Logo-ometry

How do you recognize your team? If you had to design one image that captures your history, your spirit, your abilities, and it had to set you apart from everyone else, what would it look like? In this activity you will create a logo with some assistance from a couple of math tools.

HERE'S WHAT YOU'LL NEED:

- **Paper**
- **Pencil**
- **Mathematical Compass**
- **Ruler**
- **Scissors**
- **Optional: Markers or Colored pencils**

This activity can be done individually or with a partner, as well as in a classroom or at home.

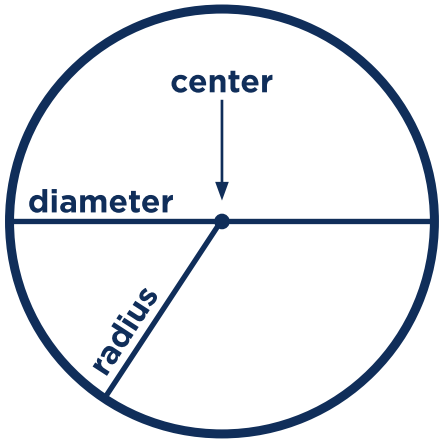


An important part of every team is the logo. A team's logo has to be bold, recognizable, and it has to represent the team all in a single image. Most logos are made of a combination of letters, shapes, colors, and images that may look simple at first glance, but are carefully crafted to evoke strong feelings in their fans.

For example, the Thunder logo is designed to feel powerful, electric, and unpredictably wild—just like the game of basketball. This is done through the bold lines and sharp edges. The shield represents OKC's tight-knit community. The colors represent depth and loyalty (blue), and energy and excitement (orange). The bold, modern font used for the "OKC" letters highlight the team's strong playstyle. All these different parts of the logo work together to connect the action and excitement that can be found at every game with the team.

Did you know math is used in designing a logo? Designs often use geometry, like circles, triangles, squares, and hexagons. To create some of these shapes, engineers, architects, and mathematicians use a tool called a **compass**. There are many different kinds of compasses, but the most common types have two pivoting arms, one with a pencil and one with a sharp point.

If you have never used a compass before, it may take practice to make good circles. Here is what to do. First, put a piece of paper on a thick surface like cardboard or a stack of paper so you don't poke the pointy end of the compass through and damage your table. Next, decide how wide you want your circle to be and spread the arms of the compass to about half of that size. (Half the width of a circle is its **radius**.) Decide where you want the middle of the circle to be and put the sharp point of the compass there. Gentle pressure will hold the arm in place as you swing the pencil around to trace out a circle.



Center: the point where you place the tip of a compass to draw a circle

Diameter: a straight line running through the center of a circle that stretches from edge to edge

Radius: a straight line from the center to the edge of a circle

If your circle doesn't look quite right, don't worry. A compass may look simple, but nobody does it right on their first try. Just try it again.

Once you are able to make nice circles, play with your compass. Did you know that compasses can be used for much more than just making circles? Ancient Greeks used a compass and straightedge to famously do other math problems, from addition to finding square roots. In **Game Time**, you will need your compass skills to create shapes other than circles, helping you develop that perfect logo.

Pro-Tip: If your circle still doesn't look right after you have tried it a few times, here are some tips to help. Be very careful not to squeeze the compass arms together or spread them apart as you make the circle. Be gentle and do not try to press hard on the pencil to make the circle darker. If you want a darker line just trace lightly around the same circle again and again. The way you hold the compass also makes a big difference. Try holding the compass by the very top. Hold it lightly between two fingers, lean the compass in the direction you want the pencil to move, and spin it between your fingertips.

GAME TIME

Once you can use a compass to draw a circle, try to use it to make different shapes that start with a circle. For example, take a compass and draw a small circle, then move the pointy end of the compass over and put it on one edge of the circle. Draw another circle whose center is right on the edge of the first circle. These two overlapping circles of the same size creates a mathematical shape called a **vesica piscis**. This shape gets its name from fish. In fact "vesica piscis" is Latin for "fish bladder". You may choose to use this shape in your logo.

One other thing you can do with two circles is find the exact middle of a line. Take your ruler and draw a short, straight line on your paper. Then, take your compass and spread the arms so they are wider than half the line. Put the point on the end of the line and draw a circle. Do the same to the other end of the line. Do you see the vesica piscis? Use your ruler to draw a

line that connects one pointed end of the vesica piscis shape to the other pointed end. The new line will cross your first line at its exact center, and at a right angle (90 degrees).

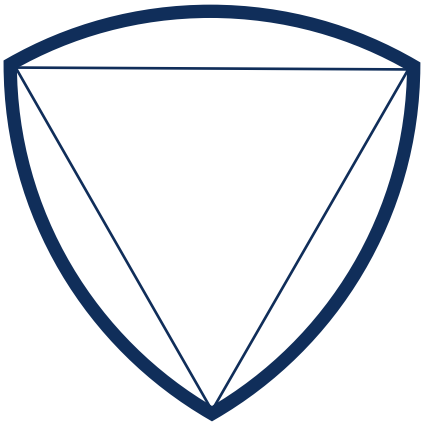
Remember when we said you could use a compass to make different shapes? Let's try doing that! If you want a square, you can take the crossed lines you just made and use your compass to draw a circle with the center at the point where the lines cross. Connect the four points where the straight lines cross this circle and you have a perfect square. Pretty neat, huh?

