GRADE 7 · UNIT 13 · LESSON 2–3

# Justifying and Choosing Measures of Center and Spread

**MA.7.DP.1.1**

I can choose the measures of center and variation that best summarize a data set, and justify the choice from its shape, outliers and context.

# Warm-Up

1. Which value is an outlier? 14, 16, 15, 41, 13, 17, 15
2. Solve: $n - 6 \geq 2$
3. Solve: $3x - 7 = 20$
4. Six prices add up to $54. What is their mean?

# Warm-Up

1. Which value is an outlier? 14, 16, 15, 41, 13, 17, 15 **41**
2. Solve: $n - 6 \geq 2$ $n \geq 8$
3. Solve: $3x - 7 = 20$ $x = 9$
4. Six prices add up to $54. What is their mean? **$9**

# Vocabulary

**symmetric**

the data look about the same on both sides of the center; the mean and the median are close

**skewed**

most of the data on one side, with a tail stretching out on the other; the tail pulls the mean toward it

**typical value**

a value that describes most of the data — what a measure of center is for

**box plot**

a display of five numbers: the least value, Q1, the median, Q3 and the greatest value; the box holds the middle half

**histogram**

bars that show how many values fall in each interval; the bars touch

# Notes

## I. Look at the shape first




A: symmetric, no outlier. Mean 6, median 6. Use the mean.

B: one far value. Mean 8, median 6. Use the median.

# Notes

## II. The pairs

| Center | Variation | Use it when |
|---|---|---|
| Mean | Range | symmetric, no outlier |
| Median | IQR | skewed, or an outlier |

The range is made of the two extremes; the mean uses every value.

The IQR ignores the extremes, and so does the median.

# Notes

## III. The purpose can overrule the shape

Outlier or tail — what is typical? Use the median and the IQR.

Every value counts — a total, the worst case? Use the mean and the range.

An outlier does not decide it alone: ask what the summary is for.

Say why: "I chose the ___ because ___."

# Example 1

Fifteen household incomes on one street, in thousands of dollars:

38, 41, 42, 45, 47, 48, 50, 52, 53, 55, 56, 58, 60, 62, 238

A report gives the median. Is the median the better measure of center?

**Find the mean and the median, then justify.**

# Example 1

Mean: 945 ÷ 15 = 63. Median: the 8th of the 15 values, 52.

238 is far above the rest, and it pulls the mean up.

63 is greater than 14 of the 15 incomes: it is not typical.

**Answer: Yes: the median, 52 thousand dollars**

# Your Turn

Seven house prices, in thousands of dollars:

210, 225, 230, 240, 245, 250, 630

An ad gives the mean as the typical price. Is the mean the best measure? What should the ad use?

# Your Turn

Seven house prices, in thousands of dollars:

210, 225, 230, 240, 245, 250, 630

An ad gives the mean as the typical price. Is the mean the best measure? What should the ad use?

