Symmetry – what is that?

Symmetry means "proportion" or "balance."
The word "symmetry" comes from the ancient Greeks. As you can see from their temples, the Greeks liked symmetry. But they did not invent symmetry, because symmetry also occurs in nature.

Symmetry is beautiful

All people like symmetry and naturally recognize it in things in their environment. They normally do not need a tape measure to do so.
We find symmetrical things to be beautiful. We like balanced proportions. But are we ourselves built symmetrically?

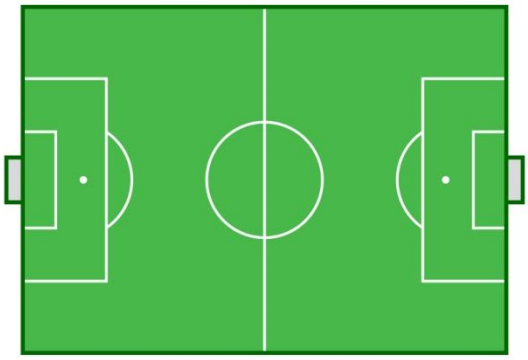
What else can you say about symmetry? For example:

Symmetry is useful

Would you like to sit on this chair? Certainly not!
The missing back leg makes the chair not only unusable, but also asymmetrical.
Are you familiar with other things in which the symmetry of their parts is not only beautiful, but also useful or necessary?

Symmetry is fair

In table tennis, symmetry ensures that the two players have equal chances of winning. The playing surface is divided by the net into two surfaces of equal size. And in soccer, the two same-sized halves of the playing field with two same-sized goals are also an example of symmetry.



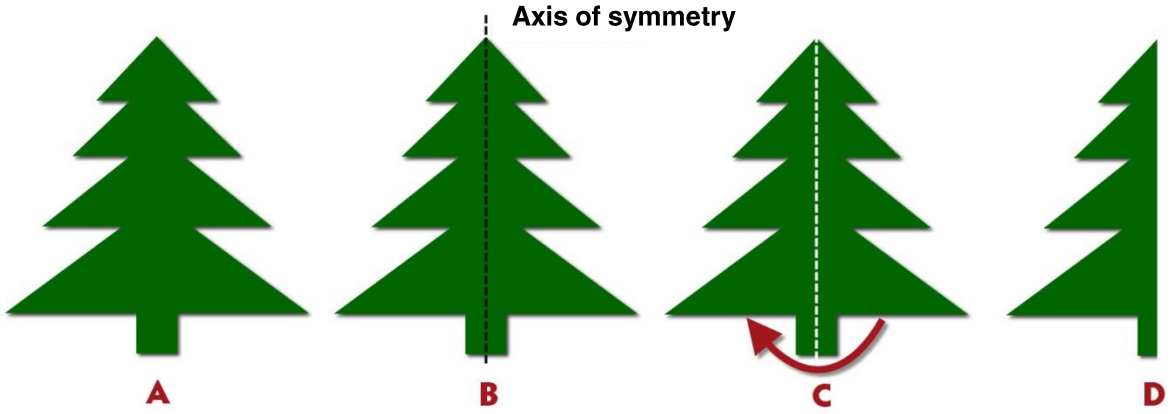
Assignment 1

Can you think of additional examples of "fair symmetry" and "useful symmetry"? Write them down (three or more)

There are three types of symmetry

Reflection or mirror symmetry

If you can divide an object (picture A) into two equal halves with a line (= axis), then we say this object has reflection symmetry. In picture B, you can see how to divide the tree into two equal halves with an axis.

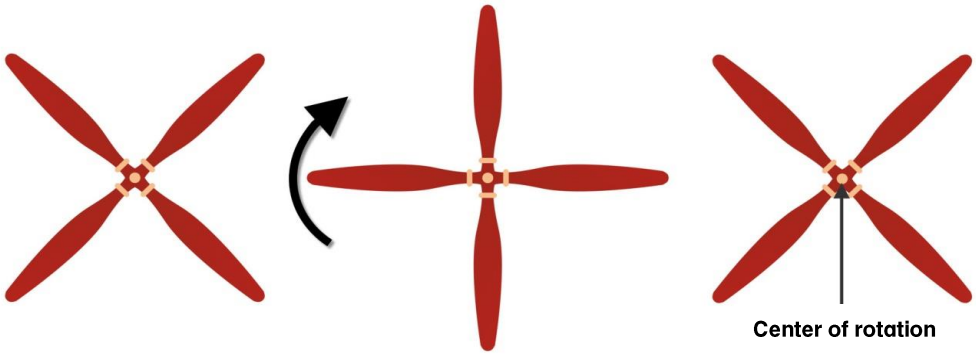


The two halves are mirror images. That's why we also call it mirror **symmetry**.

If you fold the halves along the axis of symmetry, they cover each other perfectly (pictures C and D). We say that the two halves are congruent. Congruence is an important characteristic of symmetry.

Rotational symmetry

If you rotate a figure by a given angle and it looks exactly the same as before the rotation, this figure is rotationally symmetrical. One example is this propeller, rotated 90 degrees (a quarter turn):

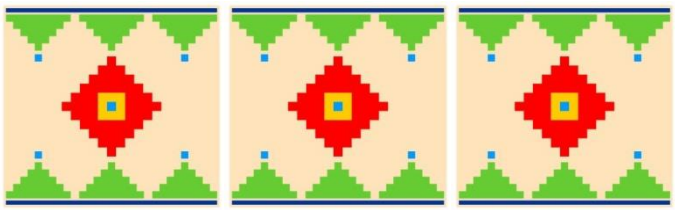


You could place the first picture on top of the third, and they would match exactly.

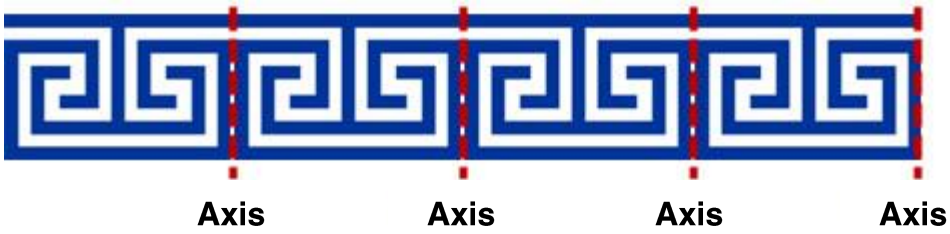
Important: All rotationally symmetrical objects have a center of rotation**.** On a propeller, it is called the "hub."

Translational symmetry

Translation symmetry occurs through the sliding and repetition of one and the same figure or pattern:


…and so on, until you have a long strip.

Frieze patterns have been a popular decoration since ancient times. You find them in ancient Roman villas, on traditional Indian clothes, and in many nurseries and children's rooms. The reflection symmetry continues in frieze patterns for as long as desired:



If you arrange patterns not in a long strip, but in two dimensions across an area such that they fill in the area without gaps and without overlapping, this is called "tiling."

You are familiar with this from floor surfaces or from wall decorations in churches and mosques. Maybe your bathroom at home is even tiled with ornamental tiles. Wallpaper, curtains, and clothing sometimes feature such patterns.


A checkerboard is also an example of tiling.

Assignment 2

Bring an object from home as an example of reflection, rotational, or translational symmetry to the next class. You should also be able to explain precisely what is symmetrical about it and what type of symmetry it has.

Assignment 3

Describe (and draw) objects with reflection, rotational, or translational symmetry that you have noticed on your way to school.