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# Circle Sighs



## Topic

Circles, radius and diameter

## Key Question

What are the radius and diameter of each of your circles?

## Learning Goal

Students will use paper clips to draw circles, determining their radii and diameters.

## Guiding Documents

*Project 2061 Benchmarks*

- *When people care about what is being counted or measured, it is important for them to say what the units are (three degrees Fahrenheit is different from three centimeters, three miles from three miles per hour).*
- *Tables and graphs can show how values of one quantity are related to values of another.*
- *Graphical display of numbers may make it possible to spot patterns that are not otherwise obvious, such as comparative size and trends.*

*NCTM Standards 2000\**

- *Build and draw geometric objects*
- *Use geometric models to solve problems in other areas of mathematics, such as number and measurement*
- *Measure with multiple copies of units of the same size, such as paper clips laid end to end*

## Math

Geometry

circles

Measurement

## Integrated Processes

Observing

Comparing and contrasting

Collecting and recording data

Interpreting data

Drawing conclusions



## Materials

*Part One*

paper clips, jumbo and regular size  
large construction paper 12" x 18", 2 sheets per pair of students  
tape  
chart paper

*Part Two*

paper clips, jumbo and regular size  
markers or colored tissue paper, white glue, and paint brushes (see *Management 1*)

## Background Information

Before students begin to use compasses and protractors, they should be given time to explore and enjoy the drawing of circles. In this activity they will use paper clips to draw circles and paper clip chains to measure the diameter and radius of each circle. Through the collection of data, students should reach the conclusion that the diameter is twice the length of the radius.

## Management

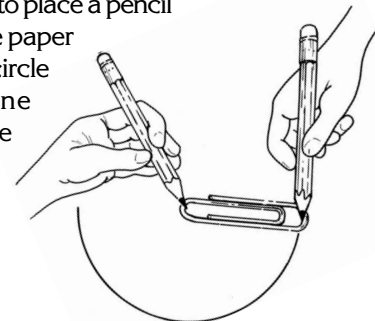
1. This activity is divided into two parts. In *Part One* the students will learn how to use paper clips to draw circles. They will collect and record data to determine the radius and diameter of each circle. In *Part Two* students will use paper clips to draw circles in interesting designs. They can then color their work or cut circles from colored tissue paper and adhere them to their drawings by applying a wash of white glue and water with a paint brush (one part white glue to two parts water).
2. Students should work in pairs with both taking turns drawing the circles.
3. Each pair will need 20 paper clips. They will use 10 chained together to make a measuring device with paper clip units (pc). The other ten will be used for drawing circles. For making comparisons, have some students use jumbo-size clips while others use regular-size clips.



## Procedure

*Part One*

1. Ask the students how they could use a paper clip to draw a circle. As they are describing their methods, try to follow their directions on the overhead projector. If students do not arrive at the solution that is illustrated (or a better one), demonstrate how to place a pencil in each loop of the paper clip and trace a circle as they spin one end around the stationary pencil in the other loop.



2. Inform them that they will be drawing circles on a piece of paper, along with measuring and recording the radii and diameters of the circles they have drawn. If appropriate, weave the story of the ranch hands riding from the rim of Circle Ranch to the resting place in the middle of the ranch for the radius measure and all the way across the circle, passing by the resting place, for the diameter measure.
3. Show students a chain of paper clips. Explain that they will use a similar device to measure their circles. Ask what units they think they will record for their measures. [paper clip units, or pc]
4. Distribute a sheet of paper (scratch paper will do) to each pair of students. Allow them time to practice drawing the circles.
5. Distribute the construction paper, two sheets per student pair. Direct students to tape a long edge of one sheet to a long edge of the other.
6. Have the students devise a strategy for finding the center of the paper and draw a dot there. Allow time for them to share their strategies and assist any who are having difficulties. (Strategies: measure; fold the paper in half horizontally and vertically and use the intersection; draw diagonals with a straight edge and use the intersection)
7. Distribute 20 paper clips to each pair of students. Have them chain 10 together as a measuring device and practice reading the length of items around their area. (For example, they might report their pencil is three paper clip units long.)
8. After measuring practice, direct students to use the center dot to draw all of their circles. Have them draw a circle using only one paper clip, then measure and record the distance from the center to the edge of the circle (radius). Next, direct them to measure and record the distance from one edge to the other edge, making sure their measuring chain goes through the center of the circle (diameter).
9. Continue to draw, measure, and record with two and three paper clips. Then ask students to predict, without measuring, how many paper clips they can use before the circle gets too big for the paper. Have them record their reasoning.
10. Allow time for the students to continue until they can no longer add paper clips for drawing circles and remain on the paper. (Those using the smaller paper clips will have more data to collect.)
11. When all circles are drawn, have the students compare their data, explaining why some groups drew more than others. Have them record any patterns they observed in their data. [The radius is always twice as long as the diameter.]
12. Challenge the students to determine the size paper needed for a circle with a radius of 15 jumbo paper clips or 20 regular clips. Then invite them to draw the circle on that size of chart paper.