Mean: $(210 + 225 + 230 + 240 + 245 + 250 + 630) \div 7 = 290$

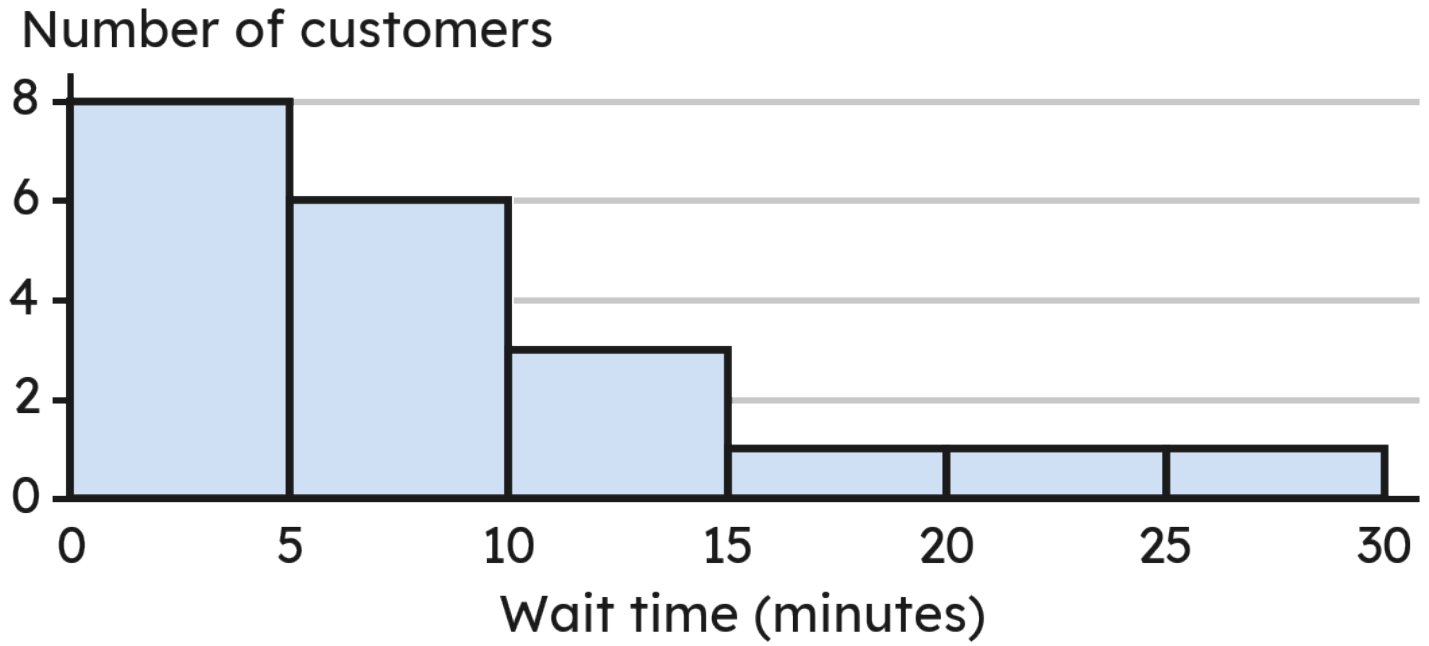
Median: the 4th of the 7 values, 240

630 is far above the rest: 290 is greater than 6 of the 7 prices

**Answer: No: the median, 240 thousand dollars**

# Example 2

The histogram shows how long 20 customers waited at a bank.




**Choose a measure of center and a measure of variation. Why?**

# Example 2

A bar holds its left number up to, not including, its right: a 10 is in the bar from 10 to 15.

Most waits are under 10 minutes; a few long waits make a tail to the right.

The data are skewed: the tail pulls the mean up.

The median and the IQR are not pulled by the tail.

**Answer: The median and the IQR**

# Your Turn

Ten sandwich prices, in dollars:

4, 5, 6, 6, 7, 7, 8, 8, 9, 10

Choose a measure of center and a measure of variation. Then find both.

# Your Turn

Ten sandwich prices, in dollars:

4, 5, 6, 6, 7, 7, 8, 8, 9, 10

Choose a measure of center and a measure of variation. Then find both.

Symmetric, no outlier: the mean and the range

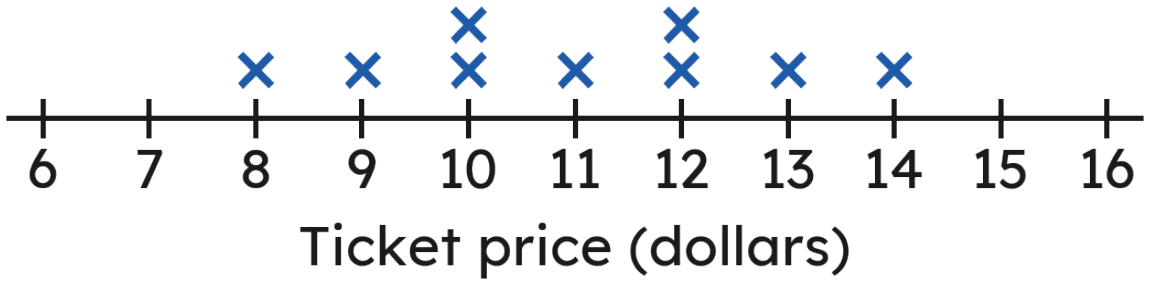
Mean $70 \div 10 = 7$ (the median agrees); range $10 - 4 = 6$

**Answer: Mean 7 dollars (the median agrees); range 6 dollars**

# Whiteboards · Question 1 of 9

The line plot shows a movie ticket's price at 9 theaters.

