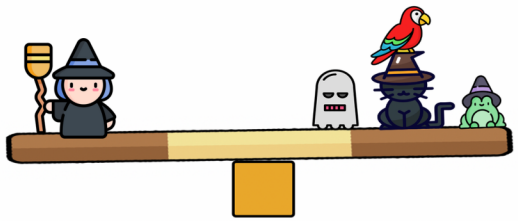
Activity 2: Make your critters. Use the templates and 3DuxDesign connectors to build at least 4 free-standing characters of equal mass. Hint: your characters should all have the same number of connectors and be close in size to keep the mass equal.




Activity 3. Don't tip the broom! Start with two critters. Place them on the broom so it stays balanced. What do you notice about their location compared to the center of the beam? Test the same characters in different locations along the length of the beam. What do you notice?

The more the merrier! Try adding more characters to the broom without tipping it. How many can you add? What do you notice about their placement along the length of the beam?

Bonus challenge. Can you think of a way to make the beam more stable? Try changing your lever design so all the critters can stay on the same side without tipping it.



3Dux|Design

Room on the Broom

a Book-n-Build STEM Project

Read the story

Cut out your game pieces

Build a balanced broom stick

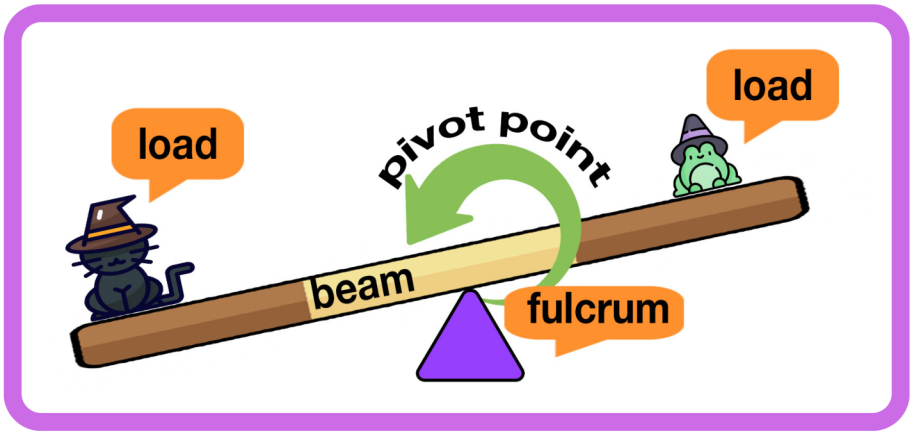
Add critters without tipping the broom

Change the forces + fulcrum to see what happens!

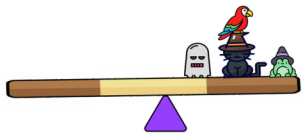
Introduction. In the book, *Room on the Broom,* our friend the witch invites critters to join her on her journey. All is going well until the forces on the broom become too great, causing it to snap. (Brooms aren't usually designed to withstand the weight of a witch, cat, dog bird and frog!!!)

In this project, we will use the story to explore how adjusting the size and location of forces can affect the position a beam. But first, some engineering basics:

A **lever** is a simple machine made of a beam (the broom), a **fulcrum** (which connects the beam to the ground), and one or more **loads** (the critters). **Force** is a push or pull applied to an object. In this project, the force will be created by the critters. Depending on the forces, the beam will **pivot** (or spin) around the fulcrum. You can change the force, and therefore the position of the beam by adding, removing, or moving the critters along the beam.



What do you think would happen to the broom if all the critters were sitting on the same end? Draw or describe your **hypothesis.**



Activity 1: Design and then construct a lever with a beam and a fulcrum. Not all levers have the fulcrum in the center of the beam but for this project, the fulcrum should be in the center. How can you tell if the fulcrum is in the center? Can you think of another way to tell?