

### Challenge: Make a Mechanical Leg

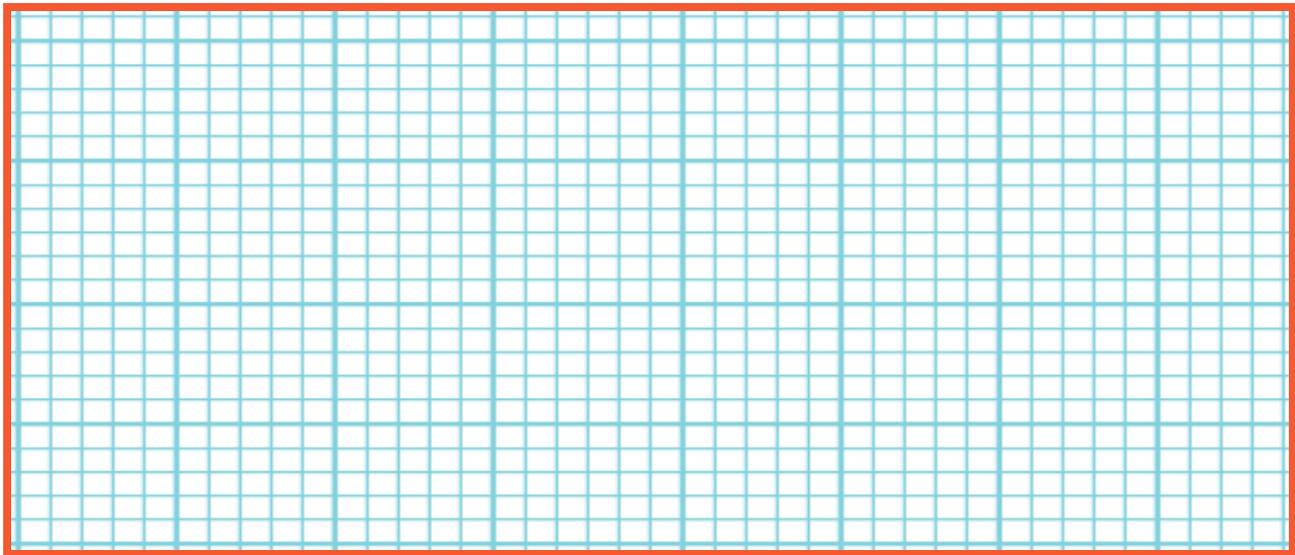
Make a mechanical leg that has a functioning ball and socket joint *and* a hinge joint. You need to design a ball and socket joint that can **rotate**, **extend** and **flex**, and **abduct** and **adduct** in order to touch three cups positioned in direction locations.

### Background Inspiration

**Biomechanics** is the study of movement in living things. If you break down the word: “**bio**” means life and “**mechanics**” is the field of physics dealing with forces and motion. Biomechanics can answer questions like why does a cat always land on its feet? or how do your muscles allow you to jump in a game of basketball? Biomechanics helps us understand how muscles make forces that help us move our bodies.

#### Studying Joints

Draw a picture - In what directions do your joints move?



List all joints. What movements can you identify?

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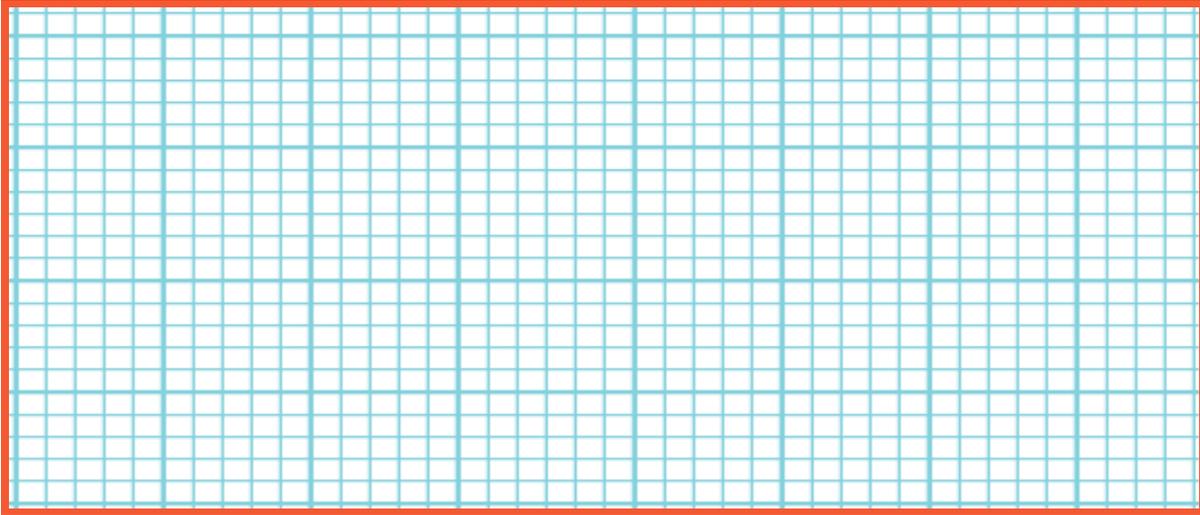
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**Studying Hip Joints** - Draw a picture of a hip joint

