2.3 The Bees Do It

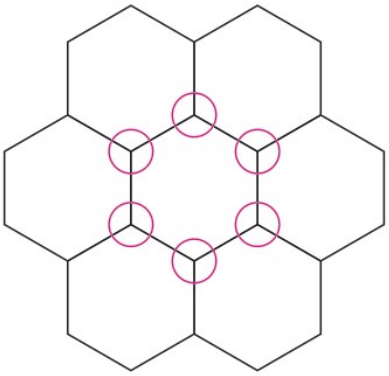
Polygons in Nature

Honeybees build nests called hives. A typical hive might be home for as many as 60,000 bees. Bees are small insects, but packing a hive with that many bees and the honey they make is tricky.

The honey is stored in a comb filled with tubes. The tops of those tubes cover the comb with a pattern of identical regular hexagons.

- Why do the bees form their honey storage tubes in the shape of hexagonal prisms?
- Why not some other shape?

The diagram below shows a pattern that uses regular hexagons to cover a flat surface without any gaps or overlaps.



Notice that three angles fit together exactly around any point in the beehive pattern. These patterns are called **tilings** or **tessellations** of the surface.

What other regular polygons do you think can be used to tile a surface?

Problem 2.3

Use regular polygons from the Shapes Set to explore possibilities for covering a flat surface with polygon tiles. Then, use what you know about the angles of regular polygons to explain your discoveries.

A Which regular polygons from the Shapes Set can be used to cover a flat surface without gaps or overlap like the hexagon pattern shown on the previous page?

- Sketch any tilings that you discover.
- Explain why copies of the shape fit neatly around the points where they meet.

B Which regular polygons from the Shapes Set cannot be used to cover a flat surface without gaps or overlap? Explain why.

C Think about tiling with regular polygons that have more than eight sides.

1. How do the angle sizes change as the number of sides increases?
2. Do you think any regular polygons of 9, 10, 11, or 12 sides could be used to tile a flat surface? Why or why not?

D Most regular polygons cannot be used to tile flat surfaces. However, it is often possible to include them in tilings that use two or more shapes.

1. Find and sketch tilings with two or more polygons from the Shapes Set.
2. What do you observe about angles that meet at a point in mixed tilings?

ACE Homework starts on page 52.

Did You Know?

A golf ball manufacturer developed a hexagon pattern for the cover of golf balls. They claim it is the first design to cover 100% of the surface area of a ball. This pattern of mostly hexagons almost eliminates flat spots that interfere with performance. The new design produces a longer, better flight for the golf ball.