**Which is the best measure of center, and why?**




**A.** Mean: it is symmetric

**B.** Median: the mean is higher

**C.** Median: 14 is an outlier

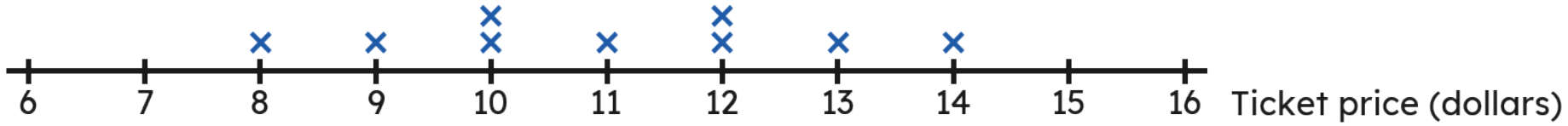
**D.** Range: it shows the spread

**Answer it.**

# Whiteboards · Question 1 of 9

The line plot shows a movie ticket's price at 9 theaters.

**Which is the best measure of center, and why?**




Symmetric about 11, and no value is far from the rest: no outlier

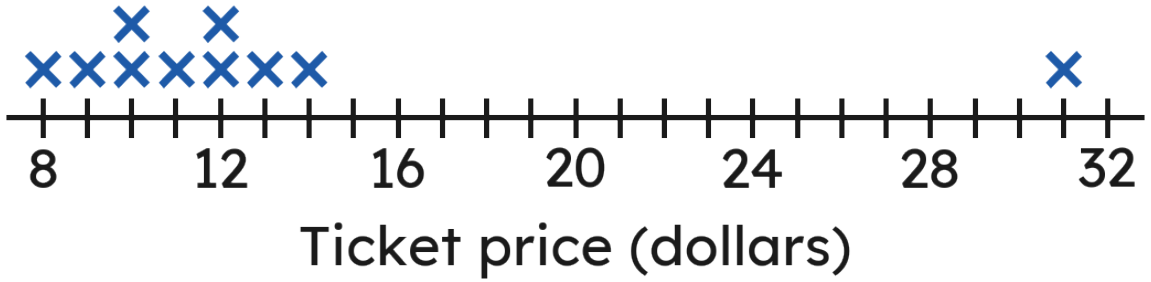
Mean: $99 \div 9 = 11$; median: 11. The mean uses every value.

**Answer: A — the mean**

# Whiteboards · Question 2 of 9

Movie ticket prices at 10 theaters, one of them 31 dollars:

**Which is the best measure of center now, and why?**




**A.** Mean: it uses every value

**B.** Median: 31 pulls the mean

**C.** Range: 31 is an outlier

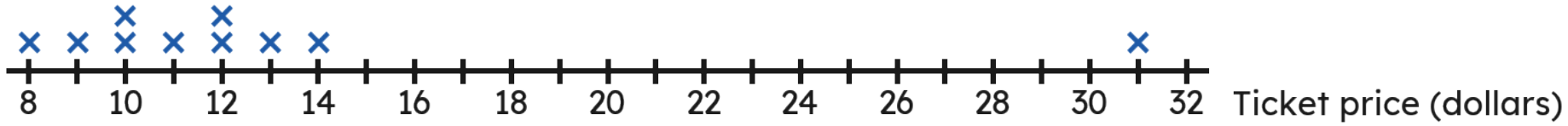
**D.** Mean: 31 pulls the median

**Answer it.**

# Whiteboards · Question 2 of 9

Movie ticket prices at 10 theaters, one of them 31 dollars:

**Which is the best measure of center now, and why?**




Mean: $130 \div 10 = 13$; median: $(11 + 12) \div 2 = 11.5$

31 is far from the rest and pulls the mean above 7 of the 10 prices

**Answer: B — the median**

# Whiteboards · Question 3 of 9

A report gives the median price of a home.

**Which measure of variation should go with it?**

**A.** The range: it uses every value

**B.** The IQR: it is the median of the upper half

**C.** The IQR: it ignores the extremes

**D.** The range: it shows the highest price

**Answer it.**

# Whiteboards · Question 3 of 9

A report gives the median price of a home.

