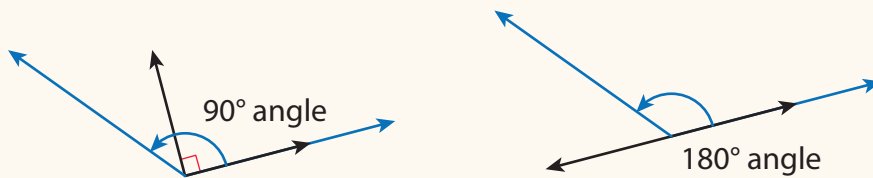


Dear Family,

This week your child is learning to measure and draw angles.

Your child is learning how to find an angle's exact measure.

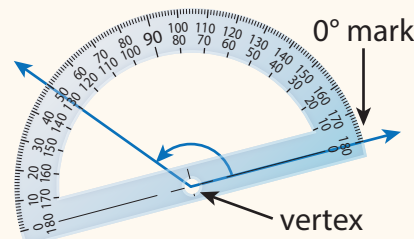
Before measuring an angle, it is helpful to estimate the measure by using benchmarks, such as a right angle and a straight angle. For example, to estimate the measure of the blue angle below, compare it to a right angle and to a straight angle.



A right angle has a measure of 90 **degrees**. A straight angle has a measure of 180 degrees. The measure of the blue angle is between 90 degrees and 180 degrees.

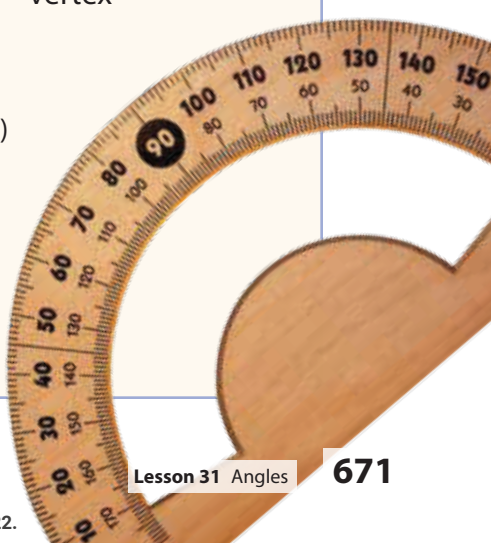
To find the exact measure of the angle, your child is learning to use a tool called a **protractor**.

- Line up the center point of the protractor with the vertex of the angle.
- Then line up one ray with the 0° mark.
- Read the mark on the protractor that the other ray passes through.



The angle measures 130°. (The ray also passes through the 50° mark, but since the angle is bigger than a 90° angle, the measure is not 50°.)

Invite your child to share what he or she knows about measuring and drawing angles by doing the following activity together.



## ACTIVITY MEASURING ANGLES

Do this activity with your child to estimate the measure of angles.

- Identify angles in and around your home or outside in the yard or neighborhood. You can also look through magazines or newspapers for pictures that show angles.

Here are some examples of angles you might find (or make):

Angles formed by the hands on a clock or watch



Angles made by a bicycle frame



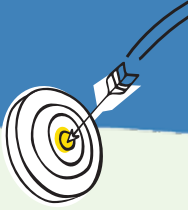
Angles formed by fingers or by the bend of an elbow



- Estimate the measure of each angle by using right angles (such as the corner of a sheet of paper) and straight angles (such as the side of a sheet of paper) as benchmarks.

Look for other real-world opportunities to estimate angle measures with your child.

# Explore Angles



Previously, you learned to identify angles. Now you will learn more about angles and angle measurement. Use what you know to try to solve the problem below.

**Lily and Dora each turn the hour hand on a clock face. They make different angles by turning the hour hand. Who makes the greater angle? Explain how you know.**



Lily's angle



Dora's angle

## Learning Targets

- An angle that turns through  $n$  one-degree angles is said to have an angle measure of  $n$  degrees.
- Measure angles in whole-number degrees using a protractor. Sketch angles of specified measure.

