



***Mathematics**

Problem Solving for Santa

Every year that Santa travels delivering presents to the “good little boys and girls”, he has one of his elves keep track of the time it takes. Students have the opportunity to use this data to solve problems and offer Santa suggestions to improve his travel time next year.

Kentucky Mathematics Arts

Measurement (2.8, 2.10, 2.12) Grades 4-6

Academic Expectations:

2.8 Students understand various mathematical procedures and use them appropriately and accurately.

2.10 Students understand measurement concepts and use measurements appropriately and accurately.

2.12 Students understand mathematical structure concepts including the properties and logic of various mathematical systems.

Ohio Mathematics Standards: Measurement

Problem-solving & Time

Benchmark(s) Grade 4

C. Develop common referents for units of measure for ...**time** to make comparisons and estimates.

Grades 5-6

E. Use problem solving techniques and technology as needed to solve problems involving...**time** and temperature.

Objective

Students will:

- Calculate and problem-solve scenarios regarding passage of time.
- Calculate sums using numbers in the thousands.
- Calculate the “mean” using numerical data.
- Interpret and explain information based on a data table.
- Make use of electronic spreadsheets. (optional)

Assessment

Student will be able to:

- Calculate multi-step problems.
- Analyze, interpret and conclude data results.
- Complete a student handout--a variety of given word problems.

Sample selected response items to gauge student understanding:

1. What is a mathematical “mean”?

Answer: The sum of a set of numbers divided by the number of elements in the set; an average of a set of numbers.

2. Define the term "data" as used for mathematical purposes.
Answer: Numerical facts from which conclusions can be drawn.
3. Deductive thinking is reasoning in which the conclusion follows necessarily from a general rule or principle. Inductive thinking is reasoning generated from particular examples to form a general conclusion. What type of thinking is used for mathematical problem-solving?

Answer: Both, dependent on the type of problem.

Vocabulary

- Mean
- Average
- Data

Materials

- Handout
- Pencils
- Calculators (optional)
- Electronic spreadsheet applications (optional) Visit the following websites to assist with use of formulas within an electronic spreadsheet
 - <http://www.baycongroup.com/el3.htm>
 - <http://www.ncsu.edu/sciencejunction/route/usetech/dataanalysis/pcdataanalysis/meuseformulas/index.html>
 - <http://www.neodesha.k12.ks.us/PD/office/5.html>

Activity

Santa's Travel Data Log

Teacher will:

1. Make copies of the Handout, "Santa's Travel Data Log." One for each student.
2. Review and/or introduce the concept of "mean" (average) through visuals, print definition, or hands-on student manipulation.
3. Distribute the handout and have the students complete (individually or in small groups). Their challenge to find the "mean" or average of the number of children per house visited by Santa in the production and tale of *Rudolph, the Red-Nosed Reindeer*, (formula: children visited / number of houses = average number of children per house), and too, answer accompanying questions about the resulting data. (Student calculations may be completed using paper and pencil, calculators, or an electronic spreadsheet program.)
4. Debrief the activity and have students examine the resulting answers and data.
5. Have students generate conclusions and ideas from the data to help Santa strategize and plan for a faster delivery the next year.

6. Have students consider how their new ideas would have benefited Santa in the Children's Theatre Production of *Rudolph, the Red-Nosed Reindeer*, in regards to the difficulties he faced with weather, etc.
7. Create a classroom display to share student ideas and thinking with others.



*** Mathematics**
Handout: Santa's Travel Data Log

Name: _____

Directions:

Santa was thankful to find Rudolph when he did on the foggy Christmas Eve night. Rudolph helped Santa and his reindeer teams make their journey safely.

Study the data table below. Analyze the data to help you answer the following questions about Santa's trip.