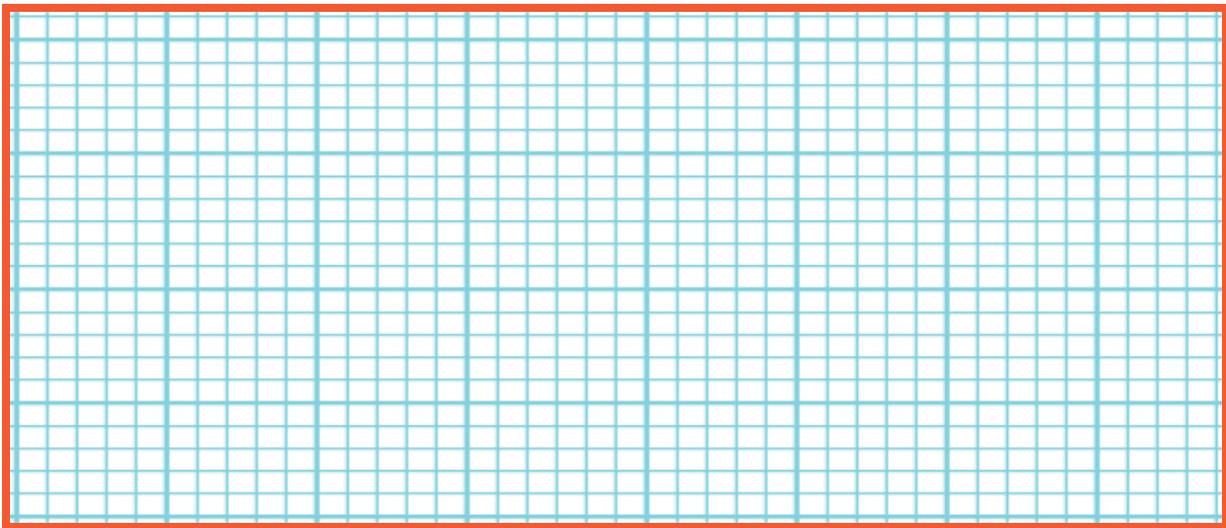


What type of joint is the hip? What directions can hip joints move?

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**Studying Knee Joints** - Draw a picture of a knee joint



What type of joint is your knee? How do knee joints move differently than hip joints?

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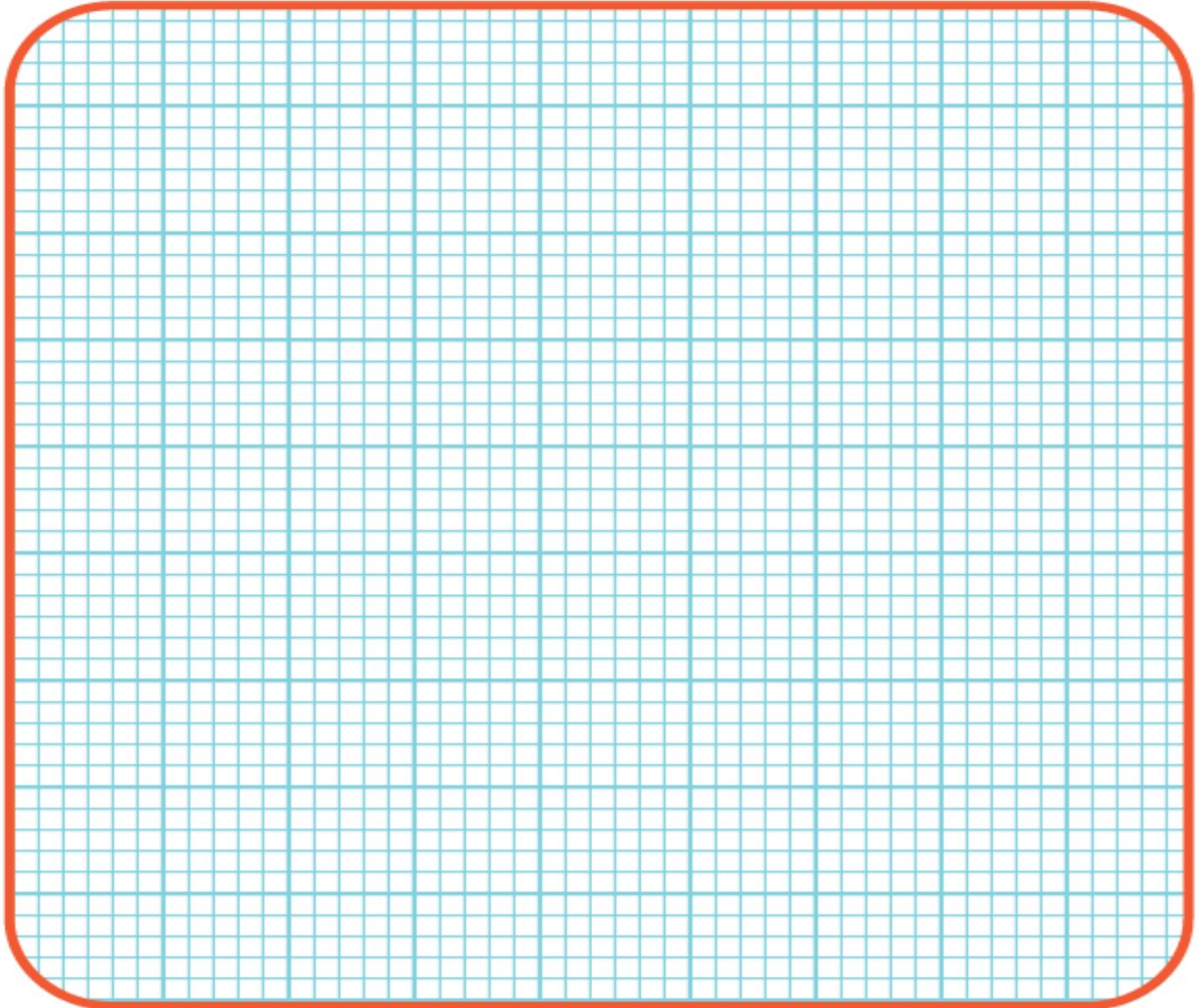
# Student Guide

