Fidget Spinner

STEM PROJECT

By Erin*tegration

Table of Contents

THANK ♡ YOU

TERMS OF USE

All pages in and digital content linked to from this packet are copyrighted to Erin Flanagan All Rights Reserved and are NOT for resale or distribution. Uploading it to a website for others to download is a violation of the DMCA.

This packet is for one teacher to use - please direct any colleagues to download this product from my TpT store. On the purchase page you can download additional licenses for half off the purchase price.

VISIT MY STORE

CREDITS

CLICK THE BUTTON TO CONNECT WITH ME

BLOG

NOTE TO TEACHERS

The Challenge:

Divide students into small groups or partners. Each group needs 1 spinner. Students will first develop a spinning technique before spinning their fidget a set number of times - each time they will record how long it spun and mark if human error resulted in the spin ending. Human error would include mistakes like hitting the end with a finger mid-spin or messing up the initial flick. They will then determine the total seconds of each spin and will graph their spin times in seconds. You can have students time the spins in minutes and seconds or just seconds. I had mine do minutes and seconds, then we used the math sheet to convert that to seconds. Next, they are tasked to find the average time for trials with and without human error included. They record & compare the spin times as a class to see whose fidget spinner spun the longest and use that info to design a better spinner. Students can create an optional slow motion spin movie on the iPad with the directions included too.

Materials Needed:

Students will need access to fidget spinners. Ideally, you will need at least 5, so students can work in small groups and share. Many students will already own these devices or you can purchase them cheaply on the internet at Amazon and AlieExpress for about $1.00-$2.00 a spinner. If your school has access to a 3D printer, there are also tutorials for making your own fidget spinners on YouTube. If you plan to do the iPad video part, students will also need access to an iPad with the free app Slow Motion Camera Free (page 21) **Click to download the app.** If you have a newer iPad with iMovie, you can film a regular video with the iPad camera and slow it down in iMovie (page 20).

SLOW MOTION APP

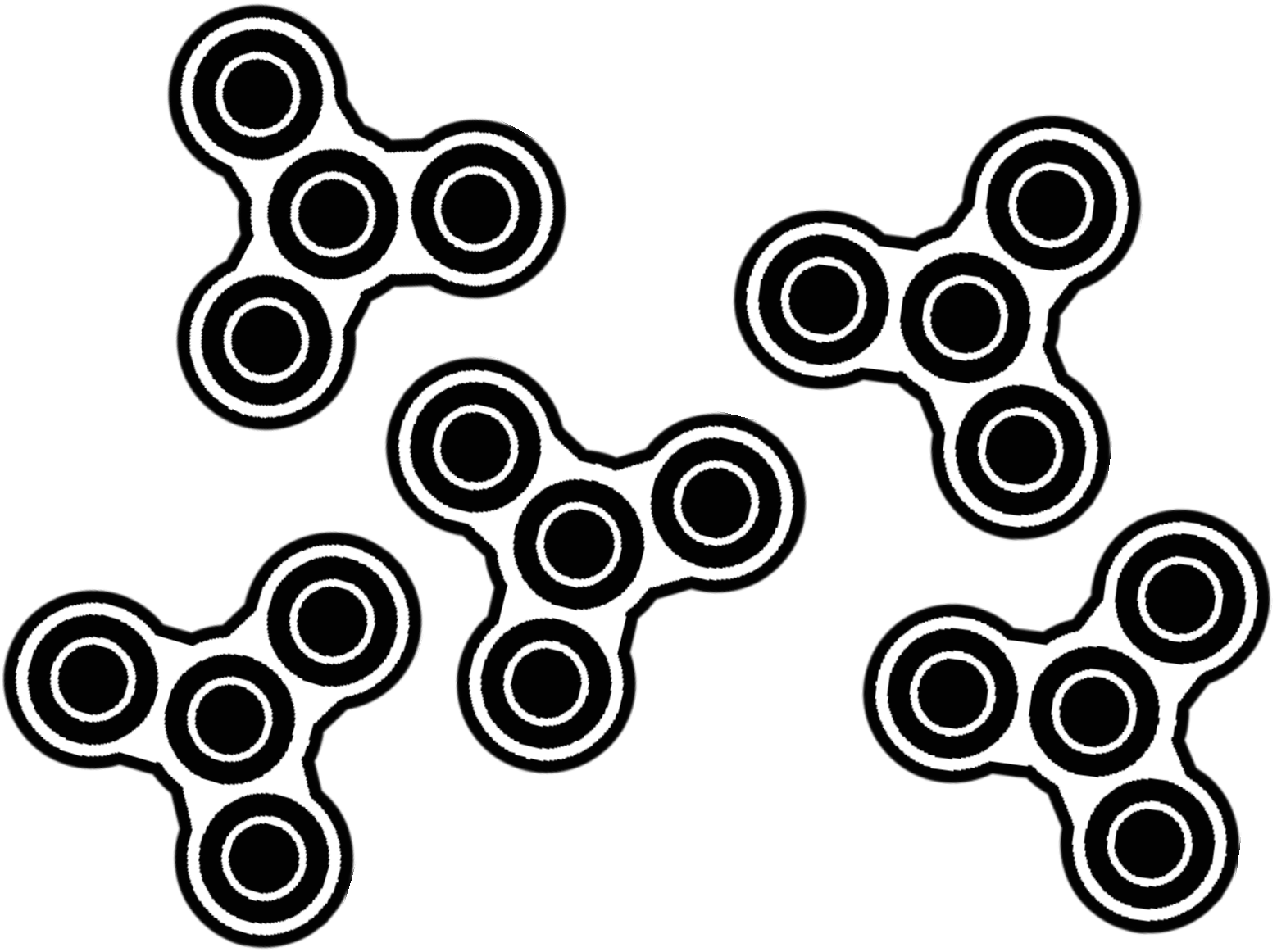
Set Up:

Print the parts you wish to use for each student or for each group. These can be printed front to back. Each page has directions for what students need to do. Students can work at their own pace to complete each page but the whole class will be needed for parts 7 & 8. Students will determine how to set up their spinner - whether on a desk, table, or the floor for example - so students will need to spread around the room. For the graphing activities, choose a graph size that fits how many trials students did or how large the class is - 2 sizes are included.

How to Spin the Fidget:

Many students are already familiar so ask them to demonstrate. If not, the most common way is to place the spinner on a surface. Apply slight pressure to the bearing with your pointer finger and flick the end. You can also hold it between the thumb and pointer finger and flick the end.

FIDGET
spin-off



Which fidget spinner and technique will result in the longest spin?

Name:

Part 1

THE SPINNER

For this challenge, you will need a fidget spinner to test. First give your spinner a nickname. Then record your spinner's brand, materials it is made from, number of weights, color, and size. Measure the diameter (length from one tip to another tip across the center) and the thickness with a ruler. Be sure to indicate the units you used to measure. Finally, draw your spinner. Show and label any specific features like curves, points, weights, bearings, or other designs.

NICKNAME OF SPINNER

BRAND/CREATOR

COLOR

MATERIALS

NUMBER OF WEIGHTS

DIAMETER

THICKNESS

ILLUSTRATION

Part 2

THE TECHNIQUE

First practice spinning. Once you have developed a technique that you are comfortable with, fill out the checklist. You will need to **use this same technique** each time you spin when collecting data so write it all down.

HAND USED

- ❑ LEFT HAND
- ❑ RIGHT HAND

HAND MOVEMENT

- ❑ PUSH WITH ONE FINGER
- ❑ QUICK FLICK WITH 2 FINGERS

BODY POSITION

- ❑ STANDING
- ❑ SITTING
- ❑ SQUATTING
- ❑ ON KNEES
- ❑ OTHER: _____

BODY DISTANCE

- ❑ 1 FOOT
- ❑ 2 FEET
- ❑ 6 INCHES
- ❑ OTHER: _____

SPINNER LOCATION

- ❑ TABLE TOP
- ❑ DESK
- ❑ FLOOR
- ❑ CARPET
- ❑ OTHER: _____

START POSTION

- ❑ SPINNER ON SURFACE
- ❑ SPINNER IN HAND

Anything ELSE?

Part 3

THE SPIN

Spin each fidget the same predetermined amount of times.. If you are working with a small group or partner, you may split the spins - just be consistent and do the technique as marked on the technique page each time. Time the length of the spin - use either minutes and seconds or just seconds. Be sure to circle which you used. The spin is over when the spinner no longer moves on its own. If the spin ends due to human error (bumping it for example) check the box.

