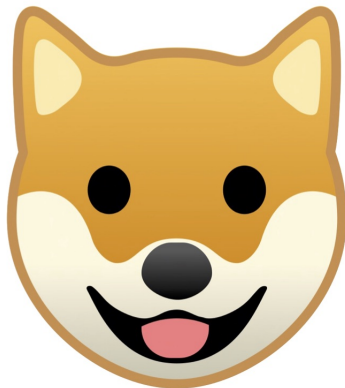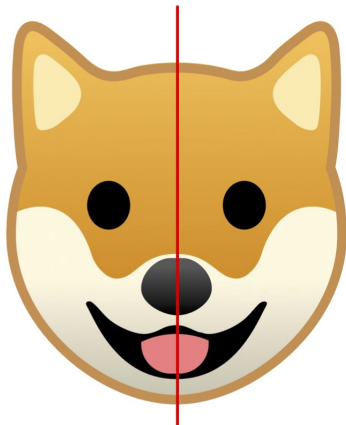What do we mean when we say a shape is symmetric?

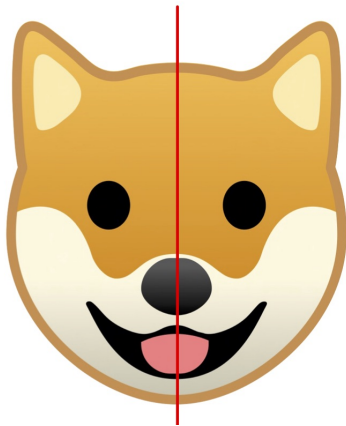# What do we mean when we say a shape is symmetric?

How is a face symmetric?

What do we mean when we say a shape is symmetric?
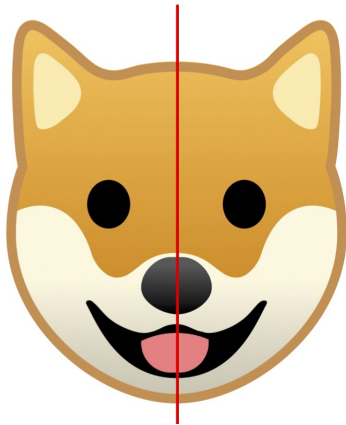
What do we mean when we say a shape is symmetric?

Flipping over the red line keeps the face the same.

What do we mean when we say a shape is symmetric?

Flipping over the red line is a **reflection**
that returns the shape to the same place.

What do we mean when we say a shape is symmetric?
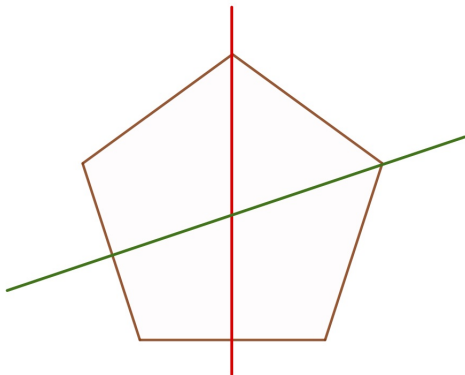
A pentagon is symmetric in multiple ways:
there are multiple **reflection symmetries**.

What do we mean when we say a shape is symmetric?

Based on your intuition, is a yinyang symmetric?.

What do we mean when we say a shape is symmetric?

Spinning halfway around keeps the yinyang the same.
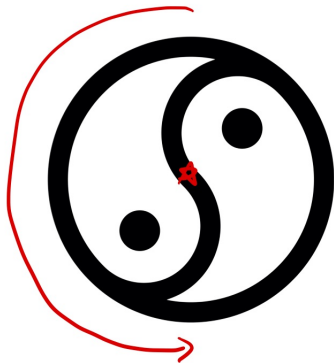
What do we mean when we say a shape is symmetric?

Spinning halfway around keeps the yinyang the same.

Spinning halfway around is a **rotation** by $180°$.

What do we mean when we say a shape is symmetric?

Spinning halfway around keeps the yinyang the same.

Spinning halfway around is a **rotation** by $180°$.

The yinyang has a $180°$ **rotation symmetry**.

Discussion questions for activity 1

1. Before moving the shapes around, which *intuitively* seem to be the most/least symmetric?
2. Which shapes would you guess have *rotational* symmetries? What about *reflection* symmetries?
3. Find as many symmetries as possible for the shapes using the applet.
4. Which shape is *most* symmetric?
5. Which shape has the most *unexpected* symmetries?

Discussion questions for activity 2

Can you draw a shape with:

1. a reflection symmetry but no rotation symmetry?
2. a rotation symmetry but no reflection symmetry?
3. infinitely many rotation symmetries?

Discussion questions for activity 2

Can you draw a shape with:

1. a reflection symmetry but no rotation symmetry?
2. a rotation symmetry but no reflection symmetry?
3. infinitely many rotation symmetries?

Challenge questions

1. For each of the above, try to draw the one with the most perfect symmetry (closest to on-the-nose match).
2. Try to draw the shape with the most unexpected symmetry.

More discussion questions for activity 2

Can you draw a shape with:

1. a $60°$-line reflection symmetry and no other symmetry?
2. exactly five rotation symmetries?
3. a $90°$ rotation symmetry but not a $180°$ rotation symmetry?
4. a $120°$ rotation symmetry and no other symmetries?
5. a $0°$-line (vertical) reflection, a $90°$-line (horizontal) reflection, and no other symmetries?

More discussion questions for activity 2

Can you draw a shape with:

1. a 60°-line reflection symmetry and no other symmetry?
2. exactly five rotation symmetries?
3. a 90° rotation symmetry but not a 180° rotation symmetry?
4. a 120° rotation symmetry and no other symmetries?
5. a 0°-line (vertical) reflection, a 90°-line (horizontal) reflection, and no other symmetries?

Warning: The answer could be "no" to some of these!

If you do something that keeps a shape in the same place,

Observation on symmetries

If you do something that keeps a shape in the same place,
then you do another thing that keeps it in the same place,

Observation on symmetries

If you do something that keeps a shape in the same place,
then you do another thing that keeps it in the same place,
then at the end, it's still in the same place.

Doing two symmetries in a row results in another symmetry.

Composing symmetries

120° rotation *then*
120° rotation = ?

R₁ 30°-line reflection

120° rotation T₁

R₂ 90°-line reflection

240° rotation T₂

R₃ 150°-line reflection

do nothing!
(trivial symmetry) N

Discussion questions for activity 3

1. What do you get when you do a rotation *then* a rotation?
2. What do you get when you do a rotation *then* a reflection?
3. What do you get when you do a reflection *then* a rotation?
4. What do you get when you do a reflection *then* a reflection?
5. Make a "then table" for the symmetries of the triangle.

Discussion questions for activity 3

1. What do you get when you do a rotation *then* a rotation?

2. What do you get when you do a rotation *then* a reflection?

3. What do you get when you do a reflection *then* a rotation?

4. What do you get when you do a reflection *then* a reflection?

5. Make a "then table" for the symmetries of the triangle.

R_1 30°-line reflection

120° rotation T_1

R_2 90°-line reflection

240° rotation T_2

R_3 150°-line reflection

do nothing!
(trivial symmetry) N