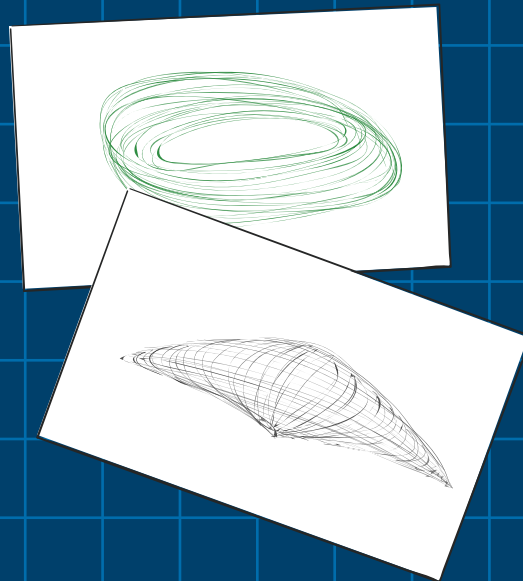
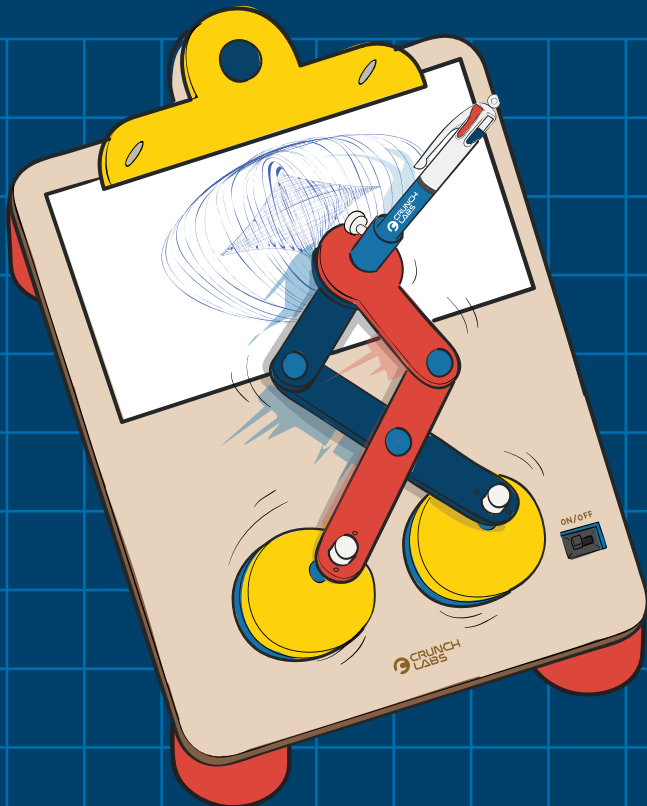




BUILD  
BOX ►

# DRAWING MACHINE



# NEW VIDEO UNLOCKED

BUILD ALONG & LEARN WITH MARK ROBER

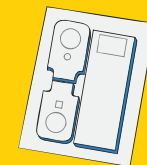


[CRUNCHLABS.COM/DRAW](https://crunchlabs.com/draw)