Time/Hour	Number of houses Santa visited	Number of children receiving gifts	Average number of children per house
9:00-10:00 pm	10,000	21,000	
10:00-11:00 pm	9,500	20,000	
11:00pm-12:00am	8,000	16,000	
12:00-1:00 am	22,000	58,000	
1:00-2:00 am	25,000	60,000	
2:00-3:00 am	28,000	63,000	
3:00-4:00 am	27,000	89,000	
4:00-5:00 am	32,000	85,000	

1. What is the hour in which Santa visited the most houses?

2. What is the hour in which the most children received gifts?

3. During what hour do you think Rudolph joined the reindeer team?
_____ What data helps you to know? (Use specific data from the chart to support your answer.)

4. Based on the data, do you think it was fog, or the number of houses visited that slowed Santa down before Rudolph joined his team? Explain your answer. (Use specific data from chart to support your answer.)

5. If Rudolph had not joined Santa's team, at what time do you think Santa would have finished delivering toys? What information will help you calculate an answer? (Use specific data from chart to support your answer.)

6. What is the **mean** of the number of houses visited by Santa before Rudolph joined his team? (Show your work.)

7. What is the **mean** of the number of houses visited by Santa after Rudolph joined his team? (Show your work.)

8. What conclusions can you make using the data from this table to help Santa strategize and plan for next year's delivery? Record your suggestions below.



*** Mathematics**

Handout: Santa's Travel Data Log Answer Sheet

Name: _____

Directions:

Santa was thankful to find Rudolph when he did on the foggy Christmas Eve night. Rudolph helped Santa and his reindeer teams make their journey safely.

Study the data table below. Analyze the data to help you answer the following questions about Santa's trip.

Time/Hour	Number of houses Santa visited	Number of children receiving gifts	Average number of children per house
9:00-10:00 pm	10,000	21,000	2.1
10:00-11:00 pm	9,500	20,000	2.1
11:00pm-12:00am	8,000	16,000	2
12:00-1:00 am	22,000	58,000	2.6
1:00-2:00 am	25,000	60,000	2.4
2:00-3:00 am	28,000	63,000	2.3
3:00-4:00 am	27,000	89,000	3.3
4:00-5:00 am	32,000	85,000	2.7

1. What is the hour in which Santa visited the most houses?
_____ **4:00-5:00am**
2. What is the hour in which the most children received gifts?
_____ **3:00-4:00am**
3. During what hour do you think Rudolph joined the reindeer team?
_____ **12:00-1:00am** What data helps you to know?
During the first three hours, the number of houses visited was 10,000 or below. During the 12:00-1:00am time period Santa

visited 22,000 houses, which is more than twice the amount of houses than he had visited any previous hour. Every hour after that there were even more houses visited than there were during the 12:00-1:00am hour.

4. Based on the data, do you think it was fog, or the number of houses visited that slowed Santa down before Rudolph joined his team? Explain your answer.

It was the fog. Before Rudolph joined the team, there was an average of 2 or 2.1 children at every house Santa visited. After Rudolph joined the team, the average number of children in the houses visited ranged between 2.3 and 3.3 children each hour. Since there were more children and more houses visited, after Rudolph joined the team, it must have been the fog that was slowing Santa down.

5. If Rudolph had not joined Santa's team, at what time do you think Santa would have finished delivering toys? What information will help you calculate an answer?

The average number of houses visited per hour before Rudolph joined the team was approximately 9,200 ($10,000 + 9,500 + 8,000 / 3 = 9,167$). After Rudolph joined the team, 132,000 houses were visited before Santa was finished ($22,000 + 25,000 + 28,000 + 27,000 + 32,000 = 134,000$). If 134,000 is divided by 9,200 (the average number of houses visited before Rudolph joined the team) we find the Santa should finish delivering presents in approximately 14.5 hours. Therefore Santa would finish delivering his toys between 1:00-2:00pm the following day without Rudolph's help.

6. What is the **mean** of the number of houses visited by Santa before Rudolph joined his team?

$$10,000 + 9,500 + 8,000 / 3 = 9,167$$

7. What is the **mean** of the number of houses visited by Santa after Rudolph joined his team?

$$22,000 + 25,000 + 28,000 + 27,000 + 32,000 / 5 = 26,800$$

8. What conclusions can you make using the data from this table to help Santa strategize and plan for next year's delivery? Record your suggestions below. **Answers will vary.**