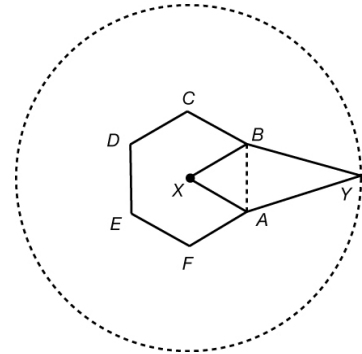


## The Shapes of Hats

Hats come in many sizes, shapes, colors, and fabrics. Some hats are asymmetric. Others display symmetry.

1. This diagram shows a regular hexagon,  $ABCDEF$ , and isosceles triangle,  $\triangle BAY$ , attached to one side.



- a. To make a hat whose base is a regular hexagon,  $ABCDEF$ , and that has six triangles that fold up to make the hat pointed at the top, point  $Y$ , how many triangles need to be added to the diagram?

---



---

- b. Explain how rotations of  $\triangle BAY$  can be used to draw the other five triangles that will form and finish the hat.

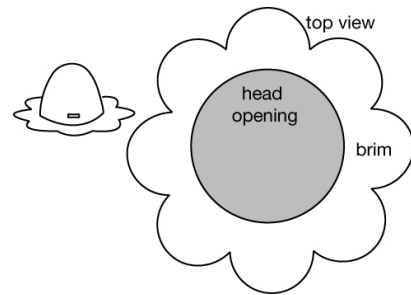
---



---

- c. On the diagram above, sketch the five other triangles needed to form and finish the hat. Use the dotted circle to help.

2. A small illustration of a hat design is shown at the right. The larger diagram shows the brim and head opening viewed directly down from the top.



- a. List the different types of symmetry in the large diagram.

---



---

- b. List all angle measures from  $0^\circ$  to  $360^\circ$ , excluding  $360^\circ$ , through which the brim can be rotated onto itself.

---



---

- c. On the diagram above, draw all lines of symmetry. How many lines of symmetry are there?

---



---

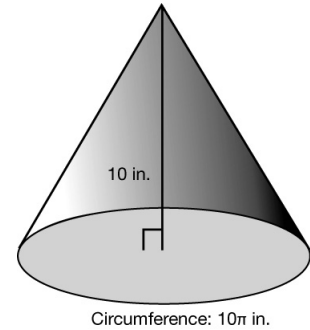
3. This diagram shows a hat in the shape of a hollow cone with no base.

- a. To the nearest tenth of a square inch, find the lateral area of the hat. Show your work.

---



---



- b. A conical hat  $X$  has base radius  $r$  and slant height  $l$ . Compare the lateral area of this hat with that of a conical hat  $Y$  whose radius is doubled and whose slant height is doubled.

---



---

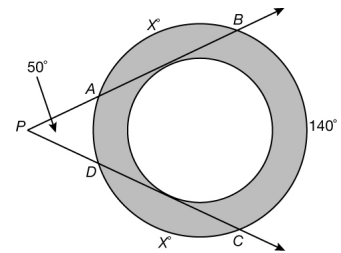
4. This diagram shows a plan for cutting felt from a larger piece for the manufacture of hat parts.

- a. Find  $m\widehat{AD}$ . Show your work.

---



---



- b. Find  $x$ . Show your work.

---

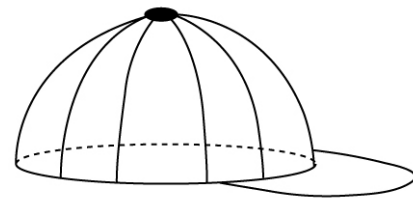


---

5. The volume  $V$  of a sphere is given by  $V = \frac{4}{3}\pi r^3$ ,

where  $r$  is the radius of the sphere.

- a. Write a formula for the volume of the hemisphere suggested by the baseball cap shown here. Explain.




---



---

- b. Write a formula for the circumference of the hemisphere in terms of  $V$ . Show your work.

---



---



---