Number of trials (spins):
Circle one or choose your own (realistic) number.

3 5 10 ◯

	Length of Spin	
SPINNER NICKNAME:	MINUTES AND SECONDS -OR- SECONDS (CIRCLE ONE)	HUMAN ERROR
Spin 1		☐
Spin 2		☐
Spin 3		☐
Spin 4		☐
Spin 5		☐
Spin 6		☐
Spin 7		☐
Spin 8		☐
Spin 9		☐
Spin 10		☐

THE SPIN *continued...*

	Length of Spin	
SPINNER NICKNAME:	MINUTES AND SECONDS -OR- SECONDS (CIRCLE ONE)	HUMAN ERROR
Spin 11		☐
Spin 12		☐
Spin 13		☐
Spin 14		☐
Spin 15		☐
Spin 16		☐
Spin 17		☐
Spin 18		☐
Spin 19		☐
Spin 20		☐
Spin 21		☐
Spin 22		☐
Spin 23		☐
Spin 24		☐

THE MATH

Example 1

Convert minutes + seconds into total seconds.

(# minutes x 60) + leftover seconds

If your first spin lasted 3 minutes and 20 seconds, you would multiply 3 x 60 to get 180 seconds plus the additional 20 seconds, which equals 200 seconds total.

Convert 3 minutes and 20 seconds:

(3 x 60) = 180

180 + 20 = 200 total seconds

	MINUTES + SECONDS	TOTAL SECONDS
Spin 1	3 min and 20 s	200 s

Example 2

Find the average length of your spins.

$$\frac{\text{Total \# seconds}}{\text{Number of spins}}$$

Add up all of the seconds in the second column. Divide the total number of seconds by the number of trials or spins you did.

TRIAL	TOTAL SECONDS
Spin 1	200
Spin 2	138
Spin 3	124

200+138+124 = 462

462 ÷ 3 = 154 s

Part 4

THE DATA

List your trials (1, 2, 3, 4...etc.) and the total seconds of each in the table. You will use this data to find the average length and make a graph.

TRIAL	TOTAL SECONDS

THE DATA continued...