**Which measure of variation should go with it?**

The median ignores the extremes, and so does the IQR

**Answer: C — the IQR: it ignores the extremes**

# Whiteboards · Question 4 of 9

The plot shows 11 students' chore earnings for a week, in dollars.

**Choose the better measure of center, and find it.**

Chore earnings (dollars)

| Stem | Leaf |
|---|---|
| 1 | 2 4 5 7 8 |
| 2 | 0 1 1 3 6 |
| 3 | |
| 4 | 7 |

Key: 1 \| 2 means 12

**Answer it.**

# Whiteboards · Question 4 of 9

The plot shows 11 students' chore earnings for a week, in dollars.

**Choose the better measure of center, and find it.**

Chore earnings (dollars)

| Stem | Leaf |
|---|---|
| 1 | 2 4 5 7 8 |
| 2 | 0 1 1 3 6 |
| 3 | |
| 4 | 7 |

Key: 1 | 2 means 12

47 is far from the rest:

use the median.

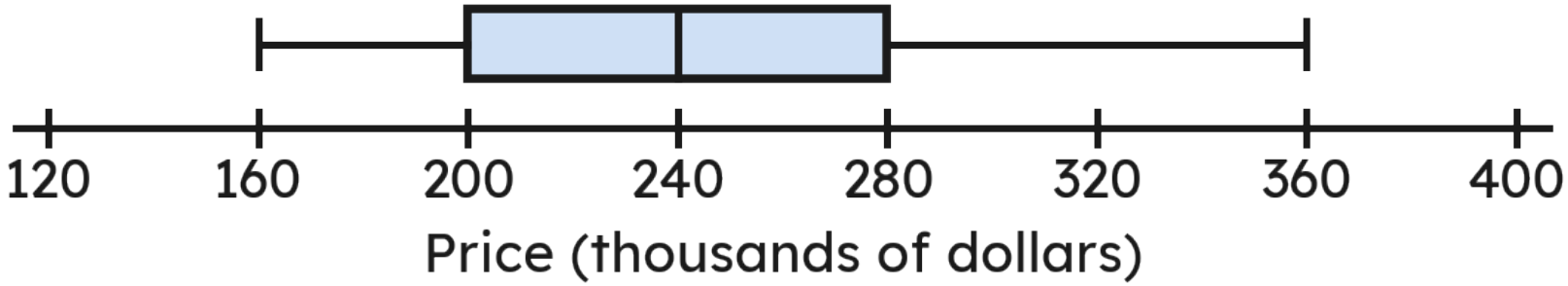
Median: the 6th of 11, 20

**Answer: The median, 20 dollars**

# Whiteboards · Question 5 of 9

The box plot shows home prices in a town, in thousands of dollars.

**What is the interquartile range of the prices?**

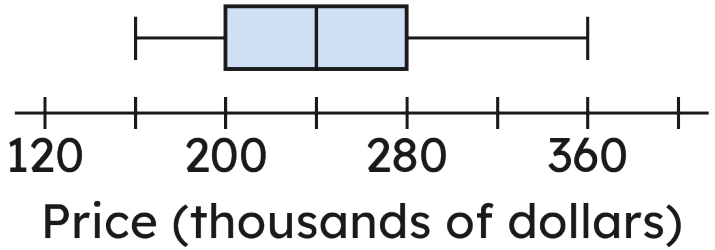



**Answer it.**

# Whiteboards · Question 5 of 9

The box plot shows home prices in a town, in thousands of dollars.

**What is the interquartile range of the prices?**




The box: Q1 is 200, Q3 is 280

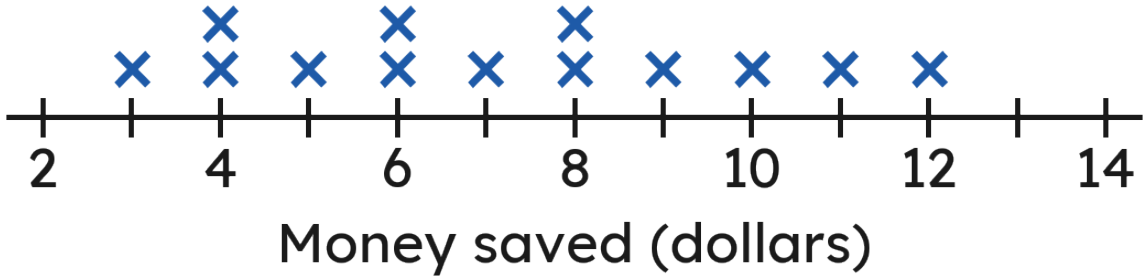
IQR: $280 - 200 = 80$

**Answer: 80 thousand dollars**

# Whiteboards · Question 6 of 9

The line plot shows how much 13 students saved in a month.

