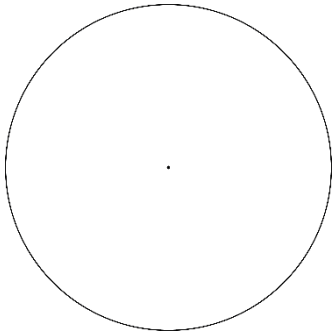
DIY Holiday Math Ornaments- Answer Key

Materials: Cardboard paper, compass, scissors
Optional materials: Yarn, ruler, beads, hole-puncher

Step 1

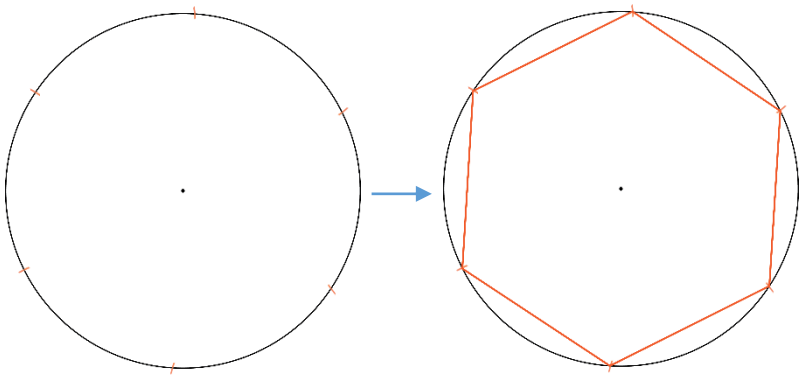
Using your compass, draw a circle large enough to be an ornament.



Questions for Students

- What is a circle?
  [A locus of points equidistant from a central point.]
- Name all the properties of a circle.
  [Center, radius, diameter, circumference, area, chord, tangent, secant, etc.]
- Where do you see circles in the real world?
  [Ferries wheel, CD/DVDs, Olympic rings, etc.]
- How many sides does a snowflake have?
  [Six.]

Step 2

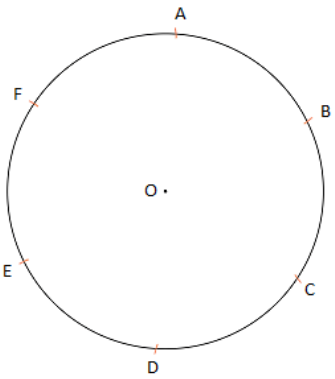


Using the radius of the circle, mark 6 equidistant points on the circumference.
This will inscribe a regular hexagon in the circle.

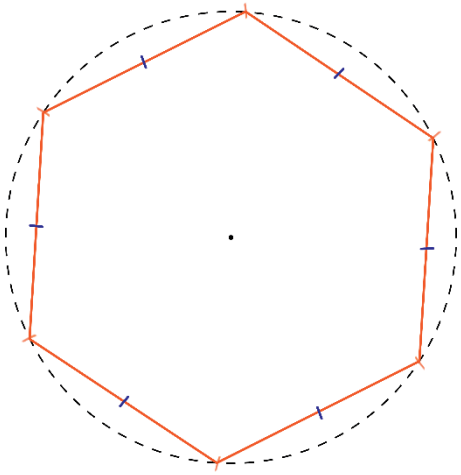
Question for Students

Construct a formal proof, or explain how this method creates a regular hexagon.

[Proof:
A, B, C, D, E, and F all lie on Circle *O*. OA=OB=OC=OD=OE=OF by definition of a circle. AB=BC=CD=DE=DF by construction (note that we must still prove FA is equal to the other sides of the hexagon, since it was not constructed). ΔAOB is an equilateral triangle by construction as well. m∠AOB=60°, since all interior angles of an equilateral triangle are 60°. Using the same reasoning, m∠BOC, m∠COD, m∠DOE, m∠EOF, and m∠FOA are all 60°. ΔAOB ≅ ΔAOF by SAS. Thus, by CPCTC, AB = AF. m∠OAB + m∠OAF = m∠FAB = 120°. Similarly, m∠ABC= m∠BCD= m∠CDE= m∠DEF= m∠EFA= 120°. Therefore, by the definition of a regular polygon, hexagon ABCDEF is a regular hexagon.]



Step 3



Find the midpoints of the sides of the regular hexagon.

Afterwards, cut out the hexagon. If you plan on using yarn, cut slits where the midpoints are. This will later help the yarn grab onto the side of the polygon.

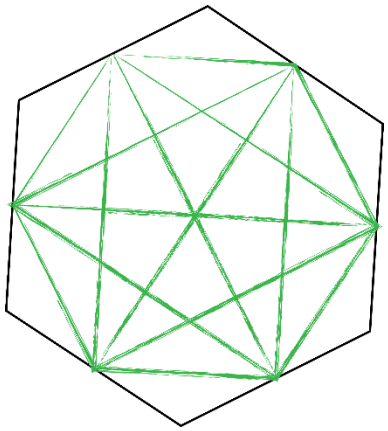
Question for Students

How do you find the midpoint of a segment?

[Answers will vary depending on grade level. The most accurate construction is as follows. Place a compass needle on one endpoint. Open the compass to more than half the length of the segment & draw an arc. Do the same thing with the compass needle of the other endpoint. Make sure you draw the arcs such that they meet at two points. Draw a line joining these two intersections. The point where the line and segment meet is the midpoint.]

Step 4

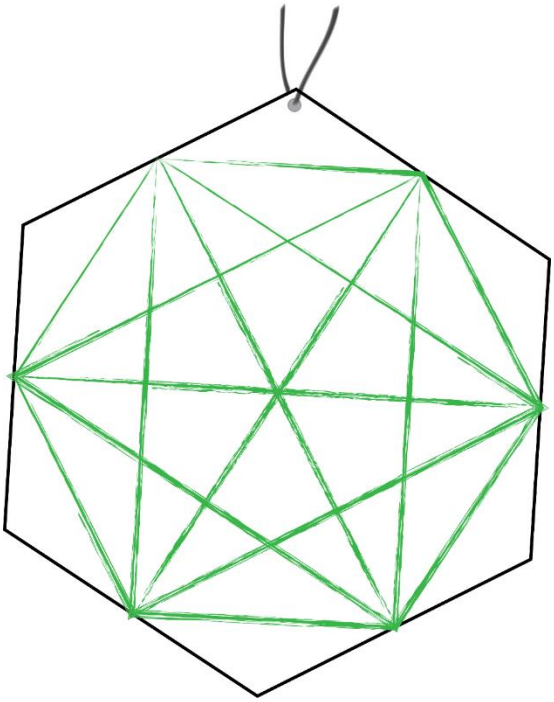
Using yarn or a writing utensil, connect all the midpoints together in as many ways as possible. If using a writing utensil, you should draw on both sides. If using yarn, you may want to further decorate your ornament using beads as well.



Questions for Students

- The ornament shows all the possible ways to connect the midpoints of a regular hexagon. Explain how you know this is either an example of a permutation or a combination.
  [This is an example of a combination, since order does not matter.]
- Create a problem whose solution could be found using the ornament.
  [Answers will vary. How many handshakes could occur amongst six people?]
- How many lines of symmetry exist in a regular hexagon?
  [Six.]

Step 5 (optional)



Using a hole-puncher, punch a hole near one of the vertices. String a piece of yarn through to hang your ornament.