**SMP** 1, 2, 3, 4, 5, 6, 7

## TRY IT



## Math Toolkit

- clocks
- clock face
- index cards
- sticky notes



## DISCUSS IT

**Ask your partner:** How did you get started?

**Tell your partner:** I started by ...

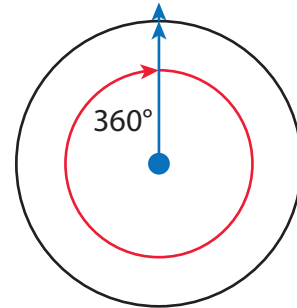
# CONNECT IT

## 1 LOOK BACK

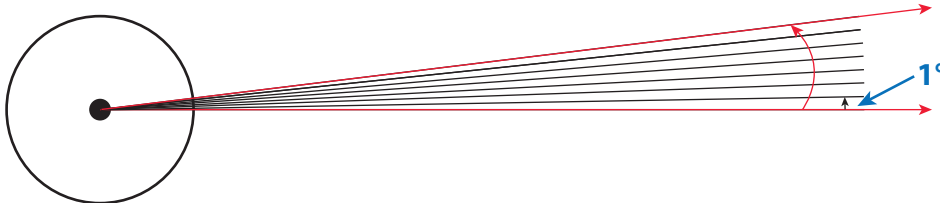
Explain how you know who makes the greater angle, Lily or Dora.

## 2 LOOK AHEAD

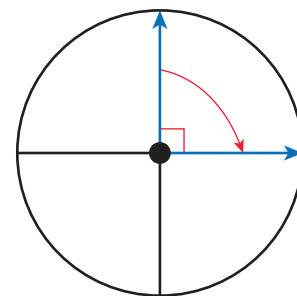
You can measure angles to compare them. A **degree** is a unit of measure for angles. Show degrees with the symbol  $^{\circ}$ . The angle made by a full turn of a ray in a circle measures 360 degrees, or  $360^{\circ}$ .



- a. Look at the diagram below. An angle that turns through  $\frac{1}{360}$  of a circle is called a  $1^{\circ}$  angle. How many  $1^{\circ}$  angles are in a circle? .....



- b. The red angle in the diagram turns through part of the circle. Count to find the measure of the red angle. Write the measure of the red angle. ....
- c. A ray turns to form a right angle in the circle at the right. What is the measure, in degrees, of a right angle? Explain.



## 3 REFLECT

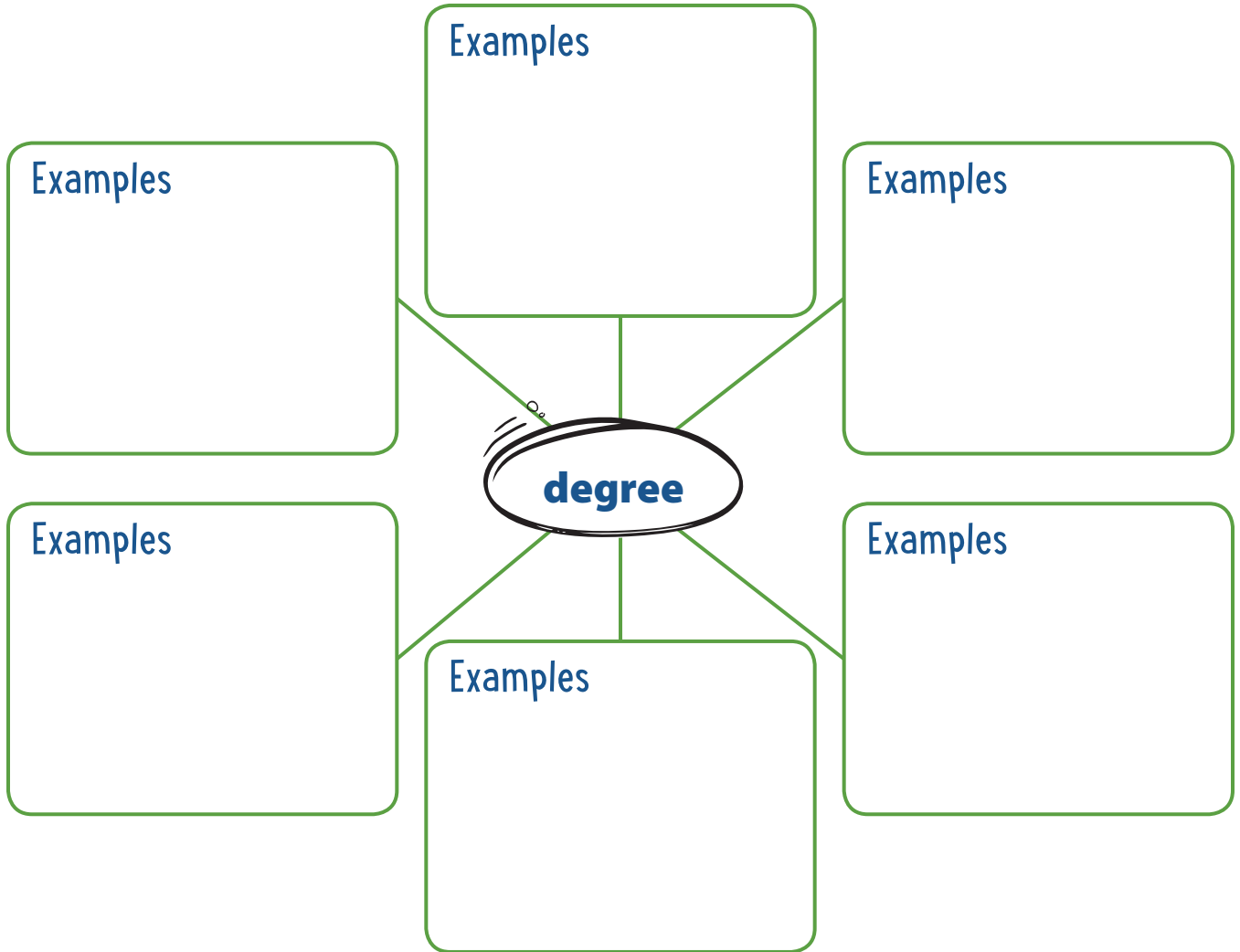
How does the way a ray turns through a circle help you think about the measure of an angle?