**Is there an outlier?**




**A.** Yes, 12: the greatest value

**B.** Yes, 3 and 12: the extremes

**C.** Yes: the range is 9

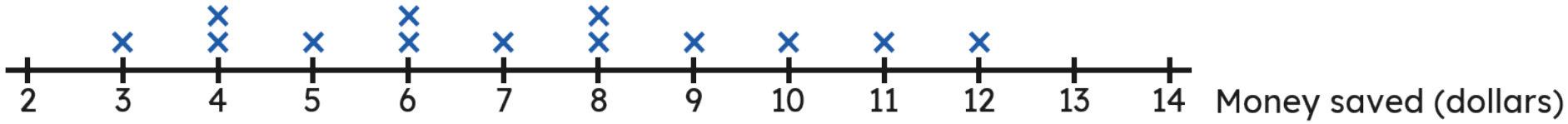
**D.** No: there is no big gap

**Answer it.**

# Whiteboards · Question 6 of 9

The line plot shows how much 13 students saved in a month.

**Is there an outlier?**




Neighbors are at most 1 apart: no value is far from the rest

3 and 12 are the extremes, not outliers

**Answer: D — no outlier**

# Whiteboards · Question 7 of 9

A town is sizing its storm drains, so its heaviest rains matter most.

**Which pair of measures should it use to summarize its rainfall?**

**A.** Median and IQR

**B.** Mean and range

**C.** Median and range

**D.** Mean and IQR

**Answer it.**

# Whiteboards · Question 7 of 9

A town is sizing its storm drains, so its heaviest rains matter most.

**Which pair of measures should it use to summarize its rainfall?**

The heaviest rains are the point: keep the extremes in

The mean and the range both use the extremes

**Answer: B — the mean and the range**

# Whiteboards · Question 8 of 9

Five apartments in a building with 12 floors rent for $850, $900, $950, $975 and $2,300 a month.

**What is the typical rent?**

**Answer it.**

# Whiteboards · Question 8 of 9

Five apartments in a building with 12 floors rent for $850, $900, $950, $975 and $2,300 a month.

**What is the typical rent?**

2,300 is far above the rest: use the median

Median: the 3rd of the 5 rents, 950

**Answer: $950 a month**

# Whiteboards · Question 9 of 9

A company's 8 workers earn $40,000 to $58,000, and its owner earns $430,000.

It says its mean salary is $90,000.

**Is that mean typical? Explain, and name a better measure.**

**Write your answer in sentences.**

# Whiteboards · Question 9 of 9

A company's 8 workers earn $40,000 to $58,000, and its owner earns $430,000.

It says its mean salary is $90,000.

**Is that mean typical? Explain, and name a better measure.**

$430,000 is far above the rest and pulls the mean up

Every worker earns less than $90,000: use the median

**Answer: No: use the median**

# Independent Practice

1. A line plot of 12 home prices is symmetric with no outlier. Which measure of center fits it best?

2. A histogram of 40 electric bills has a long tail to the right. Which measure of center fits it best?

3. Which measure of variation goes with the mean?

4. Weekly allowances, in dollars: 5, 6, 8, 8, 9, 10, 30. Choose the better measure of center and find it.

5. Electric bills, in dollars: 60, 64, 66, 70, 72, 74, 76, 78, 80, 140. Choose the better measure of variation and find it.

6. A store says the mean price of its 9 phones is $300, and one phone costs $1,200. Is the mean a good measure of a typical price? Why?

# Before You Go

Symmetric, no outlier: the mean and the range.

A tail or a far value: the median and the IQR — unless the extremes are the point.

Tomorrow: two groups, two displays — which is greater, which varies more.

# IXL

1. Open IXL and start today's skills.
2. Work on paper where the question needs work. The answer box does not show it.
3. Every skill listed is required, to a SmartScore of 60. Due by the Unit 13 test.

**Today's skills — all required**

Describe distributions in dot plots (ZX7)