## PARTS



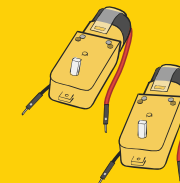
wood pieces



adhesive foam



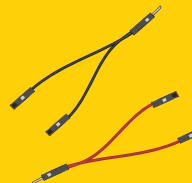
battery pack



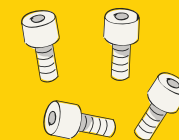
geared  
dc motors



foam feet



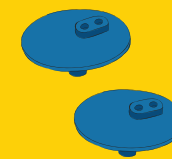
wires



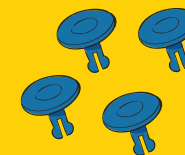
bolts



foam spacers



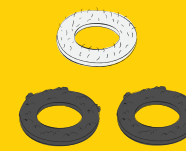
wheels



rivets



elastic cords



hook & loop  
fastener



pen holder

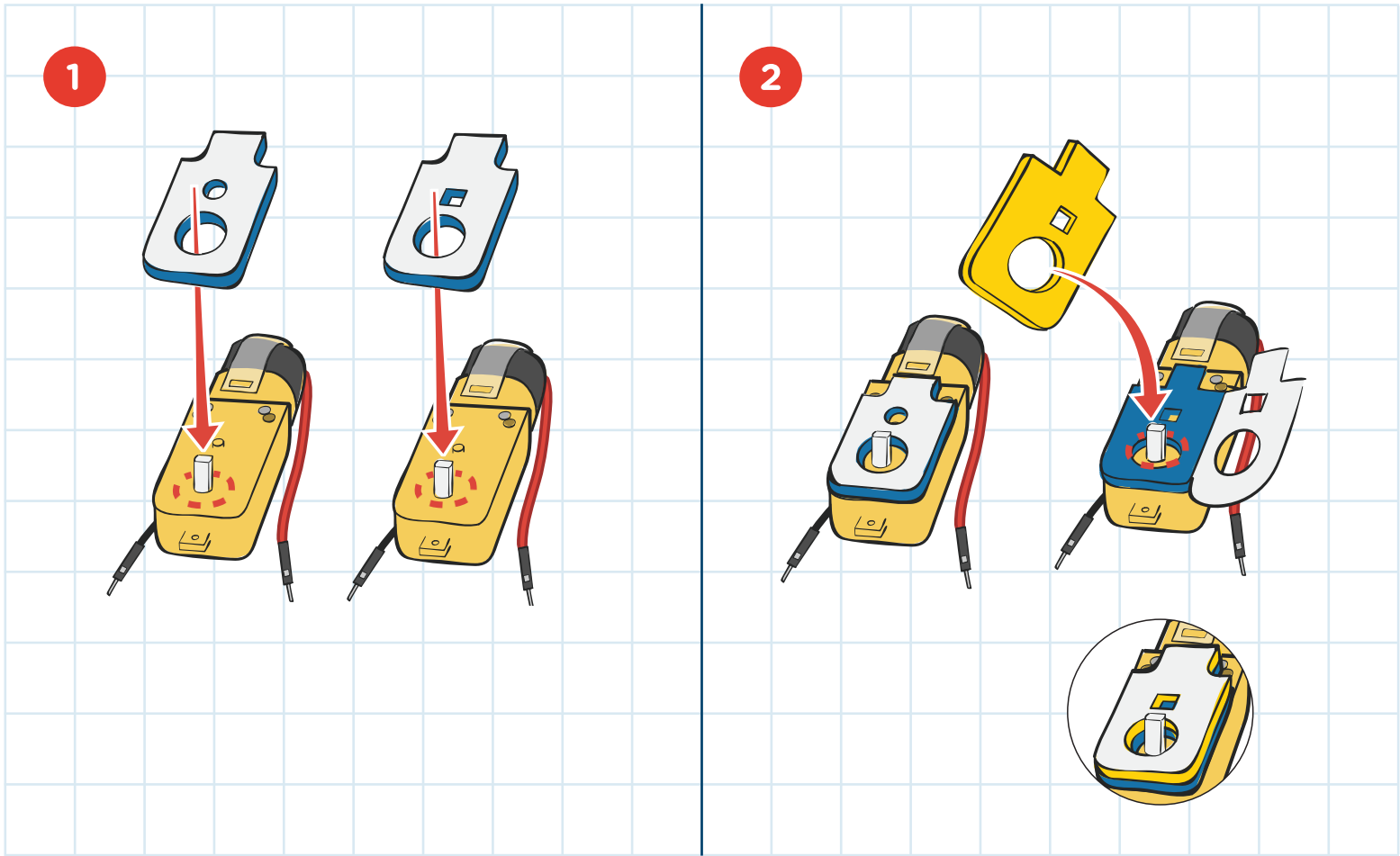


multi-color pen

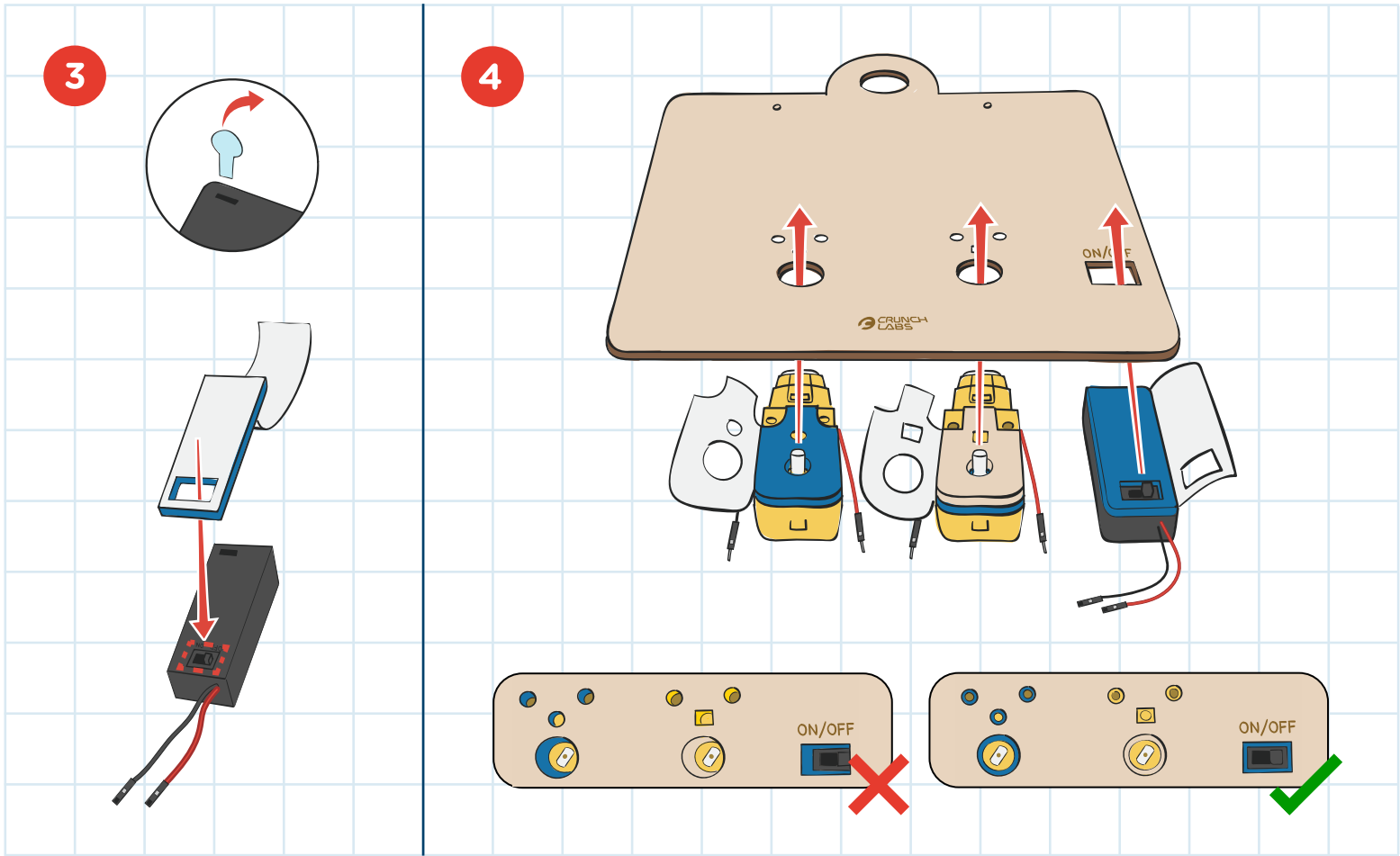


paper

BUILD

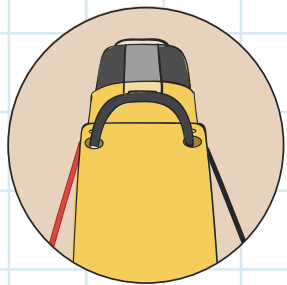
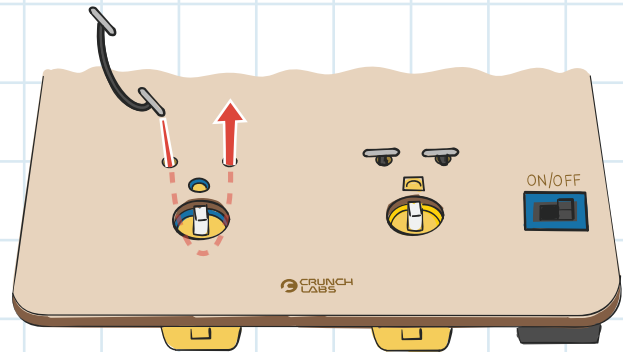


BUILD

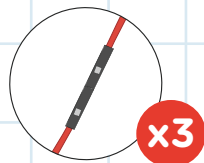
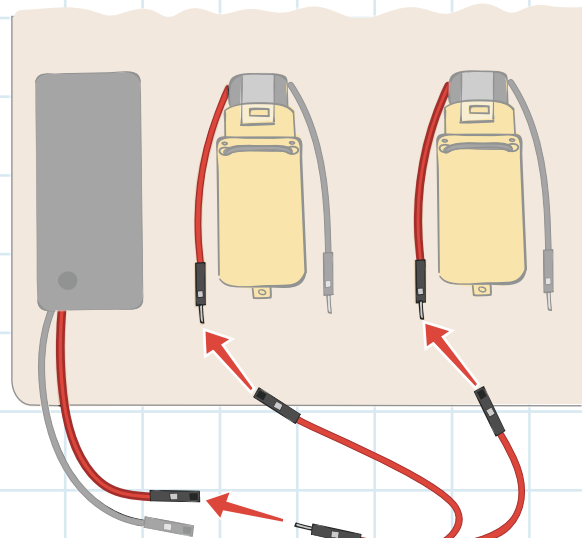


