

Teaching

measures of central tendency?

This engaging math project will make mean, median, and mode

real and relevant to your

students, teaching them where it is used in real life!

**TASK #7** **GAME ON!**  
Over the last few weeks, you've been helping the stadium improve their operations to become more profitable. Now it's time to put it to the test. Did your suggestions work?

Here is the mean revenue per game before the stadium hired you, and after the stadium hired you.

BEFORE HIRING YOU	
Category	Mean Revenue
Ticket Revenue	\$312,000
Concession Revenue	\$46,000
Gift Shop and Souvenir Revenue	\$65,000
<b>TOTAL REVENUE</b>	

In order to be profitable, the stadium needs to have a positive profit. How much would their total revenue be after hiring you?

TOTAL REVENUE BEFORE HIRING YOU

TOTAL REVENUE AFTER HIRING YOU

Category
Ticket Revenue
Concession Revenue
Gift Shop and Souvenir Revenue
<b>TOTAL REVENUE</b>

Did the total revenue after hiring you increase or decrease? Explain.

**TASK #3** **CONC**  
Your next task is to figure out why there are so many leftover hot dogs. You need to figure out why this is happening. You ask the concession manager about it and this is how she responds.

You'll need to take a closer look at the data to prepare each night.

HOT DOGS SOLD PER GAME	
Date	Number of Hot Dogs Sold
July 3	345
July 5	950
July 7	327
July 10	350
July 15	362
July 19	331
July 20	347

As you look at the data, you notice that there is an outlier that is skewing this data. Which number is the outlier? \_\_\_\_\_

What effect will this outlier have on the mean? \_\_\_\_\_

Could this explain why there are so many leftover hotdogs? Explain. \_\_\_\_\_

**TASK #2** **TICKET PRICES**  
The first thing you decide to investigate is ticket prices. Could that be the reason for the loss in revenue?

Ticket prices vary based on where fans are seated. The table below shows the prices in each section. There are an equal number of seats in each section.

RIDGEROCK FIELD	
Section	Ticket Price
1	\$75
2	\$67
3	\$42
4	\$28
5	\$13

What is the mean (average) ticket price? Show your work.

Now that you have figured out the mean ticket price, you decide to compare it to a profitable baseball stadium, Trident Park, in a nearby city.

GLOBAL PARK	
Section	Ticket Price
1	\$74
2	\$70
3	\$62
4	\$45
5	\$27

What is the mean (average) ticket price at Global Park? Show your work.

How does this compare to the mean ticket price at Ridgerock Field?

In your opinion, do the ticket prices need to be changed? Why? \_\_\_\_\_

Mean number of hot dogs sold per game: \_\_\_\_\_



So often, the mean, median, and mode unit is taught by simply giving students lists of numbers and having them do calculations.

But imagine how it could **transform students' understanding** if they actually understood WHY they might use these measures in real life!



This math project includes **12 activity pages** to practice calculating and using mean, median, and mode.

First, your students will be introduced to the back story. They are a business auditor whose job it is to figure out why a local baseball stadium is losing money.



**TASK #1**

**YOU'VE BEEN HIRED!**

There's good news and bad news. The bad news is that the local baseball stadium, Ridgerock Field, is losing money and might have to shut down. The good news – YOU have been hired to fix it!

As a Business Auditor, it's your job to find where businesses are losing money, and then make recommendations so they can fix the issues. List some possible reasons that the baseball stadium is losing money.

Because you are new to this business auditor position, you make sure to hand out business cards everywhere you go. Design your business card below. Include your company name, contact info, logo, or anything else you think people should know about you!

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Then students will be guided through various tasks to figure out how they can help the stadium become profitable again!

## TASK #7 GAME ON!

Over the last few weeks, you've been helping the stadium improve their operations to become more profitable. Now it's time to put it to the test. Did your suggestions work?

Here is the mean revenue per game before the stadium hired you, and after the stadium hired you.

BEFORE HIRING YOU	
Category	Mean Revenue Per Game
Ticket Revenue	\$312,000
Concession Revenue	\$46,000
Gift Shop and Souvenir Revenue	\$65,000
<b>TOTAL REVENUE</b>	

In order to be profitable, the stadium would have to increase their revenue by 20%. How much would their total revenue need to be to be profitable?

TOTAL REVENUE BEFORE HIRING YOU

Category	Mean Revenue Per Game
Ticket Revenue	
Concession Revenue	
Gift Shop and Souvenir Revenue	
<b>TOTAL REVENUE</b>	

Did the total revenue after hiring you increase by 20%?

## TASK #4 ORDER UPSIDE

You've noticed that this baseball team needs to work on their upsells. You have some data to make more recommendations.