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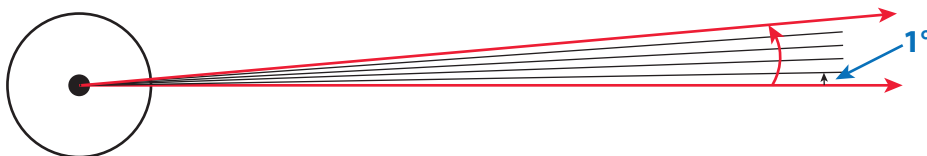
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# Prepare for Angles

- 1 Think about what you know about angles. Fill in each box. Use words, numbers, and pictures. Show as many ideas as you can.



- 2 The red angle below turns through part of the circle. Count to find the measure of the red angle. Write the measure of the angle in degrees. ....



3 Solve the problem. Show your work.

**Beau and Kong each turn the hour hand on a clock face. They make different angles by turning the hour hand. Who makes the greater angle? Explain how you know.**



**Beau's angle**



**Kong's angle**

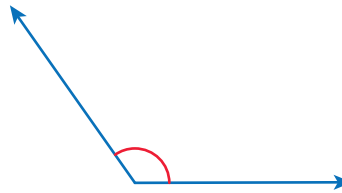
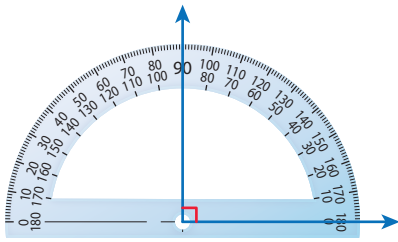
**Solution** .....

4 Check your answer. Show your work.

# Develop Using a Protractor

Read and try to solve the problem below.

A protractor is a tool used to measure angles. The protractor below shows that the measure of a right angle is  $90^\circ$ . Kara draws the other angle below. What is the measure of Kara's angle? How can you find out?



## TRY IT



### Math Toolkit

- protractors
- rulers
- index cards
- sticky notes



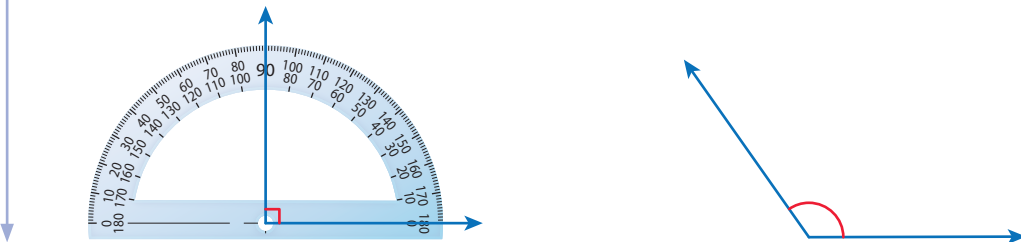
## DISCUSS IT

**Ask your partner:** Can you explain that again?

**Tell your partner:** I knew . . . so I . . .

Explore different ways to understand how to use benchmarks and a protractor to measure an angle.