# BUILD

5

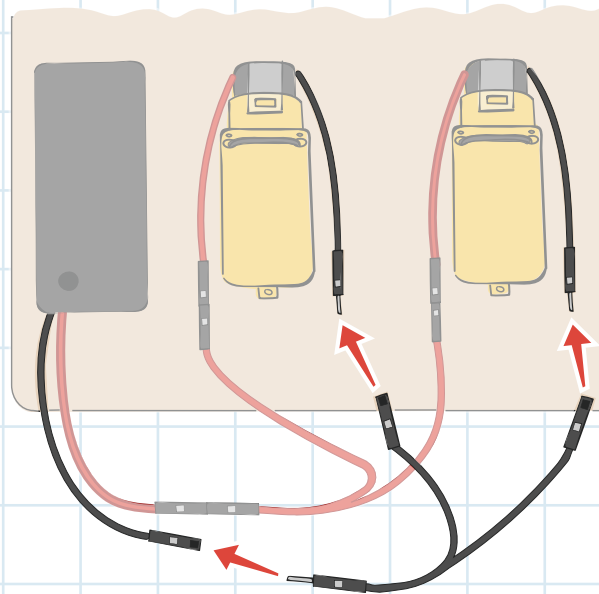


6

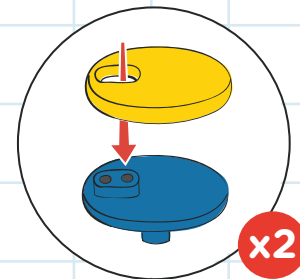


# BUILD

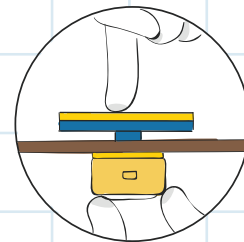
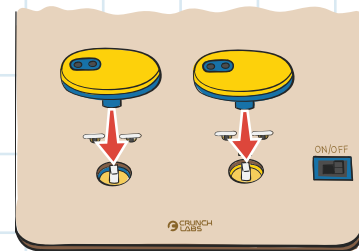
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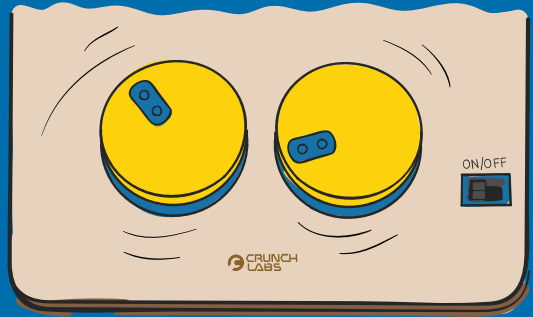
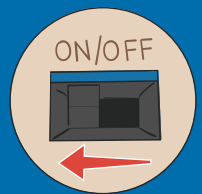
8



9

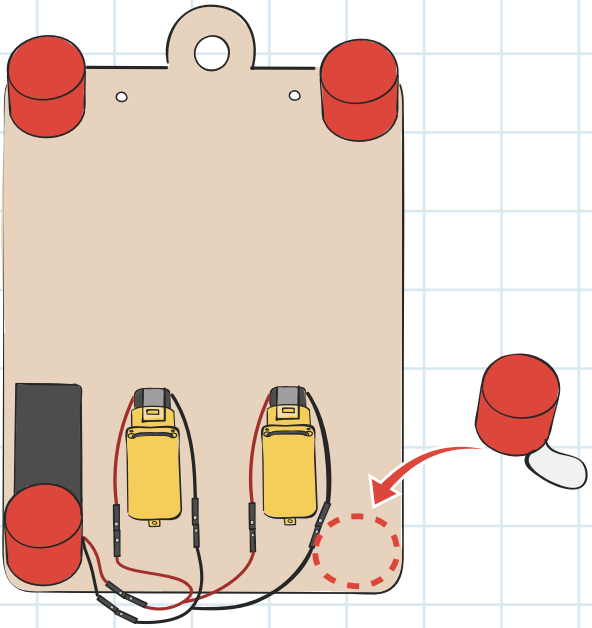


# TEST

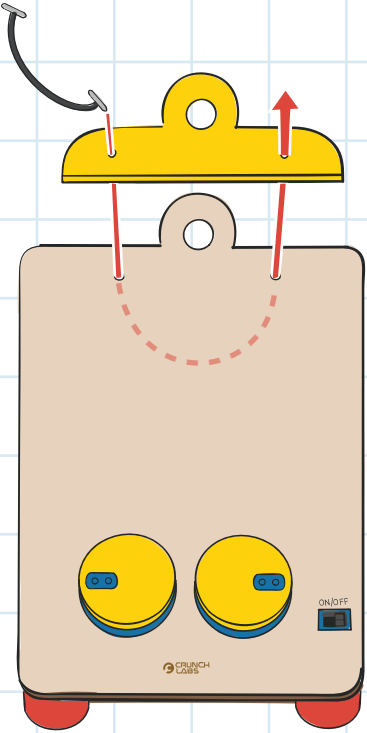


Having trouble? Watch the video at [crunchlabs.com/draw](https://crunchlabs.com/draw)

