

Instructions for IsometricDragons.ggb (or IsometricDragonsv2.ggb, etc.)

IsometricDragons.ggb is a small game I built in GeoGebra. The purpose of the game is to learn what happens when you do two reflections in a row.

Please open IsometricDragons.ggb in GeoGebra. One way to do this:

- Save IsometricDragons.ggb to your desktop.
- Download and launch GeoGebra.
- Using GeoGebra's "File" pulldown menu, open IsometricDragons.ggb

When you finish each problem to your satisfaction, advance the "Problem" slider at the top of the screen.

Problem 1

Meet Bob, the blue dragon.

Practice moving the lines. You can grab the line itself to translate (slide) it, or you can grab the control point to rotate it. See if you can turn the blue line into a floor underneath Bob.

Make the green line into a wall, right in front of Bob's nose.

When you're done, advance the Problem slider.

Problem 2

Let's meet Bob's friend, Gretel. (Click the checkbox to show Gretel.)

Move the lines, and pay attention to how Gretel moves.

How are Bob and Gretel related? That is: if you know where Bob and the lines are, can you guess where Gretel will be? Write your thoughts here.

Once you think you have it figured out, it's quiz time:

1. Uncheck Gretel's box.
2. Move and rotate the blue line to a new location.
3. Check the "Show guess" box. Move this dragon image by its belly button and/or rotate it by its eye. If you click on either dot, the image will be reflected. Position the image where you think Gretel will appear.
4. Check Gretel's box.

How did you do?

Now move the line and try again!

Problem 3

Bob is a right-handed dragon. How can you tell?

Try to mimic his snout with your right hand. Now try with your left. Which one works better?

If that made sense, great. In case it didn't, this is what I have in mind:

1. Put your hands together, palm to palm.
2. Hold them up in front of you, fingers pointing up.
3. Take your left hand away.
4. Curl your right fingers very loosely.
5. Compare the curl of your fingers to Bob's snout.

If that doesn't do it for you, try this: which hand does Bob use to hold onto the background?

Now, move the blue line so that it is vertical.

Move the green line so that it slopes at about a 45° angle.

If Gretel is in hiding, bring her out.

Is Gretel a right- or left-handed dragon? _____

Rotate the blue line, so that Gretel moves around some.

Is she still the same kind of dragon she was before? (I mean, lefty or righty.) _____

Show Rhubarb. (If you can't find Rhubarb, try making the lines meet near the middle of the screen.)

Is Rhubarb a right- or left-handed dragon? _____

Rotate the green line. Is Rhubarb still the same kind of dragon? _____

Make a conjecture about the handedness of a dragon and its mirror image. I'm not asking you to prove your conjecture now, but how might you go about it?

Problem 4

Move the lines, and pay attention to how Rhubarb moves.

How are Rhubarb and Gretel related? That is: if you know where Gretel and the lines are, can you guess where Rhubarb will be?

Once you think you have it figured out, it's time for quiz 2:

1. Uncheck Rhubarb's box.
2. Move and rotate the green line to a new location.
3. Place the Guess where you think Rhubarb will appear.
4. Check Rhubarb's box.

How did you do?

Try again if you like.

Problem 5

You know how Gretel is related to Bob, and how Rhubarb is related to Gretel. Maybe you can use this to figure out how Rhubarb is related to Bob.

First, a question: are Bob and Rhubarb mirror images of each other? _____
(Think about righty and lefty.)

Now, another quiz:

1. Uncheck Gretel and Rhubarb's boxes.
2. Move and rotate both lines.
3. Think about Gretel will appear.
4. Place the Guess where you think Rhubarb will appear.
5. Check both their boxes.

How did you do?

Try again, if you like.

Problem 6

Make sure all three dragons (but not the guess) are in view, and you can see where the lines cross. Move Bob so that his eye is on the blue line. What else is in the same place as Bob's eye?

Is it still there if you move Bob's eye to somewhere else on the blue line?

When we reflect Bob across the blue line, we get Gretel. Most of Bob moves during this reflection, but some parts may not—like his eye, when he's in this position. Any point that doesn't move during a transformation is called a *fixed point*. Every point on the blue line is a fixed point of the blue line reflection.

Where are the fixed points of the green line reflection? That is, at what points do Gretel and Rhubarb see eye to eye?

At how many points do Bob and Rhubarb see eye to eye?

Problem 7

Bye, Gretel.

Is there a nice way to describe how Bob and Rhubarb are related, without involving Gretel?

Please explore this page and come up with at least two of your own ideas.

Nudge:

What happens if the two lines are parallel? You may not be able to get them to line up just right, but you should be able to get close enough to support a conjecture.

Also, make sure you check out "Show angles" and the slider it brings up.