**A protractor is a tool used to measure angles. The protractor below shows that the measure of a right angle is  $90^\circ$ . Kara draws the other angle below. What is the measure of Kara's angle? How can you find out?**



## PICTURE IT

You can use benchmarks to estimate the measure.

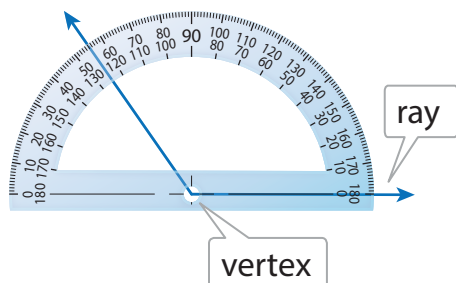


Kara's angle seems to be between  $90^\circ$  and  $180^\circ$ . It is obtuse.

## MODEL IT

You can use a protractor to measure the angle.

- First, line up either mark showing  $0^\circ$  on the protractor with one ray of the angle.



- Next, line up the center point of the protractor with the vertex of the angle. Remember that the vertex is the point where two rays meet to form an angle.
- Then look at the other ray to read the number of degrees.



## CONNECT IT

Now you will use the problem from the previous page to help you understand how to use a protractor to measure an angle.

- 1 Estimate the angle measure of Kara's angle.
- 2 Why must you line up the protractor's center point with the vertex of the angle?
- 3 Suppose you line up one ray with either mark showing  $10^\circ$  or  $170^\circ$  instead of either mark showing  $0^\circ$  or  $180^\circ$ . How would it change which mark the other ray points to?
- 4 Line up either mark showing  $0^\circ$  or  $180^\circ$  with one ray. Which mark does the other ray point to?
- 5 Which number of degrees is the measure of the angle? Explain how you know.

## 6 REFLECT

Look back at your **Try It**, strategies by classmates, and **Picture It** and **Model It**. Which models or strategies do you like best for measuring an angle? Explain.

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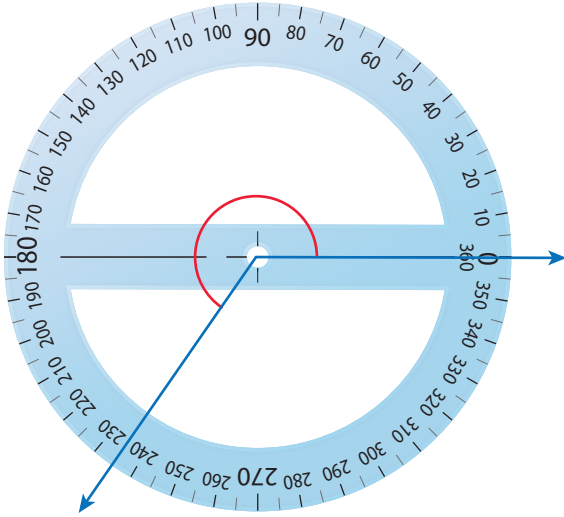
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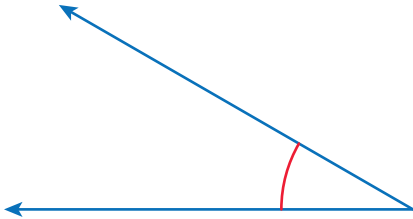
# APPLY IT

Use what you just learned to solve these problems.

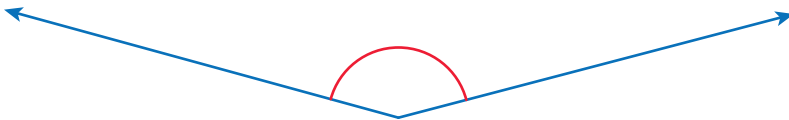
7 What is the measure, in degrees, of the angle shown? .....



8 What is the measure of the angle shown? .....



9 What is the measure of the angle shown? .....



# Practice Using a Protractor

Study the Example showing how to use a protractor to measure an angle. Then solve problems 1–5.