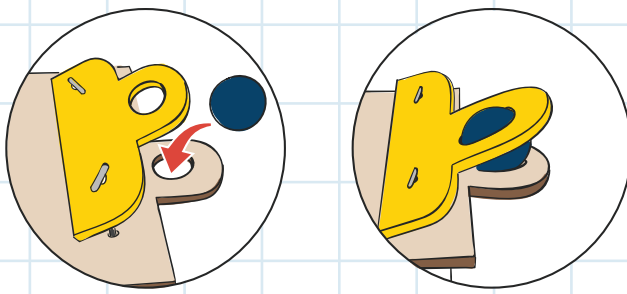
10



11



12

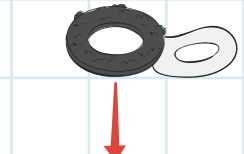


## PRO TIP! ▲

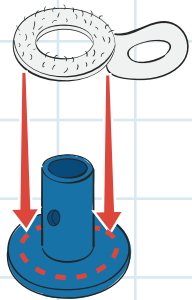
A **ball joint** uses a ball to help things rotate smoothly. You have a ball joint in your shoulder and hip bones.

# BUILD

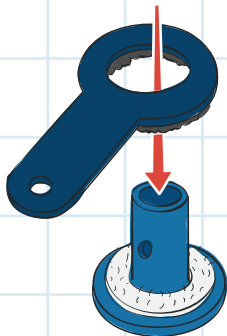
13



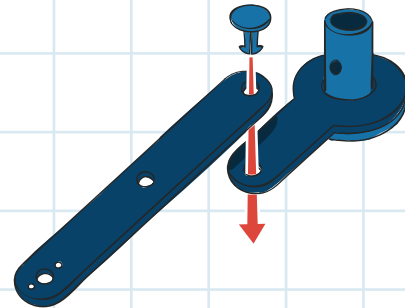
14



15



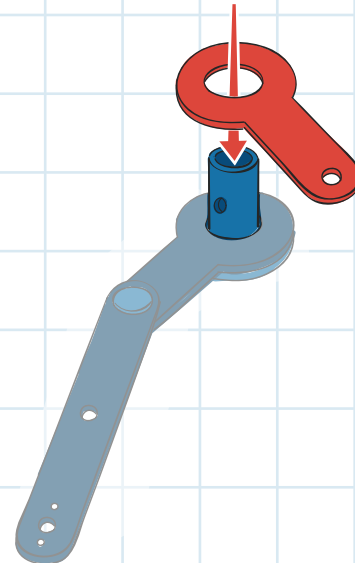
16



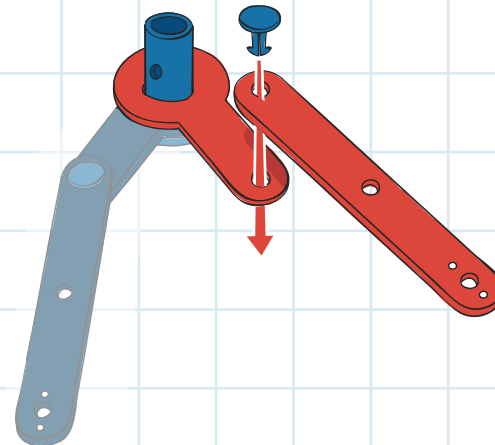
**PRO TIP!** ▲

This rivet holds the linkage arms together and lets the arms rotate easily. **Pivots** are the point things rotate around. It's a pivot rivet.