To make our next shape, you want to draw a small circle because you are going to add more circles to it. In fact you will need to draw three overlapping circles of the same size. Use the compass to draw one circle. Make your second circle with the center on the edge of your first one. Then to draw the third circle, put the pointy end of the compass on one of the intersections where the edge of the first and second one meet. The rounded triangle created where the three circles overlap also has a special name, **reuleaux** (pronounced: roo-LO). It is named after a German mathematician, Franz Reuleaux.

If you use your ruler to draw straight lines between the corners of the reuleaux, you will get a perfect equilateral triangle.



Circles Overlap to Make a Reuleaux Triangle



A Reuleaux Triangle With Lines Between the Corners

Take a quick time out and look closely at the Thunder logo again. The shield shape is actually a reuleaux! This is a fun shape with lots of amazing properties. Not only is it a part of the logo of the Thunder, you can also find this shape in the Wankle engine, which is used in high performance motorsports. This is because this shape is unusual. It is a shape with **constant width**.

A shape of constant width is a shape that no matter how you twist it or turn it, the distance from one side to the other is always exactly the same. A circle is the best known example of

a shape of constant width. When a circle rolls along, the top is always the same distance from the ground, but that doesn't look like it is possible with a reuleaux. To show that it is true, take your scissors and carefully cut out a reuleaux shape. Then, use your ruler to draw a straight line across a piece of paper. Place the reuleaux shape on the paper so one point touches the line. Then carefully draw a line parallel to the first one so it just touches the opposite side of the reuleaux shape. Now, move the shape around between the lines. You will notice that one side or the other is always touching both lines.

You probably have never thought about this before, but these shapes of constant width are important. They allow us to make lids or plugs that fit on the top of a container without falling in.

Back to using the compass to draw some shapes. You may wonder what happens if you continue to make overlapping circles. Well try it!

Draw one circle in the middle of the page. Then draw the same sized circle with the center on the edge of the first circle. Draw more circles with their centers at the point where the second circle crossed the first circle. Keep making circles where the previous circle crossed the first circle and before you know it you have drawn circles all the way around the first circle and arrived back at the point where you started. The pattern created by all the overlapping circles looks a little like a flower with six petals.

Connecting the tips of the flower petals with straight lines will make a six sided shape called a hexagon.

If you continue to draw circles that overlap the previous circle you can make a continuous pattern that fills the whole page and looks quite nice.

OVERTIME Let's take it further.

You can make almost any shape you can think of using a combination of compass and ruler. If you invent a shape no one has ever seen before, you could name it after yourself, or even give it a weird name if you wanted to like a squircle (combination of square and circle).

Once you have a shape you like, it is time to break out the colored pencils and put your own artwork on the shape to turn it into a logo. You can use words like your name or initials, or individual letters. The letters could fill the shape like the "S" on Superman's cape, they could go around the shape, or go right across it. Or, you could leave off the letters and use a symbol or picture that represents you. It is your logo after all! Have fun with it by experimenting with colors, shapes, and sizes. Who knows, you may create a logo that everyone wants on a t-shirt!

COACH'S CORNER
Additional information and explanations for parents and educators

Straightedge-and-compass construction has been a foundation of geometry for thousands of years. It does not depend on language or on units of measurement or even numbers at all. In fact, archeologists who studied ancient Egypt and Babylon knew some of their discoveries were geometry problems before the ancient languages had been deciphered because the concepts are so universal.

This method of construction is an ideal way to branch out from a field that is traditionally difficult to connect to. It first combines the fields of math and art to do simple things, but also leads to exploring what is possible with very simple tools. The things you can do and discover with a ruler and compass can lead into much deeper problems that include logic, math, and art.

DO YOU WANT TO LEARN MORE?

Search terms: names of common shapes, find square roots with a ruler and compass, solids of constant width, logos, tessellations

STANDARDS ALIGNMENT

This activity can be used to support students with developing the skills and/or content associated with the areas listed below.

Subject Areas and Skills/Content		2nd Grade	3rd Grade	4th Grade
Geometry & Measurement	Recognize regular and irregular trapezoids and hexagons.	●		
	Measure angles in geometric figures and real-world objects with a protractor or angle ruler.			●
	Describe, compare, and classify two-dimensional figures according to their geometric attributes.	●		
	Describe, classify, and construct quadrilaterals, including squares, rectangles, trapezoids, rhombuses, parallelograms, and kites. Recognize quadrilaterals in various models.			●
	Classify angles within a polygon as acute, right, obtuse, and straight.		●	
	Sort three-dimensional shapes based on attributes such as number of faces, vertices, and edges.	●		
	Recognize right angles and classify angles as smaller or larger than a right angle.	●		