## EXAMPLE

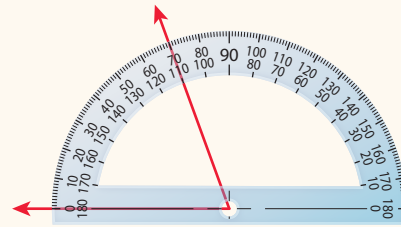
Omar draws the angle at the right. What is the measure of the angle?

Line up the  $0^\circ$  or the  $180^\circ$  mark on a protractor with one ray of the angle.

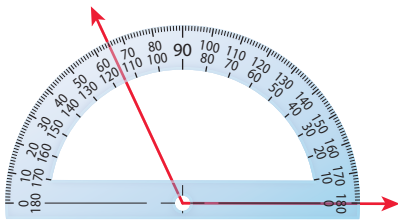
Line up the center point of the protractor with the vertex of the angle.

Look at the other ray. Read the number of degrees on the protractor. Read the number that is less than  $90^\circ$ .

The angle measures  $70^\circ$ .

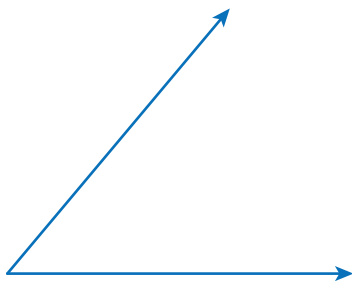


- 1 Read the number of degrees on the protractor to find the measure of the angle.



The angle measures ..... degrees.

- 2 Use a protractor to measure the angle below.



The angle measures ..... degrees.

## Vocabulary

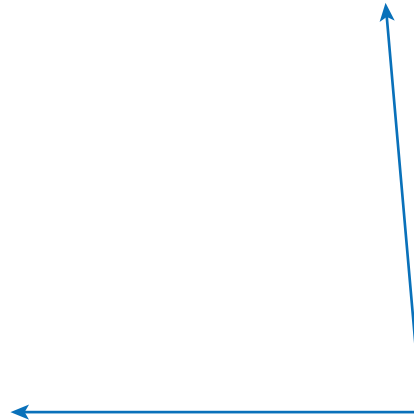
**degree ( $^\circ$ )** a unit of measure for angles.

**protractor** a tool used to measure angles.

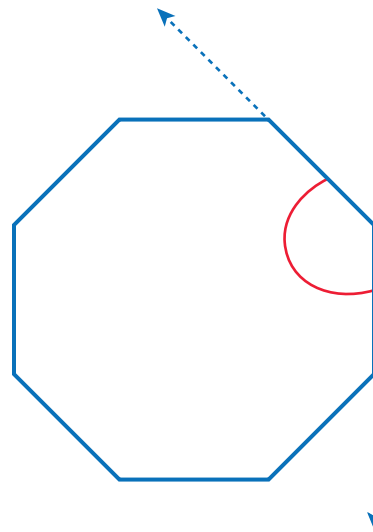
**vertex** the point where two rays, lines, or line segments meet to form an angle.

For problems 3–5, use a protractor to measure the angles. Write each measure.

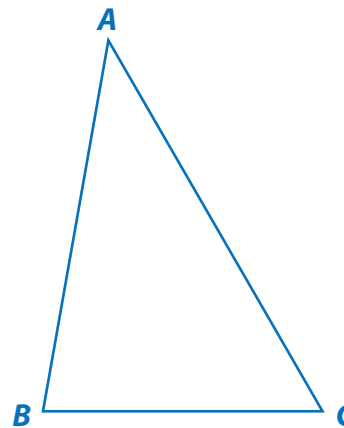
- 3 Measure the angle at the right.  
The angle measures ..... degrees.



- 4 Measure one angle of the polygon at the right.  
The angle measures ..... degrees.



- 5 Measure the angles of the triangle at the right.  
Angle *A* measures ..... degrees.  
Angle *B* measures ..... degrees.  
Angle *C* measures ..... degrees.



# Develop Drawing Angles

Read and try to solve the problem below.

Draw a  $30^\circ$  angle. Think about using two pencils to make an angle.