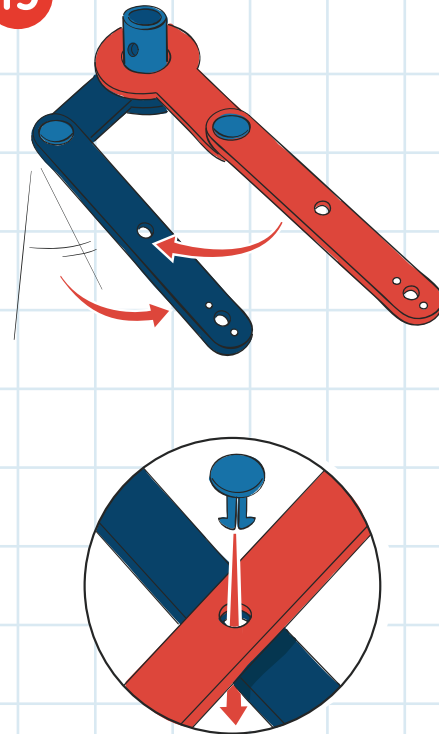
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18

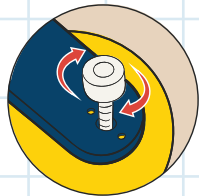
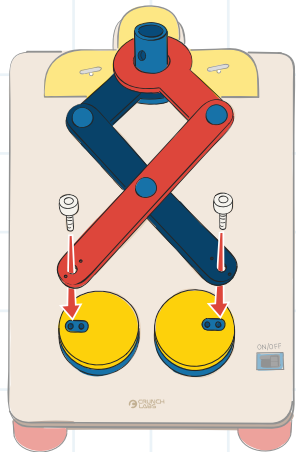


19

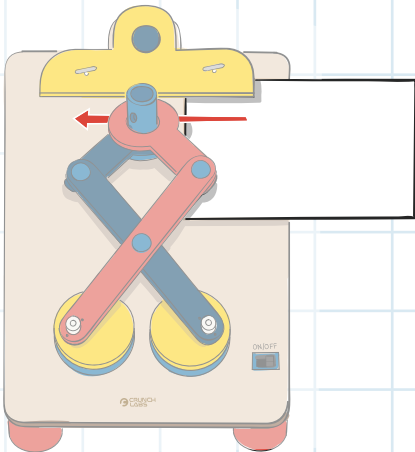


BUILD

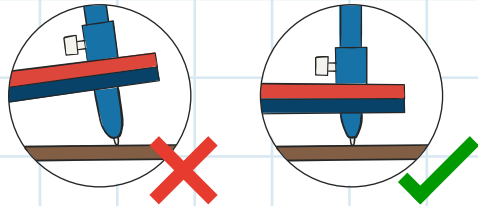
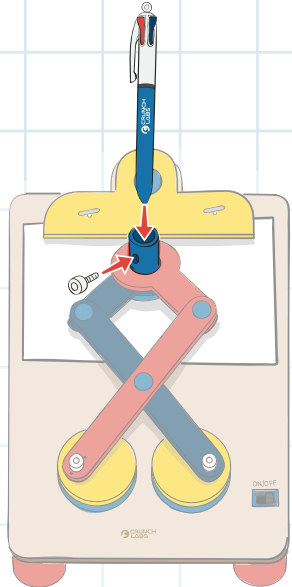
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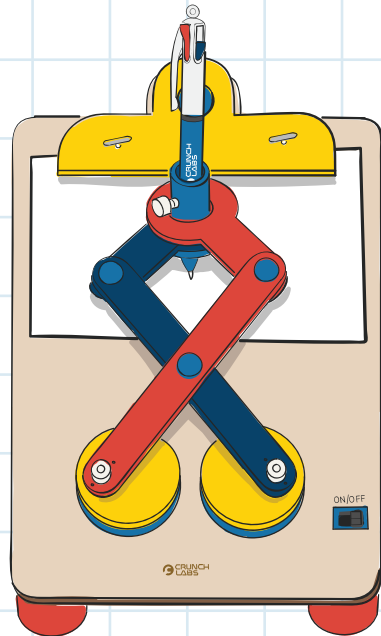
21



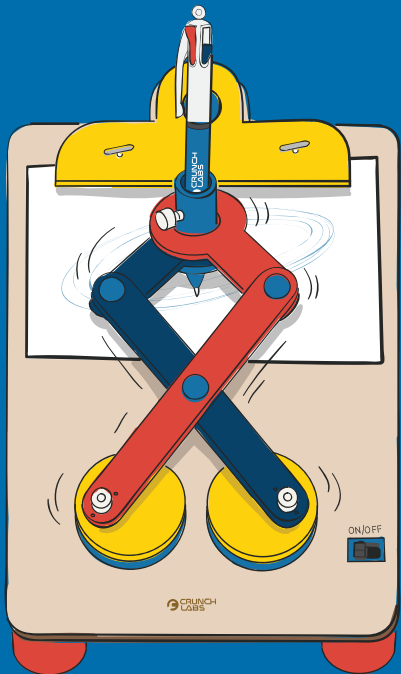
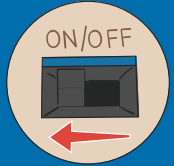
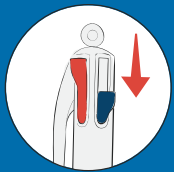
22



BUILT!