Popcorn sales are an easy place to start with upsells. This stadium only has one size of popcorn and there are no upsell options.

- Offer extra butter as an option (at an additional cost of \$1).
- Offer a Popcorn and Candy Combo for only \$2 more.

On the night of the next game, you're already noticing a lot of upsell purchases! Take a look!

FIRST 10 POPCORN SALES (Before the upsell options were implemented)				FIRST 10 UPSIDE SALES	
Item	Cost Per Item	Quantity Sold	Total Revenue	Item	Total Revenue
Regular Popcorn Bag	\$5	10		Regular Popcorn Bag	
<b>TOTAL REVENUE FROM FIRST 10 POPCORN SALES</b>				Regular Popcorn Bag with Extra Butter	
<b>MEAN AMOUNT OF EACH ORDER</b>				Popcorn and Candy Combo	

How did the upsell options impact the mean amount of each popcorn order?

Do you think upsells are a good way to increase the mean amount of each order? Or is there a better way?

## TASK #3 CONCESSION STAND

Your next task is to investigate the concession stand. Could this possibly be where even more money is being lost?

Hot dogs are popular at baseball games, but when you spend some time in the concession stand you notice that there are lots of leftover hot dogs being thrown out after each game. This is a lot of wasted money! You need to figure out why this is happening! When you ask the concession manager about all this waste, this is how she responds.



You'll need to take a closer look at the data that she's been using to decide how many hot dogs to prepare each night.

HOT DOGS SOLD PER GAME	
Date	Number of Hot Dogs Sold
July 3	345
July 5	950
July 7	327
July 10	350
July 15	362
July 19	331
July 20	347



As you look at the data, you notice that there is an outlier that is skewing this data. Which number is the outlier?

What effect will this outlier have on the mean?

Could this explain why there are so many leftover hotdogs? Explain.

Popcorn and Candy Combo	\$7	4	
<b>TOTAL REVENUE FROM FIRST 10 POPCORN SALES</b>			
<b>MEAN AMOUNT OF EACH ORDER</b>			

# Throughout the project, students will learn about:

- ✓ when it makes sense to use mean, median, or mode as a measure of central tendency
- ✓ the effect of an outlier
- ✓ calculating mean, median, and mode
- ✓ investigating real-life scenarios using measures of central tendency

### GIFT SHOP

**TASK #5**

You have a sneaking suspicion that the gift shop is not as profitable as it could be. Let's dig into the data.

First, you ask the gift shop manager to provide you with the amounts of the first 15 gift shop sales at the last game. He gives you the following amounts:


17, 4, 17, 35, 17, 17, 25, 4, 17, 17, 25, 17, 17, 4, 25

Arrange these amounts into ascending order to make them easier to analyze.

The mode (number that appears most often) is 17. The median is 17. The mean is 17. The range is 31. The outlier is 4.

Looking at the price list, it's clear that the most popular items are the 17 dollar items.

Here's what the manager has to say:



I just wish we had more of the 17 dollar items. The 4 dollar items take up 75% of our sales. In my opinion, we need to get rid of the 4 dollar items. I don't want to see anyone out of foam just not ending up with a gift.

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You recommend to the concession manager that she use a different measure of central tendency, because the mean is being skewed by the outlier. Which one should she use - median or mode? Let's check it out.

Calculate the <u>mode</u> for the hot dog data set on the previous page.	Calculate the <u>median</u> for the hot dog data set on the previous page.
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**MODE**  
THE NUMBER THAT APPEARS THE MOST

Which measure of central tendency (mean, median, mode) do you think is the best to use to decide how many hot dogs to prepare for the game? Why?

Based on your opinion above, how many hot dogs should be prepared for the game?

What effect will this have on the amount of waste? Will it be more or less? Why?

**THINK ABOUT IT:**

What is an outlier? \_\_\_\_\_

What are three different ways to describe a data set? \_\_\_\_\_


What are three measures of central tendency? \_\_\_\_\_

### AGES OF FANS

**TASK #6**

The ages of the fans who attend the baseball game will help the stadium manager make decisions about marketing, snacks, and other things.

When you ask the Marketing Manager about the ages of fans that they primarily market to, this is what she has to say:



The majority of our fans fall into the age 0-30 and 31-60 categories. We think most of those fans are in their 20's and 30's so we make sure that the majority of our marketing is for people in that age range.

You'll need to investigate this to make sure the stadium's marketing is targeting the right age range. You survey 30 random people as they enter the stadium. Their ages are:

31	42	12	15	35	29
65	17	35	56	50	7
29	59	79	13	12	56
7	28	14	44	17	12
35	34	32	15	35	10

Plot the data on the line plot below. Draw a ● to represent each person.