MONTH 11

Data, Statistics & Investigation

Collect, Represent & Question

Month 11 asks students to use data to understand the world while remaining alert to misleading conclusions. Students calculate measures of center, compare distributions, read and create graphs, evaluate samples, and plan a small investigation.

WHY THIS MONTH MATTERS

Students move from solving individual problems toward organizing evidence, selecting representations, and explaining strategies that can be reused in unfamiliar situations.

Students Should Be Able To:

- Calculate mean, median, mode, and range.
- Represent data clearly.
- Compare data sets with equal centers.
- Identify misleading graph scales.
- Recognize biased samples.
- State what evidence does and does not show.

Skills We Will Practice

- Data collection
- Measures of center
- Measures of spread
- Graph interpretation
- Sampling and bias
- Mathematical communication

This Month's Activities

- Data Detective
- Same Mean, Different Story
- Read the Bar Graph
- Misleading Graph Alert
- Sampling Bias
- Line-Plot Investigation

Connection to Month 12

The month develops a different kind of mathematical maturity: organizing possibilities, evaluating uncertainty, or interpreting evidence. These habits will be essential during the final multi-topic Math Mania Challenge.

ACTIVITY 1

Data Detective

Solve, represent, and explain your reasoning.

THE CHALLENGE

A group records puzzle-solving times: 4, 6, 6, 7, 9, 10 minutes. Find the mean, median, mode, and range.



WHAT TO RECORD

Show each calculation.

Hint: The mean is total divided by the number of values.

FINISHED EARLY? TRY THESE CHALLENGES

1. Add a time of 14 minutes. Find the new mean and median.

2. Which measure changes the most after adding 14?

Show Your Strategy

FINAL ANSWER: _____

ACTIVITY 2

Same Mean, Different Story

Solve, represent, and explain your reasoning.

THE CHALLENGE

Team A scores 6,6,7,7,8. Team B scores 2,6,7,9,10. Compare the mean and range of the two teams.



WHAT TO RECORD

Explain why the mean alone does not tell the whole story.

Hint: Both totals are 34.

FINISHED EARLY? TRY THESE CHALLENGES

1. Which team is more consistent? Use the ranges as evidence.

2. Can five identical whole-number scores have mean 6.8? Explain.

Show Your Strategy

FINAL ANSWER: _____

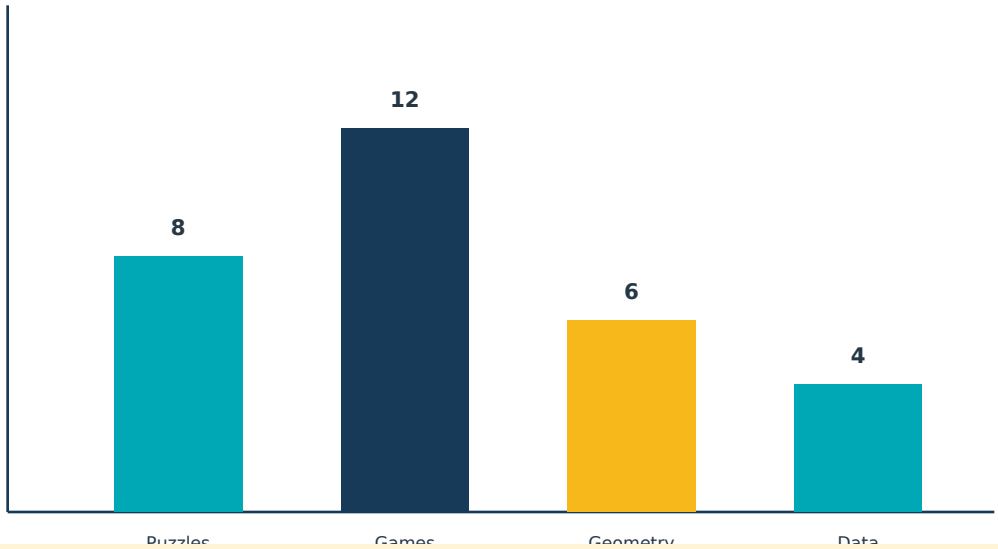
ACTIVITY 3

Read the Bar Graph

Solve, represent, and explain your reasoning.