## Make a Mechanical Leg



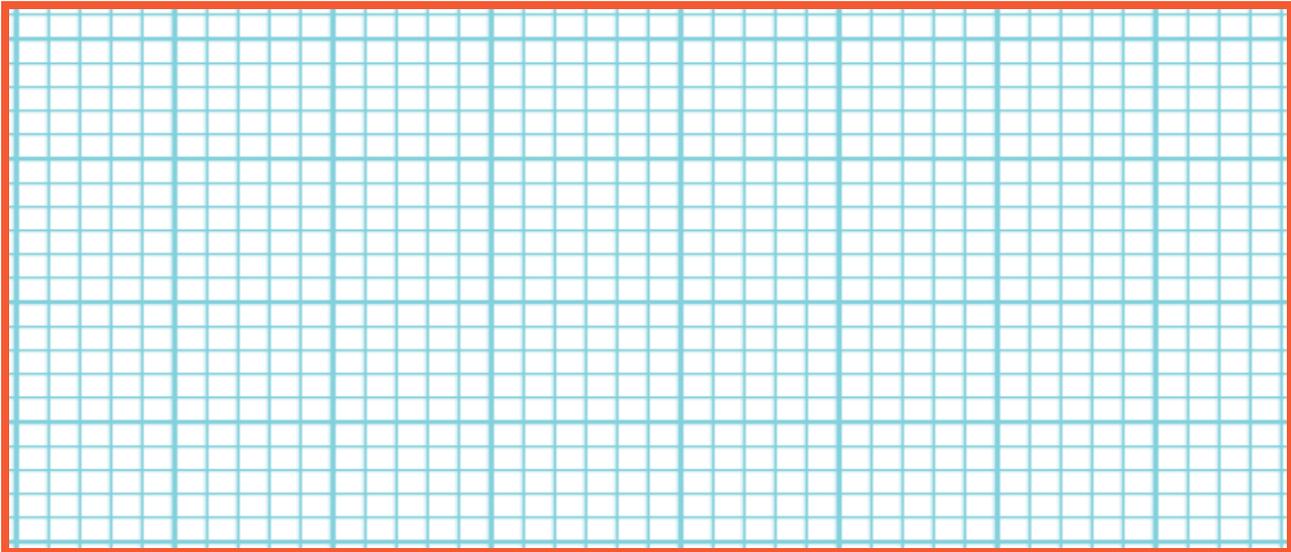
### Plan - Draw your Design

Make a mechanical leg that has a functioning ball and socket joint *and* a hinge joint. You need to design a ball and socket joint that can **rotate**, **extend** and **flex**, and **abduct** and **adduct** in order to touch three cups positioned in direction locations.



### Redesign

How would you improve your mechanical leg?



### Tips to Build and Test Your Design

- ❖ Make the hip joint first. Add your knee joint after you've tested the hip joint!
- ❖ If you don't know where to start, get some inspiration by looking at the materials!
- ❖ Make sure that the ball fits snugly in the socket but can also move fluidly. The ball should also be secured in the socket so it doesn't fall out easily. You can secure it with a rubber band or string that keeps it in place but doesn't limit the movement.
- ❖ If you get stuck, go back to your plan.
- ❖ Be persistent and creative. This isn't easy and there isn't just one right way so if they are having trouble, that's okay! We can all learn from failure instead of letting it limit our capabilities.

### Reflect on Your Design!

How did you build your mechanical legs so it could complete the task?

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How could you add an ankle joint to your mechanical leg?

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