Grade 8 Math, Explained

Unit 18 · Tessellation

HARDER PRACTICE QUESTIONS

Full marks 23

Write your answers on separate paper. Show your working. All the tiles in the questions are regular polygons of the same side length, unless a question says otherwise. The angle of a regular polygon of n sides is $\frac{(n-2)\times 180^\circ}{n}$.

1 How many fit round a corner? [3]

Copy and complete the table, to two decimal places where needed. Which regular polygons can tile a floor alone? Why those?

Sides n	**3**	**4**	**5**	**6**	**8**	**12**
One angle						
$360^\circ \div$ angle						

2 The missing tile [3]

Find the regular polygon that completes each corner, and write the corner's name.

i. Two regular 12-sided polygons and one more.
ii. Four equilateral triangles and one more.
iii. A square, a hexagon and one more.

3 Counting tiles [3]

In the tessellation 3.6.3.6, every corner has two triangles and two hexagons.

i. A triangle has 3 corners, and a hexagon 6. Think of a large floor with C corners in all. Each corner holds two triangle corners. How many triangles does that make, in terms of C? How many hexagons?
ii. What is the ratio of triangles to hexagons on a large floor?
iii. The same way, what is the ratio of squares to octagons in 4.8.8?

4 Tiles that aren't regular [3]

A four-sided tile has angles of 70°, 80° and 100°. It isn't regular, and all its sides are different.

i. Find its fourth angle.
ii. Copies of it, half of them turned half way round, cover a floor. Explain why it fits round a corner.
iii. A triangular tile has angles of 50°, 60° and 70°. How many tiles meet at each corner of its floor?

5 Spot the error [3]

Each student has made a mistake. Find it and correct it.

i. Reshma: "Regular octagons tile a floor. Three of them make $3 \times 135^\circ = 405^\circ$, which is close enough to 360°."
ii. Prabin: "A floor of triangles and hexagons, with triangle, hexagon, triangle, hexagon round each corner, is called 6.3.6.3."
iii. Shruti: "3.3.6.6 and 3.6.3.6 are the same floor, since they use the same tiles."

6 In a real setting [3]

A room is 3.6 m long and 2.5 m wide. It is to be tiled with square tiles of side 30 cm, starting from one corner, and a tile cut to fit a row can't be used again.

i. How many tiles fit along each wall? (Count a cut tile as one.)
ii. How many tiles must be bought?
iii. What percent of the tiles in the last row is cut away?

7 Think [3]

Two regular pentagons and a regular 10-sided polygon fit exactly round one corner: $108^\circ + 108^\circ + 144^\circ = 360^\circ$. But no floor can be made with this corner everywhere.
Look at one pentagon. At each of its corners, the other two tiles are a pentagon and a 10-sided polygon. So round its five sides, its neighbors must go pentagon, 10-gon, pentagon, 10-gon… What goes wrong when you get back to the start?

8 Make your own [2]

On squared paper, draw a square tile. Change its top side into a wiggly line, and copy the same wiggle onto the bottom side. Do the same for the left and right sides. Draw six of your tiles fitting together. Why is the area of your tile the same as the square's? Why do the tiles fit?