## TRY IT



### Math Toolkit

- protractors
- rulers
- index cards
- sticky notes



## DISCUSS IT

**Ask your partner:** Do you agree with me? Why or why not?

**Tell your partner:** I agree with you about ... because ...

Explore different ways to understand how to draw angles.

Draw a  $30^\circ$  angle. Think about using two pencils to make an angle.

## PICTURE IT

You know an angle is made up of two rays with a common endpoint, called the vertex.

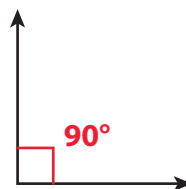
You can use two pencils to make an angle.



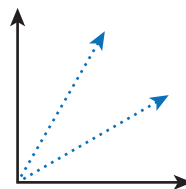
## MODEL IT

You can use a benchmark angle to get an idea of what your drawing should look like.

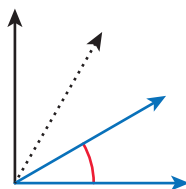
Think about a right angle. A right angle measures  $90^\circ$ .



You know  $30 \times 3 = 90$ . Imagine rays that split the  $90^\circ$  angle into 3 angles of equal measure.



A  $30^\circ$  angle opens about the same amount as the angle shown at the right.

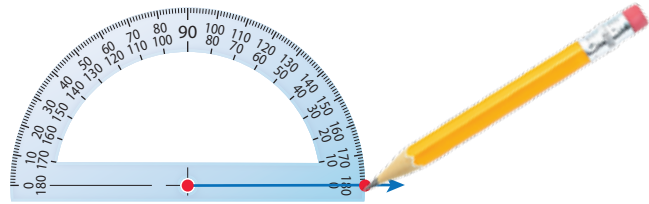


## CONNECT IT

Now you will use the problem from the previous page to help you understand how to draw angles.

1 Draw a ray on a sheet of paper. Then place the protractor's center point on the endpoint of your ray. What part of the angle is that point? .....

2 Keeping the protractor's center point on the endpoint of your ray, draw a point on your ray at  $0^\circ$ .



3 There are two marks on the protractor labeled "30." Choose the one that is  $30^\circ$  from your  $0^\circ$  mark. Draw a point at this mark.

4 Use the straight edge of the protractor to draw a ray from the vertex through the point you drew at  $30^\circ$ .

5 Suppose you choose the other "30" mark and draw a point at that mark. What would be the measure of your angle? .....

6 Think about a right angle. Compare it to the angle you drew. How wide does your angle open compared to a right angle? .....

## 7 REFLECT

Look back at your **Try It**, strategies by classmates, and **Picture It** and **Model It**. Which models or strategies do you like best for drawing angles? Explain.

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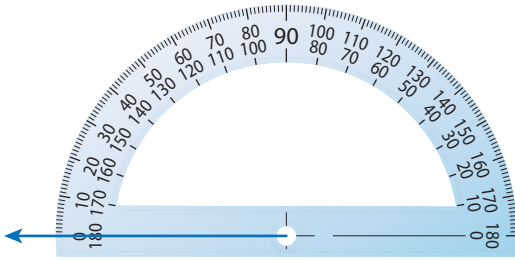
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## APPLY IT

Use what you just learned to solve these problems.

- 8 Angle  $D$  measures  $80^\circ$ . One ray of angle  $D$  is shown. Draw another ray to make angle  $D$ .



- 9 Draw a  $75^\circ$  angle.

- 10 Draw a  $100^\circ$  angle.



# Practice Drawing Angles

Study the Example showing how to draw an angle. Then solve problems 1–6.

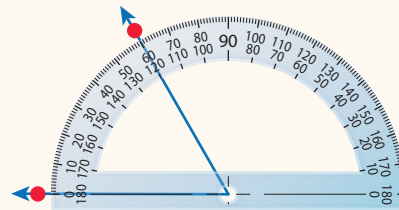
## EXAMPLE

Stephanie wants to draw a  $60^\circ$  angle. She draws a ray and positions the endpoint of the ray on a protractor's center point. Then she lines up the protractor so the ray passes through the  $0^\circ$  mark on the protractor. How does she draw the other ray to form a  $60^\circ$  angle?