### Part Two

1. Introduce some of the circle designs that are illustrated. Talk about the strategies for making them. Inform the students that the dots represent the middle of the circles they will draw. Allow students time to draw some.
2. Encourage the students to replicate a given design or create one of their own. Invite them to color their creations (or use the tissue paper/white glue wash).
3. Display their work.

### Connecting Learning

1. What is the radius of a circle? [It is a straight line from the center point of a circle to the circumference.]
2. What is the diameter of a circle? [It is a straight line that passes through the center point of a circle from one edge to the other edge.]
3. How are the radius and diameter of a circle related? [The diameter is twice the length of the radius.]
4. Will this pattern be different if you use the other loop on the paper clip? Explain. [No, it still takes two radii (on opposite sides of the circle center) to make the diameter.]
5. How many circles were you able to draw on the construction paper? What does the difference in the numbers tell you about the paper clips? [We used two different sizes of paper clips.]
6. How are your circles alike? [They are all round. They share the same center—they're concentric.] How are they different? [The radius and diameter differ in each one.]
7. What patterns did you notice in your data?
8. What patterns do you get when circles of the same size are drawn so that their centers are placed on the circumference of another circle? What do you notice? What is the measure between centers? What about circles of different sizes?
9. What things did you discover when you were drawing your circle designs? Which designs do you want to explore further? Why?

### Extensions

1. Have students symmetrically color their circle designs.
2. Have students research the five rings of the Olympic symbol and replicate them.
3. Investigate drawing circles using loops of string instead of paper clips.

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# Circle Signs



## Key Question

What are the radius and diameter of each of your circles?

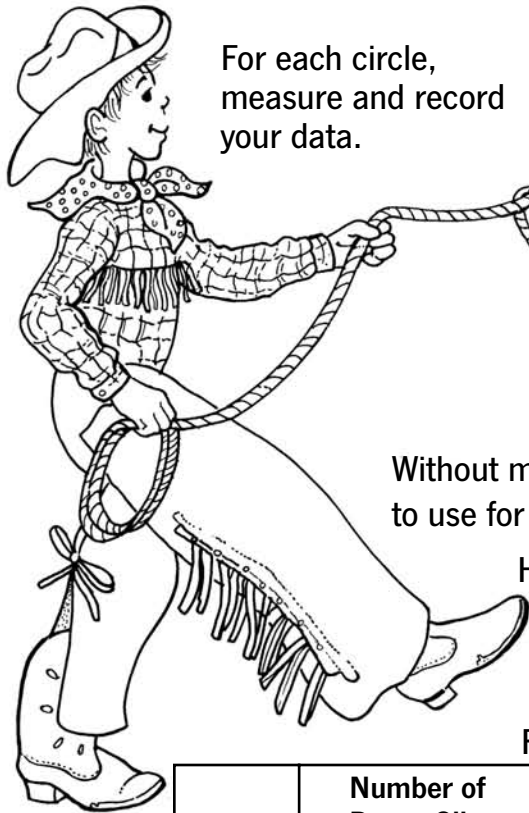
## Learning Goal

***Students will:***



- use paper clips to draw circles, determining their radii and diameters.



# Circle Signs



For each circle, measure and record your data.

Circle	Number of Paper Clips for Drawing	Radius (pc) 	Diameter (pc) 
A			
B			
C			

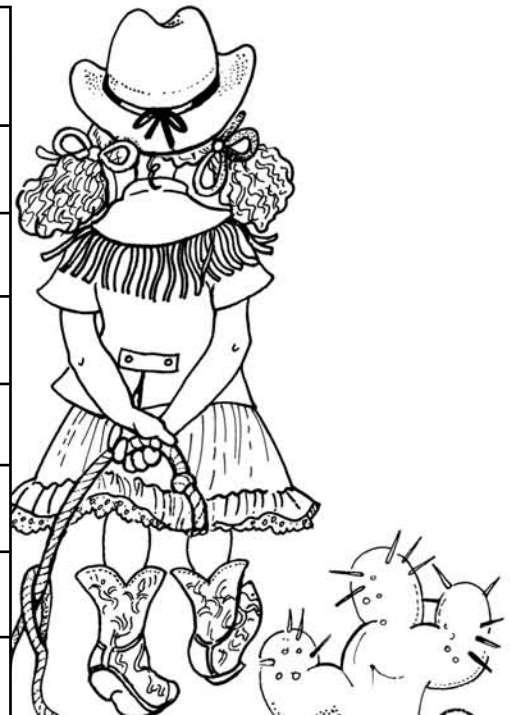
Without measuring, predict how many paper clips you'll be able to use for drawing circles before you go off the paper.

How did you decide?

Finish collecting your data.