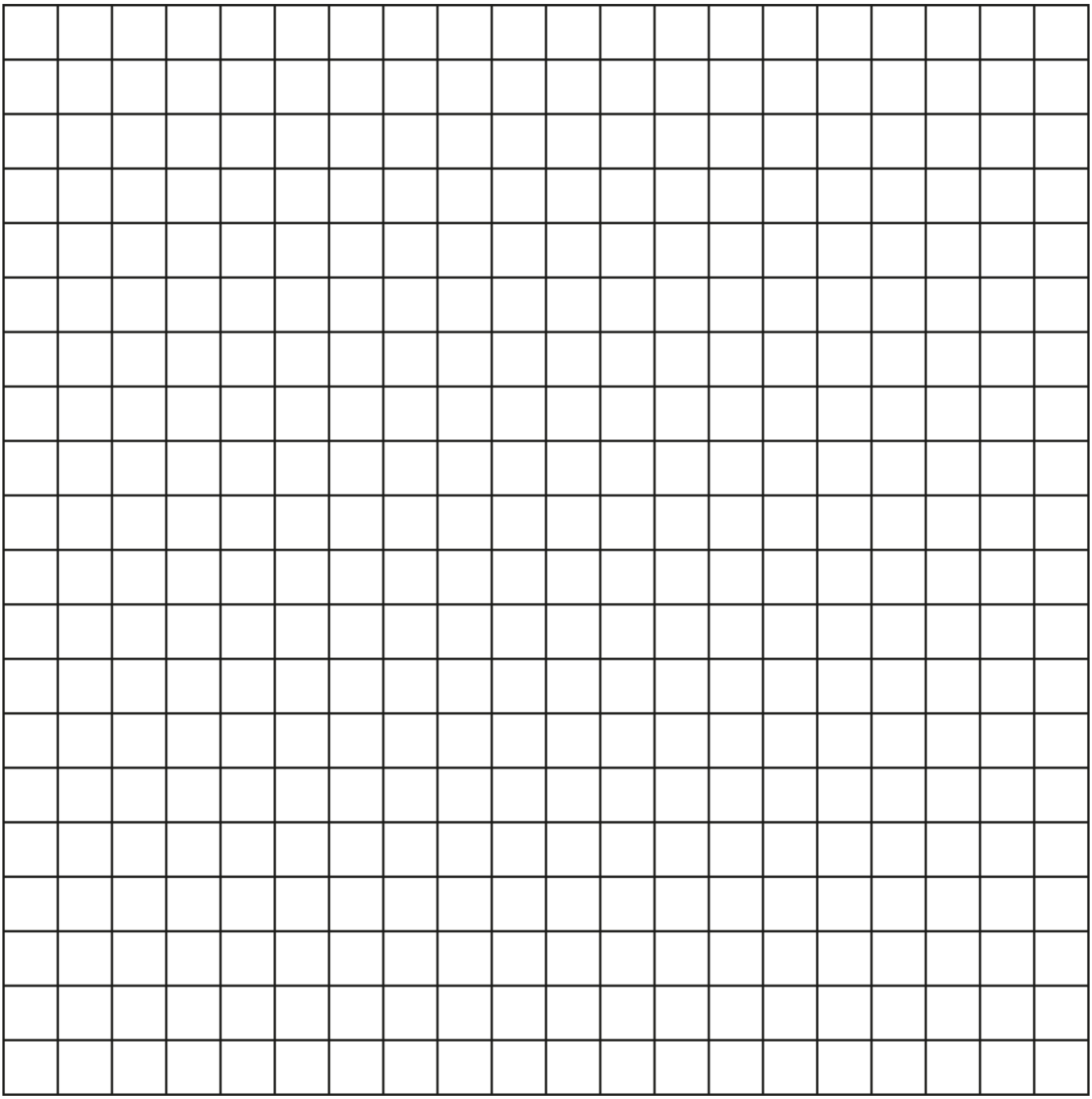
TRIAL	TOTAL SECONDS

Part 5

THE GRAPH

Use the data to create a bar graph of the total seconds each spin lasted. Title your graph and label the trials and seconds. Think about how to label your y-axis to fit your data best.

(Title)