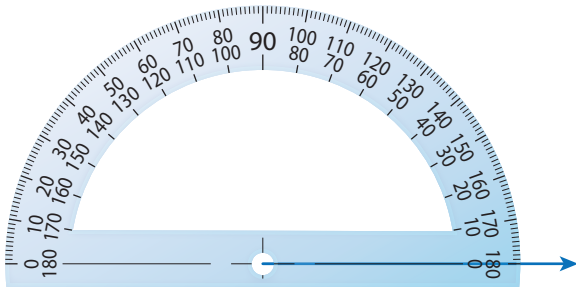
Find  $60^\circ$  on the protractor.

Choose the mark that is  $60^\circ$  from the first ray.  
Draw a point at this  $60^\circ$  mark.

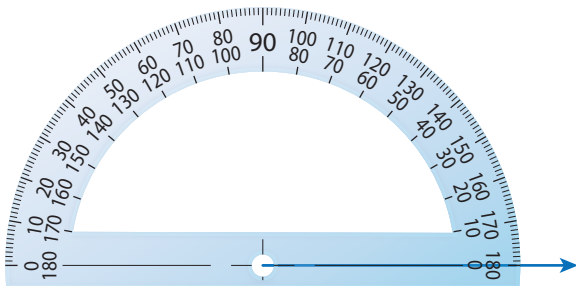
Draw a ray from the vertex through this point.



- 1 Draw a ray to show a  $70^\circ$  angle.



- 2 Draw a ray to show a  $110^\circ$  angle.



3 Draw a  $160^\circ$  angle.

4 Draw a  $20^\circ$  angle.

5 Draw a  $45^\circ$  angle.

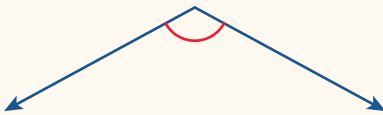
6 Draw a  $135^\circ$  angle.

# Refine Angles

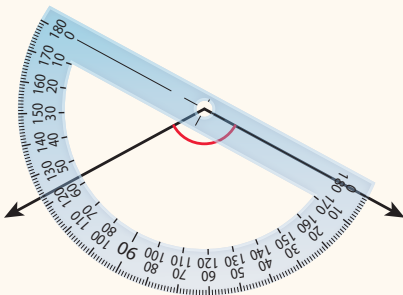
Complete the Example below. Then solve problems 1–8.

## EXAMPLE

What is the measure of the angle below?



Look at how you could use a protractor to measure the angle.



**Solution** .....

The center point lines up with the vertex of the angle, and the  $0^\circ$  mark lines up with one ray of the angle. The other ray points to the measure of the angle.

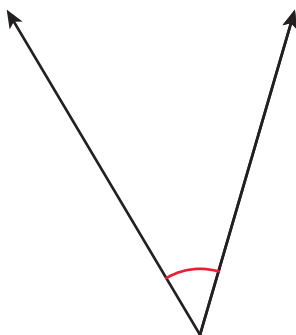


### PAIR/SHARE

Does it matter which ray you choose to line up with the  $0^\circ$  mark?

## APPLY IT

1 What is the measure of the angle below?



**Solution** .....

The angle looks like it opens less than a right angle. The measure will be less than  $90^\circ$ .

### PAIR/SHARE

How did you and your partner decide where the vertex is?

2 Draw a  $145^\circ$  angle.

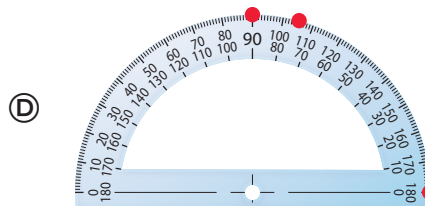
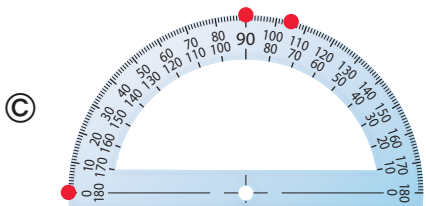
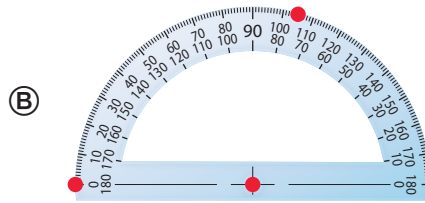
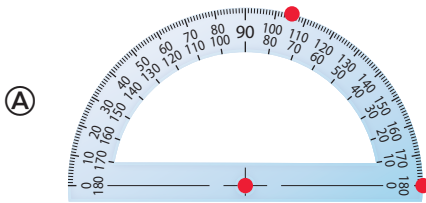
I'll need to draw two rays to make an angle.