THE CHALLENGE

A survey records favorite activities: Puzzles 8, Games 12, Geometry 6, Data 4. Answer: Which is most popular? How many students responded? How many more chose Games than Data?



WHAT TO RECORD

Use the graph to answer all three questions.

Hint: Add all four bars for the total.

FINISHED EARLY? TRY THESE CHALLENGES

1. If 3 more choose Geometry, what are the new total and top category?

2. After that change, how many more choose Games than Geometry?

Show Your Strategy

FINAL ANSWER: _____

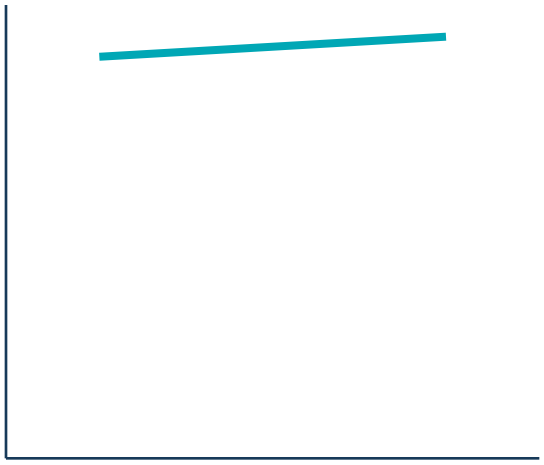
ACTIVITY 4

Misleading Graph Alert

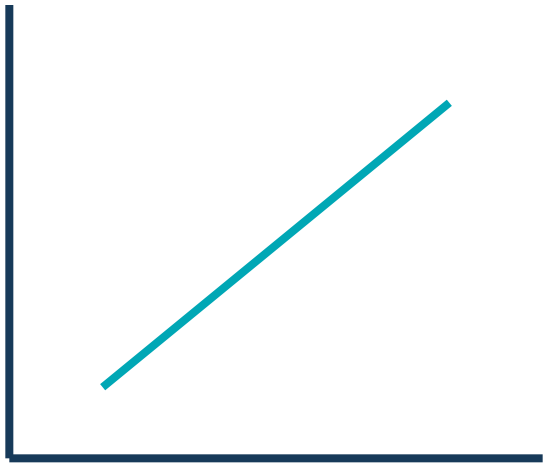
Solve, represent, and explain your reasoning.

THE CHALLENGE

Two graphs show scores rising from 80 to 84. One vertical axis begins at 0; the other begins at 79. Which graph makes the increase look larger, and why?



Axis begins at 0



Axis begins at 79

WHAT TO RECORD

A graph can be numerically accurate yet visually misleading.

Hint: Inspect the starting value of each vertical axis.

FINISHED EARLY? TRY THESE CHALLENGES

1. What is the percent increase from 80 to 84?

2. Name one way to make the graph comparison more honest.

Show Your Strategy

FINAL ANSWER: _____

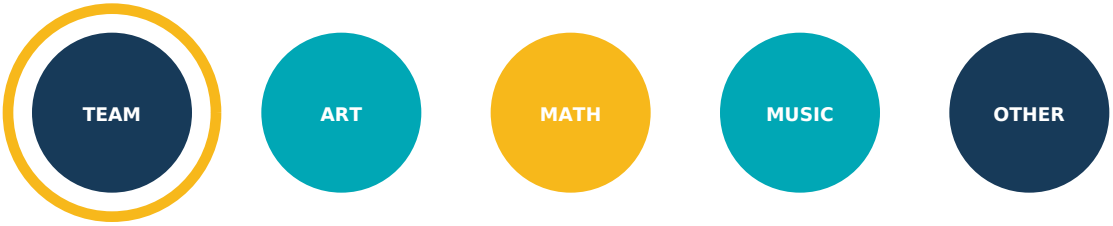
ACTIVITY 5

Sampling Bias

Solve, represent, and explain your reasoning.

THE CHALLENGE

A student asks only members of the basketball team, “What is the best school sport?” Is this a fair sample of the whole school? Explain and propose a better sample.



Only one group was asked.

WHAT TO RECORD

Think about who had a chance to be selected.