Spin Time in Seconds

Trial Number

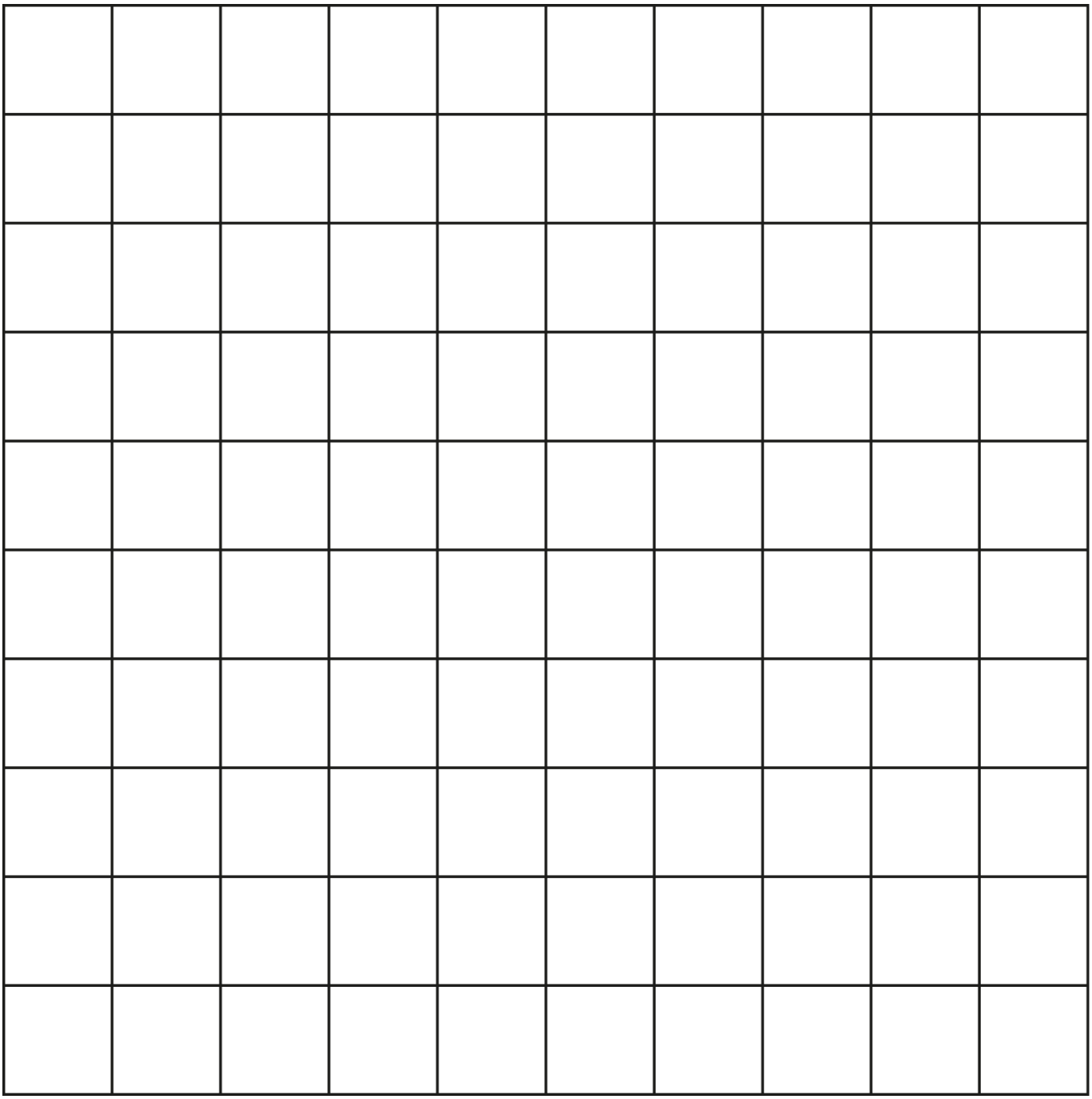
Part 5

THE GRAPH

Use the data to create a bar graph of the total seconds each spin lasted. Title your graph and label the trials and seconds. Think about how to label your y-axis to fit your data best.

(Title)

Spin Time in Seconds



Trial Number

Part 6

THE LANDMARKS

Look at your data to determine the following. First, calculate the average length of time in seconds that your fidget stayed spinning using the data from ALL trials. Next, eliminate outliers - in this case, do NOT use the data when a spin ended due to human error. Then calculate the average length of the spin in seconds when a human error did NOT end the spin. Use the space to show your work.

MEAN / AVERAGE LENGTH OF SPIN (including trials that ended in human error)	MEAN / AVERAGE LENGTH OF SPIN (NOT including trials that ended in human error)

How does the average change when you calculate it without the outliers?

Which average do you think more accurately reflects the length of time the spinner fidget will spin?

Part 7

CLASS DATA

Share and record the data with classmates to determine which spinner stayed spinning the longest on average. Use the average spin length for spins that did NOT end with human error.

SPINNER NICKNAME:	AVERAGE LENGTH OF SPIN IN SECONDS W/O HUMAN ERROR

CLASS DATA continued...

SPINNER NICKNAME:	AVERAGE LENGTH OF SPIN IN SECONDS W/O HUMAN ERROR

Part 8

CLASS GRAPH

Use the data to create a bar graph of the average length of spin for your class data. Title your graph and label the spinner nicknames and average seconds. Think about how to label your y-axis to fit your data best.

(Title)

Average Spin Time in Seconds

Spinner Nickname

Part 8

CLASS GRAPH

Use the data to create a bar graph of the average length of spin for your class data. Title your graph and label the spinner nicknames and average seconds. Think about how to label your y-axis to fit your data best.

(Title)

Average Spin Time in Seconds

Spinner Nickname

Part 9

THE RESULTS

Which spinner stayed spinning on average for the longest time? Have that team share and demonstrate their technique.

What variable in their technique do you think helped their fidget stay spinning the longest? Why?

Change your technique to mirror the technique used by the student/group with the longest spinning fidget. Time a few trials using the new technique - does changing your technique help your fidget spin longer? If not, what else might effect the length of time a spinner spins?