TEST



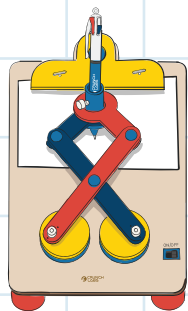
Having trouble? Watch the video at [crunchlabs.com/draw](https://crunchlabs.com/draw)



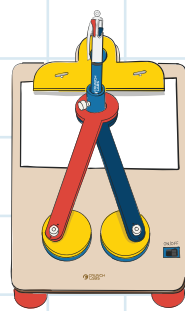
## PLAY

# SCAVENGER HUNT

Experiment with your drawing machine and find these four patterns! You'll need to adjust the **radius** and swap the **linkage arms** to find all four.

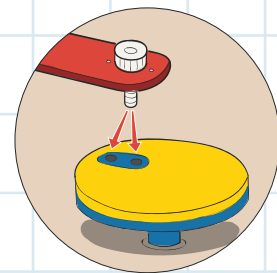


OR



### PRO TIP!

Linkage arms are the long pieces that make up a linkage. Changing the *number* of pivots in the linkage arms will change the way the whole linkage moves.



### PRO TIP!

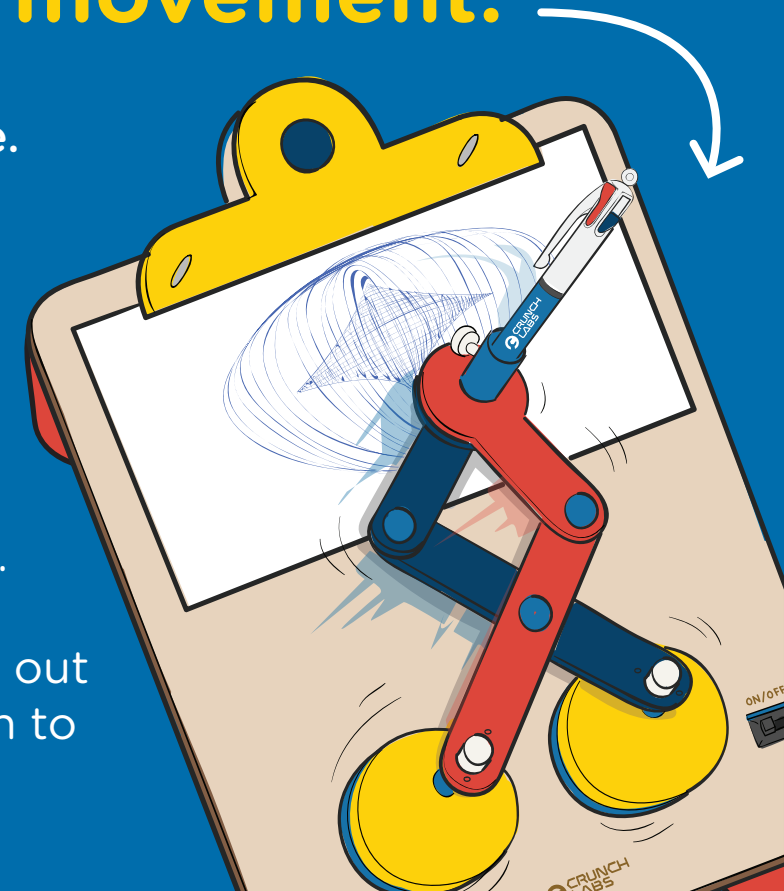
The **radius** is the distance from the middle of a circle. Changing it will change how *fast* each linkage arm rotates.

## THINK

A **linkage** uses **pivoting bars** to **guide** a machine's movement.

Basically, linkages help things move.

Your Drawing Machine uses linkages to **guide** the pen in complex but predictable patterns. The linkage arms are connected to wheels that spin at slightly different speeds. The arms also **pivot in different places**. Those differences change where the pen can go. As the wheels go in and out of sync, the linkage will push the pen to every possible spot in the **pattern**.

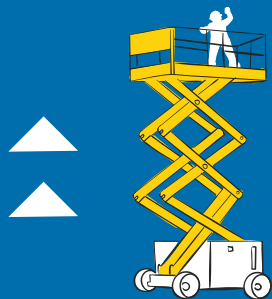




THINK

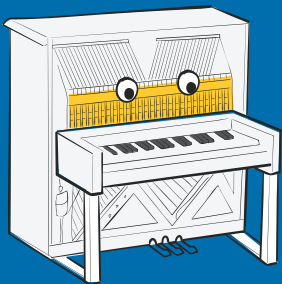
## Find linkages in other machines!