Hint: A representative sample should include students from many groups.

FINISHED EARLY? TRY THESE CHALLENGES

1. Describe a better sample using at least three student groups.

2. Could a large biased sample still mislead? Explain.

Show Your Strategy

FINAL ANSWER: _____

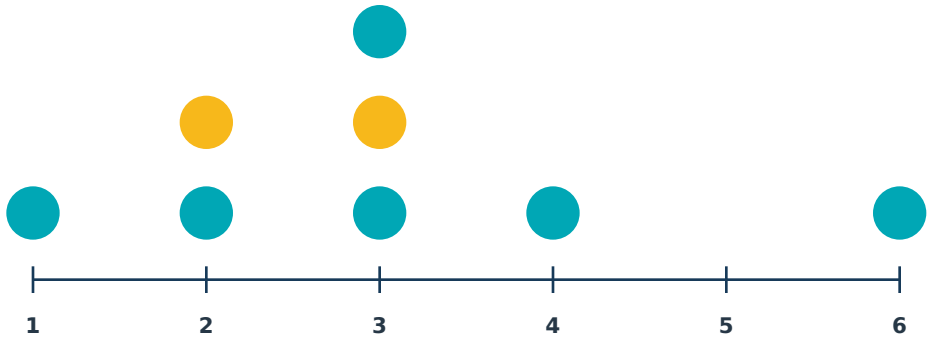
ACTIVITY 6

Line-Plot Investigation

Solve, represent, and explain your reasoning.

THE CHALLENGE

Books read by eight students: 1,2,2,3,3,3,4,6. Find the median, mode, and range, then describe the shape of the data.



WHAT TO RECORD

Use the line plot as well as the list.

Hint: For eight values, average the fourth and fifth values for the median.

FINISHED EARLY? TRY THESE CHALLENGES

1. Add a value of 9. Find the new median and range.

2. Give a value that could be added without changing the mode.

Show Your Strategy

FINAL ANSWER: _____

FINAL ACTIVITY

Mini Data Investigation

Plan, represent, test, and communicate.

YOUR MISSION

Choose a question that can be answered with data. Collect at least 15 responses or measurements, organize the data, create an appropriate graph, calculate at least two summary measures, and present one supported conclusion plus one limitation.

Project Checklist

- Write a clear question or goal.
- Choose an organized mathematical representation.
- Show calculations and label evidence.
- Explain the strategy or conclusion.
- Check the result and identify a limitation or possible revision.

Planning Space

INSTRUCTOR SECTION

Month 11 Answer Key

Data, Statistics & Investigation

1. Data Detective

Mean 7; median 6.5; mode 6; range 6.

2. Same Mean, Different Story

Both means are 6.8. Team A range 2; Team B range 8, so Team B varies more.

3. Read the Bar Graph

Games; 30 students; Games exceeds Data by 8.

4. Misleading Graph Alert

The graph beginning at 79 makes the 4-point rise look much larger.

5. Sampling Bias

Biased. Use a random or stratified sample drawn from the whole school.

6. Line-Plot Investigation

Median 3; mode 3; range 5. Most values cluster around 2-3 with a high value at 6.

Project

Answers vary; check sample, graph, calculations, conclusion, and limitation.

INSTRUCTOR SECTION

Month 11 Extension Answers

Solutions for the finished-early questions

1. Data Detective

Challenge 1: New mean 8; new median 7.

Challenge 2: The range changes most, from 6 to 10.

2. Same Mean, Different Story

Challenge 1: Team A; its range is 2.

Challenge 2: No. Five identical whole-number scores have a whole-number mean.

3. Read the Bar Graph

Challenge 1: Total 33; Games remains highest with 12.

Challenge 2: 12 - 9 = 3.

4. Misleading Graph Alert

Challenge 1: 4/80 = 5%.

Challenge 2: Begin at 0 or clearly mark the truncated axis.

5. Sampling Bias

Challenge 1: Randomly sample students from each grade or activity group.

Challenge 2: Yes. A large sample can still be selected unfairly.

6. Line-Plot Investigation

Challenge 1: New median 3; new range 8.

Challenge 2: For example, 5; the mode remains 3.