Look at the top 3 longest spinning fidgets. What design choices do those spinners have in common? What design did you notice seems to correlate with longer spin times?

Part 10

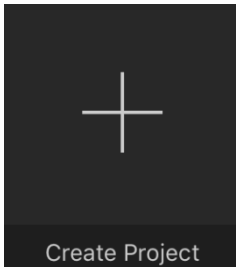
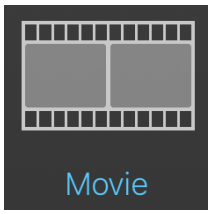
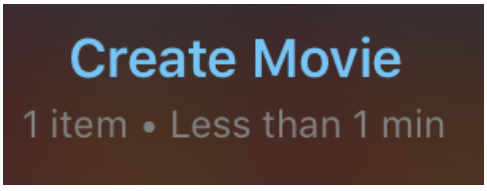
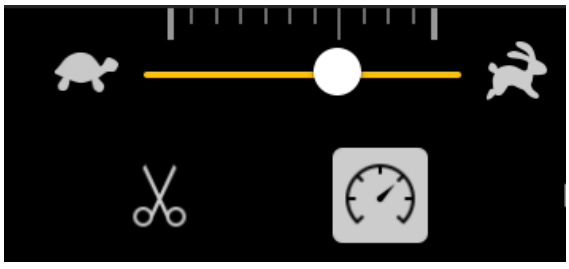
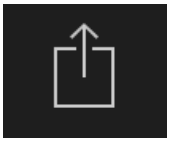
DESIGN YOUR OWN

Use what you have learned from your data and your classmates' data to design your own fidget spinner. Your goal is to design a spinner that will hypothetically spin the longest. Label the parts of your spinner and the materials each part is made from.

Part II

THE VIDEO on iPads

Film yourself spinning your fidget spinner using the iPad camera. Then you can slow down your video with iMovie.

1. After filming a short video on the iPad camera, open the app iMovie. If it is your first time using the app, give it access to the camera and microphone.	
2. Press Create Project	
3. Choose Movie	
4. Select your video clip by touching it and then touching Create Movie	
5. Touch your clip then the speedometer. Touch and drag the dot over to the turtle to slow down your video.	
6. Touch Done.	
7. Name your clip and touch the box with the arrow to save your slowed-down video to the camera roll.	

Part II

THE VIDEO on iPads

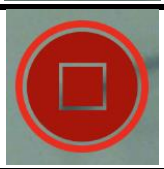
If you don't have iMovie, you can use a free app called Slow Motion Camera Free.

1. Open the App Slow Motion. If it is your first time using the app, give it access to the camera and microphone.

2. Set up an area to film. Have a buddy hold the iPad vertically and do a few practice spins to make sure he/she can fit the entire spin into the frame.

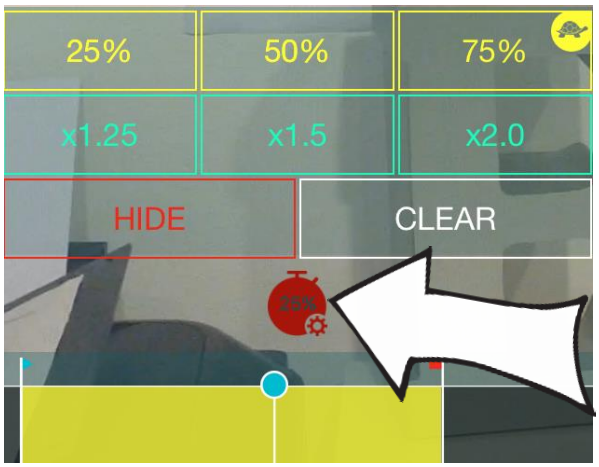
3. Press the red circle button to start filming.

4. Press the circle button again to stop filming.



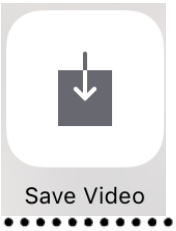
5. Press the video in the bottom left corner to open it. Touch it again.

6 Touch the yellow bar and adjust the length if you want or just drag it to fill the space. Then touch the stop watch. Set the speed to 25%.