A linkage joins different moving parts on a machine so it can accomplish unique movements. Some linkages help the whole machine move **together**, and some linkages are used to move specific parts **separately**.



### SCISSOR LIFT

This machine is called a scissor lift because it uses a scissor linkage to raise and lower workers. Because the linkage arms are all **connected**, the platform on top stays flat. Workers can stand safely as it moves.

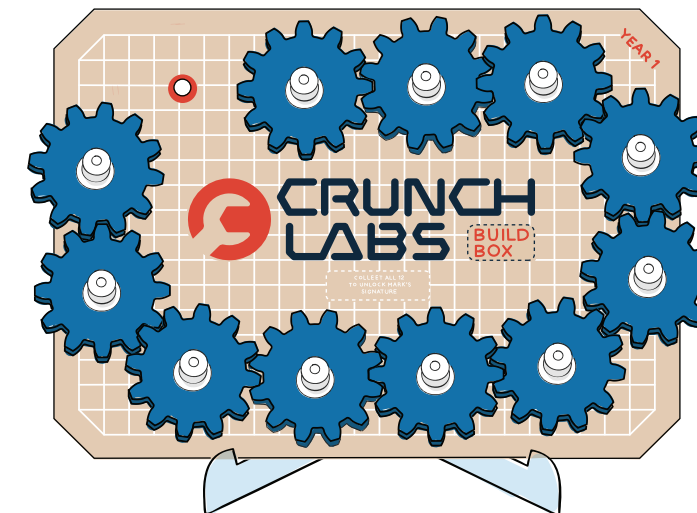


### ROBOT PIANO

One time, Mark built a talking piano robot named Chopstix. Like all pianos, its “vocal chords” use linkages. When each piano key is pressed, a linkage hammers a **specific** string inside the piano. Ding!

THINK

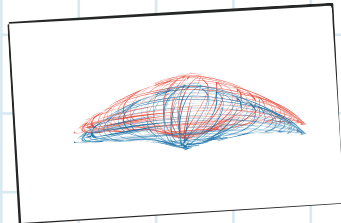
## CONGRATULATIONS! You earned a gear badge for linkages



Don't forget to add your gear badge to your gear train!

# CRUNCH

It's crunch time! Use your engineering superpowers to keep building.



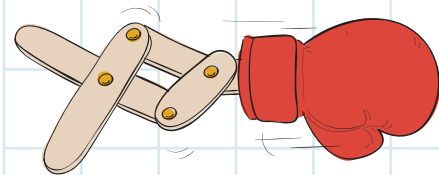
## SEEING DOUBLE

Test different colors and sizes of markers, pens, and pencils, and see which combinations layer the best.



## CARD MACHINE

Use your drawing machine to make someone a card. Try drawing in light color so you can write on top of it, or color in a background to make the art stand out.



## SCALE UP

Recreate the scissor linkage from your drawing machine out of cardboard, but bigger. Use brads as pivots. What can you use your giant linkage for?

# SHOW OFF YOUR BUILD



Share your favorite drawings and coolest mods!  
**#crunchlabs @crunchlabs**    



**WARNING:** Improper assembly can short circuit battery.

#### **BATTERY SAFETY**

Remove exhausted battery. Do not mix old & new battery. Do not mix alkaline, standard (carbon-zinc), or rechargeable battery. Do not recharge non-rechargeable battery. If using rechargeable battery, remove it from the toy before charging. Rechargeable battery should be charged under adult supervision. Do not short-circuit supply terminals. Do not connect this toy to a power supply greater than one AA battery. **How to remove battery:** 1. Remove screw and lid from battery pack. 2. Remove battery. **How to insert battery:** 1. Remove screw and lid from battery pack. 2. Insert one new battery into the battery pack with correct polarity (+ and -). 3. Replace lid and secure the screw on the battery pack.

#### **SWEEPSTAKES**

**Each CrunchLabs build box contains the chance to WIN a trip to visit CrunchLabs with Mark Rober! Sadly, you are not a prize winner this time. Check inside your next build box for another chance to win.**

*Trip includes roundtrip transportation and two (2) night's hotel accommodations for a family of four (4). Approximate value: \$4,500. NO PURCHASE NECESSARY. Open to legal U.S. residents, 18 years of age or older. Void where prohibited. For complete Official Rules, including promotion end date and information on how to obtain a free game ticket, visit [www.crunchlabs.com/win](http://www.crunchlabs.com/win).*

This toy is intended for use by children over the age of eight years. These instructions contain important information, do not throw away.