

Circle Shape Lab

Plan precise regular shapes inside circles.

HIGH SCHOOL • HSG-CO.D.13

CCSS.Math.Content.HSG-CO.D.13 "Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle."

NAME _____

DATE _____

CONSTRUCTION CONNECTIONS

To inscribe a regular polygon, place its vertices equally around the circle. For a regular hexagon, step the compass around the circle using the radius as the compass width, then use every other hexagon vertex for an equilateral triangle. For a square, use the endpoints of two perpendicular diameters.

WORKED EXAMPLE

A circle is divided into 12 equal central angles to plan a regular dodecagon. What is the measure of each central angle?

1. A full turn measures 360 degrees.
2. Divide 360 degrees by 12 equal angles.
3. $360/12 = 30$.

Answer: 30 degrees

PRACTICE 6 problems

- 1** A circle has radius 5 cm. What compass width should you use to mark the vertices of an inscribed regular hexagon?

ANSWER _____

- 2** You begin marking an inscribed regular hexagon at point P on a circle. How many more vertex locations must you mark after P?

ANSWER _____

- 3** After constructing a regular hexagon, you connect every other vertex. What polygon do you create, and what is the central angle between its adjacent vertices?

ANSWER _____

- 4** A circle has center O. Diameter AB is drawn, and perpendicular diameter CD is drawn through O. Which labeled points are the vertices of the inscribed square?

ANSWER _____

- 5** A square is inscribed in a circle. The four central angles between adjacent vertices are equal. What is the measure of each central angle?

ANSWER _____

- 6** A circle has radius 6 cm. Kai sets a compass opening of 4 cm and tries to step around the circle to construct a regular hexagon. Will this work? State the correct compass opening.

ANSWER _____

APPLY IT Show your work

- 1** An art club is making a circular sticker with radius 4 cm. The sticker needs an inscribed regular hexagon. What compass width should the club use, and how many new vertex points should it mark after choosing the first vertex?

WORK SPACE

ANSWER _____

- 2** A game design team has a circular profile icon with center O and diameter LM already drawn. Describe the next two construction actions needed to make an inscribed square.

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

A robotics club marks six equally spaced points on a circle for a regular hexagon. The club wants to make both an equilateral triangle and a square using only those six marked points. Can it make both shapes? Explain your reasoning.

PART 1 • PRACTICE

#	PROBLEM	ANSWER
1	A circle has radius 5 cm. What compass width should you use to mark the vertices of an inscribed regular hexagon?	5 cm
2	You begin marking an inscribed regular hexagon at point P on a circle. How many more vertex locations must you mark after P?	5 more vertex locations
3	After constructing a regular hexagon, you connect every other vertex. What polygon do you create, and what is the central angle between its adjacent vertices?	An equilateral triangle, with a 120-degree central angle between adjacent vertices.
4	A circle has center O. Diameter AB is drawn, and perpendicular diameter CD is drawn through O. Which labeled points are the vertices of the inscribed square?	A, B, C, and D
5	A square is inscribed in a circle. The four central angles between adjacent vertices are equal. What is the measure of each central angle?	90 degrees
6	A circle has radius 6 cm. Kai sets a compass opening of 4 cm and tries to step around the circle to construct a regular hexagon. Will this work? State the correct compass opening.	No. The compass opening must be 6 cm.

PART 2 • APPLY IT

- Use a 4 cm compass width and mark 5 new vertex points.** For an inscribed regular hexagon, each side equals the circle's radius. One starting vertex is already chosen, so five additional vertices are needed.
- Construct a diameter through O that is perpendicular to LM. Then connect the four diameter endpoints in order around the circle.** Two perpendicular diameters create four equally spaced points on the circle. Connecting those points in circular order forms the square.

CHALLENGE

It can make the equilateral triangle by connecting every other marked point. It cannot make a square using only those points because the marks are 60 degrees apart, while square vertices must be 90 degrees apart.

Accept equivalent construction wording, such as "draw a perpendicular diameter" for the square procedure. For the challenge, students must state that alternating hexagon vertices make the triangle and that 60-degree spacing cannot create 90-degree square spacing.