7. Press the share button to save.

8. Select to save the video to the camera roll.

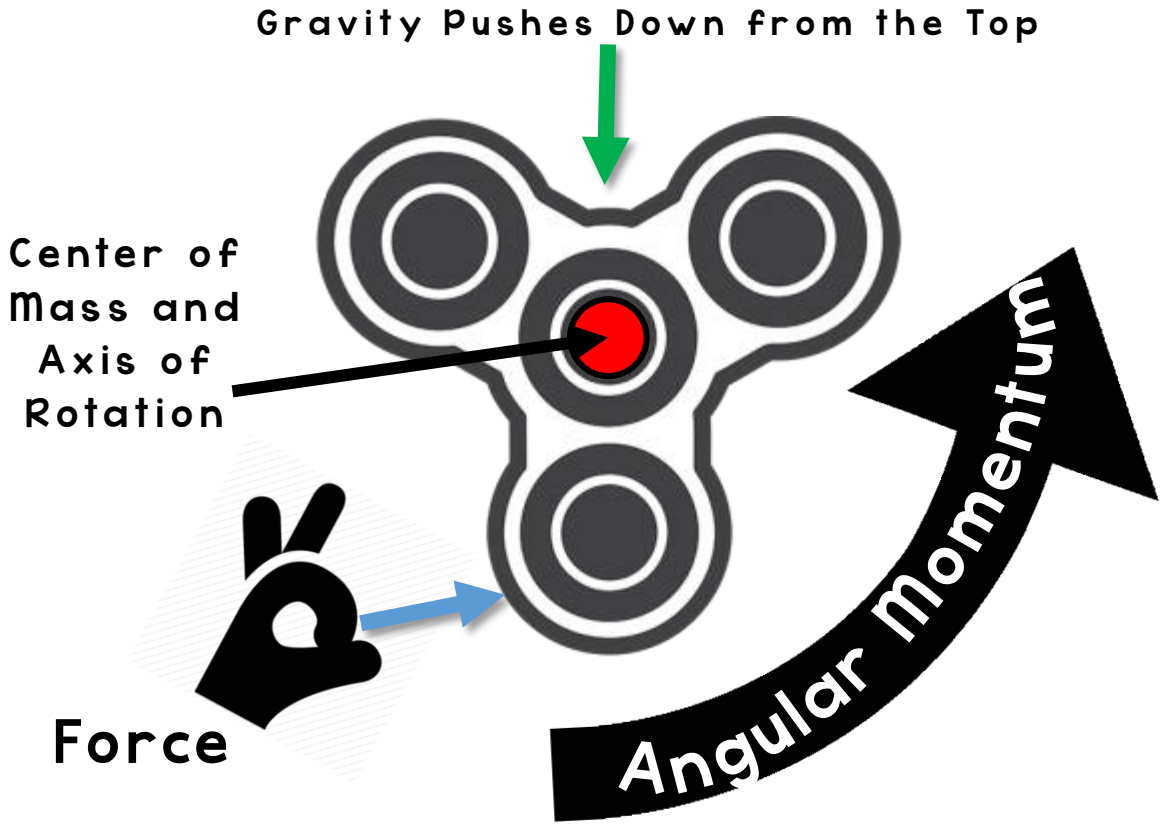


THE RUBRIC

How did you do? Use the scale to rate your performance in the Fidget Spin-Off

	NEEDS IMPROVEMENT	GOOD	EXCELLENT
I completed all parts of the project.	1	2	3
I followed the directions .	1	2	3
I determined the average length of time my fidget will stay spinning.	1	2	3
I determined which spinner in the class had the longest average spin time.	1	2	3
My calculations were accurate.	1	2	3
		TOTAL	/15

THE EXPLANATION



When spun, the fidget has one axis about which it will spin steadily and smoothly. The fidget's center of mass is located in the center of the bearing. When you apply a force to the outer part of the fidget with your fingers - away from the center of mass - it will rotate. The fidget's spin about the rotational axis gives it an **angular momentum**, which will remain constant until some outside **torque** works on it.

Angular momentum is a property involving the speed of rotation, the mass of the spinner, and how the mass is distributed.

The property of angular momentum resists change. But variables such as friction, human interference and design flaws that shift the center of gravity slightly or unequal weight distribution can all impact the length of the spin.