Circle	Number of Paper Clips for Drawing	Radius (pc)	Diameter (pc)
D	4		
E	5		
F	6		
G	7		
H	8		
I	9		
J	10		



What patterns do you notice in your data?



# Circle



**A.**

1 2 3 4

**B.**

1 2 3 4

**C.**

1 2 3 4

**D.**

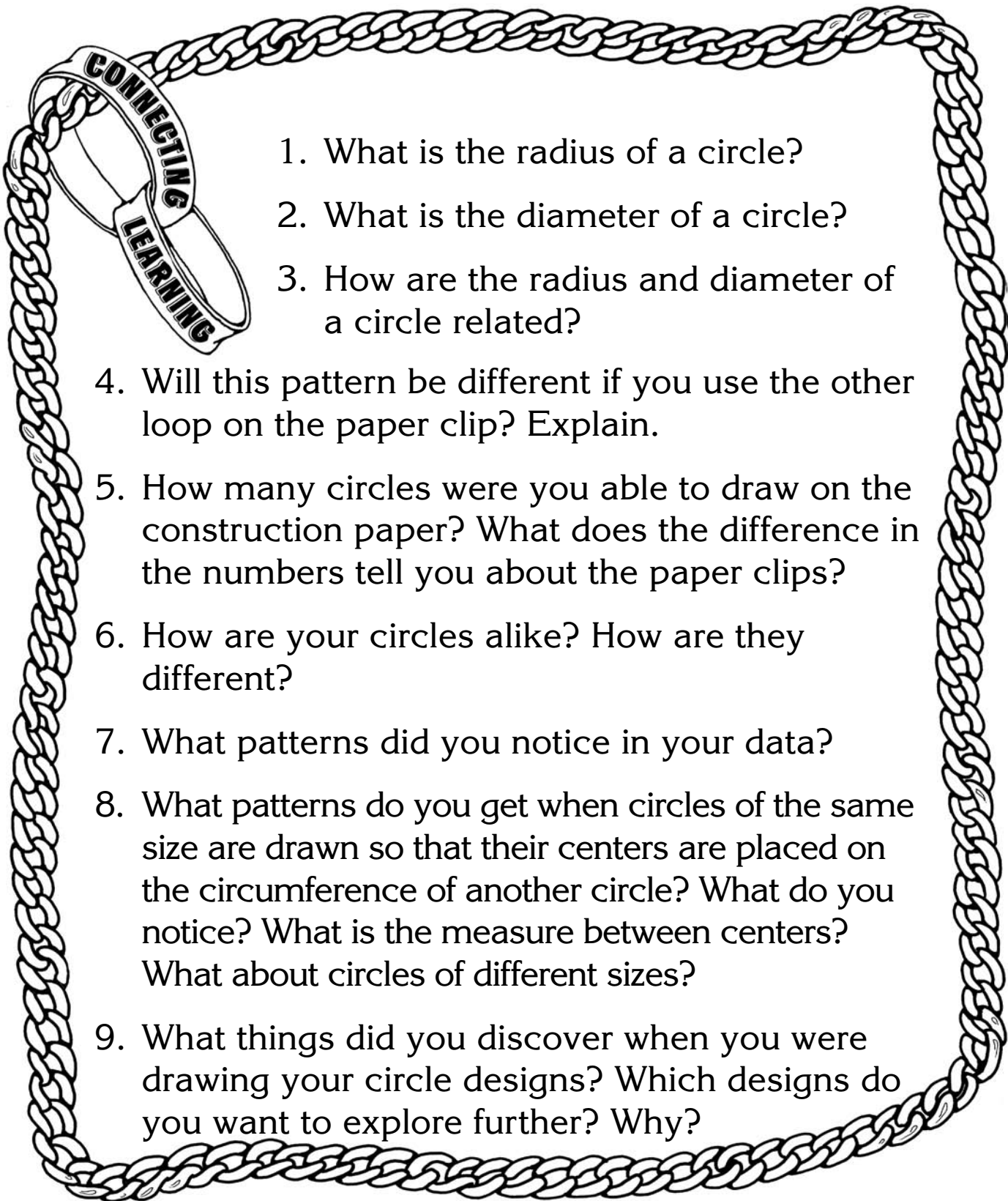
1 2 3 4 5 6 or

**E.**

1 2 3



# Circle Signs



1. What is the radius of a circle?
2. What is the diameter of a circle?
3. How are the radius and diameter of a circle related?
4. Will this pattern be different if you use the other loop on the paper clip? Explain.
5. How many circles were you able to draw on the construction paper? What does the difference in the numbers tell you about the paper clips?
6. How are your circles alike? How are they different?
7. What patterns did you notice in your data?
8. What patterns do you get when circles of the same size are drawn so that their centers are placed on the circumference of another circle? What do you notice? What is the measure between centers? What about circles of different sizes?
9. What things did you discover when you were drawing your circle designs? Which designs do you want to explore further? Why?