

LESSON PLAN

Subject: Grade 8 Math

Lesson: The Many Shapes of a Chair

Standards Addressed: Understand and apply the Pythagorean Theorem. (NC.8.G.6, NC.8.G.7)

Objective:

- Students will be able to prove and apply the Pythagorean theorem in graphing a model of an octagonal chair leg.

Materials Needed:

- Device for viewing the video
- $\frac{1}{4}$ inch Graph Paper
- Ruler
- Compass
- “The Many Shapes of a Chair” Activity

Outline:

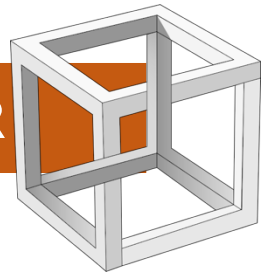
- Prior to this lesson, students should be able to find the length of a side of a triangle using the Pythagorean theorem.
- Show the 10-minute video, “The Many Shapes of a Chair.” <https://youtu.be/sTTfC-ypYFU>
- Discuss the activity prompts.
- Students finish the activities independently or with a partner.

Take It Further: Students construct their own “spar gauge” (demonstrated in the video) used to mark the points of an octagon using a flat piece of wood, 2 small nails, and 2 dowels.

Cross-Curriculum Connection: Students design their own board back chair using design elements that convey significance to them. Students can search for historic examples to inspire ideas. (Possible search terms: “18th Century German Farmhouse Chairs”; “Pennsylvania Dutch Rocking Chairs”; “Moravian Rocking Chairs”; “Moravian Splay Leg Chairs”.) Students should check to see that their drawing is symmetrical.

THE MANY SHAPES OF A CHAIR

Grade 8 Math



Student Name: _____ **Date:** _____



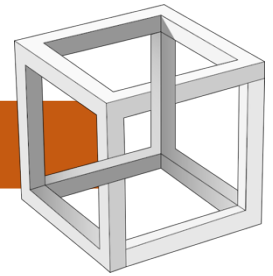
ACTIVITY 1: In this activity you will draw an octagon to represent the base of the chair leg as the joiner demonstrated in the video.

- STEP 1: On $\frac{1}{4}$ inch graph paper draw a 6X6 inch square using a ruler.
- STEP 2: Locate the center of the square by drawing 2 lines from each corner of the square to its opposite, diagonal corner.
- STEP 3: Set a compass to the distance from any corner to the center of the square. (If you don't have a compass, make one with two pencils and a piece of string.)
- STEP 4: Pivoting from each corner, draw 4 arcs through the center of the square connecting 2 perpendicular sides of the square.
- STEP 5: Draw a line connecting the points where the arcs intersect the sides of the square to make an octagon.

ACTIVITY 2: In this activity you will prove the Pythagorean theorem using your drawing of an octagon.

- STEP 1: Locate the triangles you drew in the corners while graphing the octagon. Shade in one set of these triangles. (You will be shading in a corner. This is the triangle you will measure in STEP 2.)
- STEP 2: Measure the lengths of line segments forming the right angle of this triangle to the nearest $\frac{1}{4}$ inch. (You should have the same measurement for both line segments.)
- STEP 3: Convert your measurement to decimals. Use the Pythagorean theorem to determine the length of the third side of the triangle. Round this number to the nearest tenth.
- STEP 4: Measure the third side of the triangle. Convert your measurement to decimals. What do you notice about this number?





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ANSWER KEY, page 1

Activity 1: In this activity you will draw an octagon to represent the base of the chair leg as the joiner demonstrated in the video.

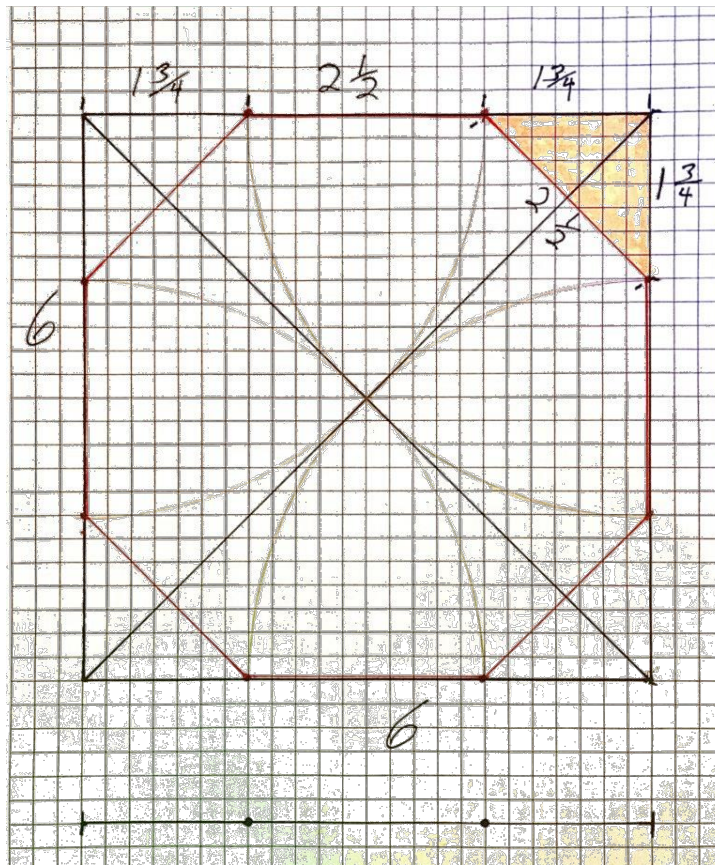
STEP 1: On $\frac{1}{4}$ inch graph paper draw a 6X6 inch square using a ruler.

STEP 2: Locate the center of the square by drawing 2 lines from each corner of the square to its opposite, diagonal corner.

STEP 3: Set a compass to the distance from any corner to the center of the square. (If you don't have a compass, make one with two pencils and a piece of string.)

STEP 4: Pivoting from each corner, draw 4 arcs through the center of the square connecting 2 perpendicular sides of the square.

STEP 5: Draw a line connecting the points where the arcs intersect the sides of the square to make an octagon.





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ANSWER KEY, page 2

Activity 2: In this activity you will prove the Pythagorean theorem using your drawing of an octagon.

STEP 1: Locate the triangles you drew in the corners while graphing the octagon. Shade in one set of these triangles. (You will be shading in a corner. This is the triangle you will measure in STEP 2.)

STEP 2: Measure the lengths of line segments forming the right angle of this triangle to the nearest $\frac{1}{4}$ inch. (You should have the same measurement for both line segments.)

STEP 3: Convert your measurement to decimals. Use the Pythagorean theorem to determine the length of the third side of the triangle. Round this number to the nearest tenth.

STEP 4: Measure the third side of the triangle. Convert your measurement to decimals. What do you notice about this number?

STEP 1: (Shaded in orange)

STEP 2: $1\frac{3}{4}$ in.

STEP 3: $1\frac{3}{4}^2$ in. + $1\frac{3}{4}^2$ in. = 1.75^2 in. + 1.75^2 in.

3.0625 in. + 3.0625 in. = 6.125 in.²

The square root of 6.125 is 2.474 in. Round to 2.5 in.

STEP 4: $2\frac{1}{2}$ in. = 2.5 in. The measurement of the third side of the triangle is the same number as what was found using Pythagorean theorem.

(Note concerning the open line segment drawn on the bottom of the graph paper insert: This is the ratio that represents the length of the sides in the shaded triangle, and it is also the same ratio that the joiner used to make his spar gauge in the video.)