**PAIR/SHARE**

If you had drawn a point at the other  $0^\circ$  mark, how would it change your angle?

3 Which set of points can be used to draw a  $105^\circ$  angle?



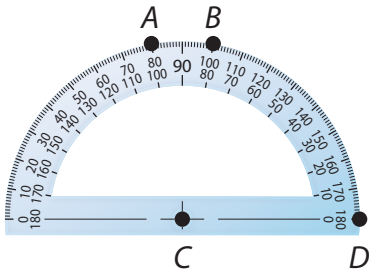
Will a  $105^\circ$  angle be wider or narrower than a right angle?

Mia chose (C) as the correct answer. How did she get that answer?

**PAIR/SHARE**

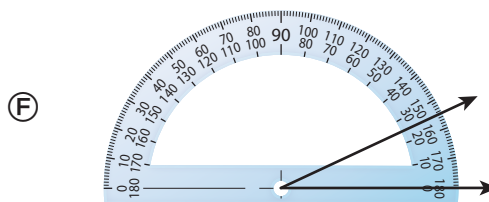
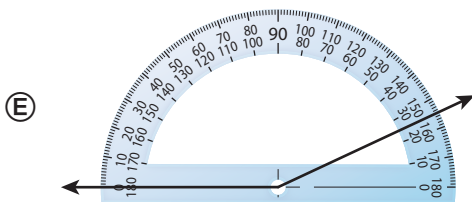
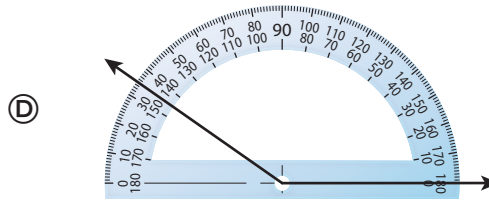
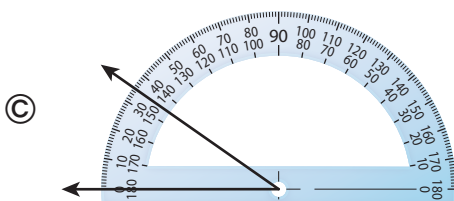
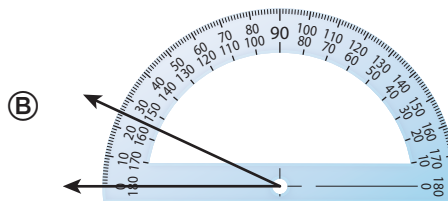
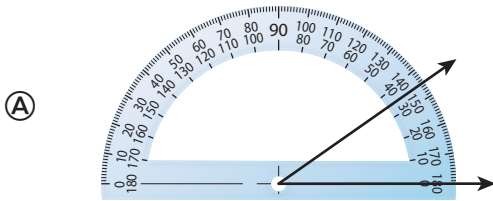
Does Mia's answer make sense?

- 4 Which point could be the vertex of an  $80^\circ$  angle that you could measure without moving the protractor?

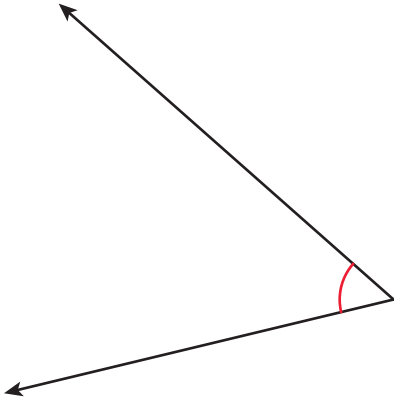


- (A) point A
- (B) point B
- (C) point C
- (D) point D

- 5 Which diagrams show a  $25^\circ$  angle?



- 6 What is the measure of the angle below?

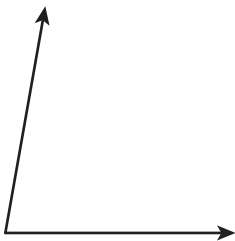



**Solution** .....

- 7 Draw a  $40^\circ$  angle.

## 8 MATH JOURNAL

Explain how you can use a protractor to measure the angle below.



 **SELF CHECK** Go back to the Unit 5 Opener and see what you can check off.