

Title: Collecting, Organizing and Displaying Data / “NEAT FEET”

Brief Overview:

These lessons will encompass collecting and displaying data with line plots and line graphs. In addition, children will analyze data by identifying the mean, median, mode, range, and outlier. When constructing line graphs the students will include the necessary components and choose an appropriate scale. All of the aforementioned is conclusive in this three-day data analysis mini-unit.

NCTM Content Standard/National Science Education Standard:

Data Analysis, Statistics and Probability

Grade/Level:

Grades 3 and 4

Duration/Length:

Three days (60 minutes per lesson)

Student Outcomes:

Students will:

- Collect and organize data by constructing a glyph, line plot, and line graph
- Analyze and interpret data displayed on line plots and line graphs

Materials and Resources:

Centimeter ruler
Construction Paper
Calculators
Centimeter Graph Paper
Adding Machine paper
Colored Pencils
Markers
Chart Paper
Numbered Cards
Newspaper
Graph Dry Erase Boards

Development/Procedures:

Lesson 1: Shoe Glyph.

Students will complete a glyph activity to collect, display and interpret data (Student Resource 1). Students will use some of the data later to create a line plot.

Preassessment –

- Show the students a completed glyph. Facilitate a discussion with the students to assess what they know about glyphs.

Launch –

- Using the completed glyph, have students make up a story about the glyph. Have one student begin the story then have others add details to the story using the glyph data. Use their words and descriptions to assess their current knowledge of interpreting glyph data.

Teacher Facilitation –

- Teacher will facilitate a discussion about glyphs.
 - What do glyphs represent? According to the Webster's Dictionary, a glyph contains a pictograph, hieroglyph or symbol used to represent different information.
 - How can you use your math skills to create a glyph? Glyphs allow students to collect, display and interpret data about themselves and other topics.
 - How can we convert some of this data to be used on a line plot? The teacher will then select a data set from the glyph that can be represented on a line plot.

Student Application –

- Students will independently read the survey questions and circle their answers.
- Students will work with a partner to trace the outline of their foot on the appropriate color of construction paper.
- Students will construct their glyph based on their responses using the glyph key Student Resource Sheet 1.
- Students will create an additional survey question and add the data to their glyph. Questions will be shared with their group and class so that their glyph will be correctly interpreted.

Embedded Assessment –

- Students will demonstrate their knowledge of collecting, displaying and interpreting data by accurately completing their glyph. (Student Resource Sheet 2).

Reteaching/Extension –

- For an extension of interpreting the data from the glyphs, as a class, graph the shoe numbers on a line plot. Determine the mean, median and mode (Student Resource Sheet 2).
- Reteach –Discuss each question with the group as students complete their glyphs. Select a glyph with no more than three sets of data. For teacher suggestions on glyphs refer to “ Glyphs I and II by Susan O’Connell.

Lesson 2 Line Plots Students will use a set of data in order to find the range, mean, median, and mode.**Preassessment –**

- Display previously completed shoe glyphs across the chalkboard. Ask students how they displayed their shoe glyph data and review and discuss the components of a line plot.

Launch –

- Arrange students in groups of eight.
- Give each student his or her foot patterns, ruler, marker, and chart paper.
- Students will use the ruler to measure their foot in centimeters.
- Then working with their group, they will make a line plot using their foot sizes on Student Resource Sheet 3.
- The teacher will facilitate and ask the students the following questions:
 - Why is this information important?
 - Who could use this information?
 - What do you think the typical foot size is for a fourth grader?

Teacher Facilitation –

- Each group will present their line plots to the class. The teacher will monitor and check to make sure the data is displayed correctly. Students will share the largest and the smallest sizes on their line plots.
- After each group has presented, the teacher will collect the class data (foot sizes) and complete a class line plot (Teacher Resource Sheet 1).
- As the teacher is creating the class line plot she will elicit support from each group for the construction of the plot. In addition to this the students will construct the plot as the teacher is creating it on the chalkboard using adding machine tape, numbered cards, and their foot patterns.
- The teacher will then explain the following vocabulary to the students: range, median, mode, and outlier. (The teacher will use his or her foot size to display the outlier.

Student Application –

- The teacher will give the Students Resource Sheet 4 “ Second Graders Tiny Feet”.

- Students will work with a partner to complete the activity. The teacher will facilitate to monitor individual student progress.
- Upon completion of "Second Graders Tiny Feet " the teacher will use an overhead copy to complete and discuss with the class. Answer key can be found on Teacher Resource Sheet 2.

Embedded Assessment –

- Students will write a letter to a tennis shoe company explaining their data (Sneakers for the Holiday – Student Resource Sheets 5a and 5b).
- Vignette Question: All of the tennis shoe companies need your help. They are anxiously planning their inventory for the holiday season and they desperately need to know what sizes to keep in stock for the season. Please explain to the company why it is important for them to know your range, median, and mean.

Reteaching/Extension –

- Students having difficulty should have reinforcement activities supervised by the teacher. In order to reteach mean give them a smaller data set (8-10 pieces of data) and let them use manipulatives.
- In order to review the median, give each student a numbered card with a set of data to model the median.

Lesson 3 Line Graphs Students will use a set of data in order to construct a line graph.

Preassessment –

- The teacher will facilitate a discussion about types of data and how to display data. Students will be asked the following questions:
 - What type of data do you display on a line plot?
 - What type of data do you display on line graphs? How do you know?

Launch –

- Give students the Student Resource Sheet 6 "Meekins Mighty Feet".
- Explain to the students that they need to construct a line graph with their group.
- Facilitate to make sure the students include all the components of a line graph.
- Then have the students list the components of a line graph. Answer key can be found on Teacher Resource Sheet 3.

Teacher Facilitation –

- Teacher will model how to construct a line graph using Meekins Mighty Feet Resource sheet on the overhead.
- The teacher will explain and clarify the following vocabulary with the students: x-axis, y-axis, scale, and line graph.
- The teacher will explain that a line graph displays data that shows change over time.

- While constructing the line graph discuss the importance of an appropriate scale.

Student Application –

- Arrange students in pairs.
- Give each pair of the students the graph paper and colored pencils to construct their graphs.
- Distribute Resource Sheet 7 “Baby Steps to Big Foot” and give students approximately 15 minutes to complete their line graphs. Answers can be found on Teacher Resource Sheet 4.

Embedded Assessment –

- Students will complete student resource sheet 8 “Little League Tennis Shoes” to construct and interpret a line graph. Answer key can be found on Teacher Resource Sheet 5.

Reteaching/Extension –

- Students that need more assistance with choosing appropriate scales for line graphs will complete group work with the teacher. The teacher will give the students a data set and they will use dry erase graph boards to construct the graphs. Use the weather page from the newspaper.
- Students who have grasped the concept should be given Student Resource Sheet 9 “Shopping for Shoes” to complete a double line graph. Answers can be found on Teacher Resource Sheet 6.

Summative Assessment:

Give the students the Student Resource Sheet 10 - Summative Assessment. They will need approximately 15-30 minutes to complete the activity. The answers are included in the packet on Teacher Resource Sheet 7.

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IT'S ALL ABOUT FEET



Name _____

Date _____

Shoe Glyph Instructions

Trace the outline of your foot on the appropriate color construction paper.

1. What is your favorite activity?

	Dance	Football	Basketball	Cheerleading	Other
Color of Foot	Red	Black	Yellow	White	Orange

2. Would you rather play sports or watch someone else play?

	Play	Watch
Write a number on your shoe	Write a number greater than 0 and less than 11 on your glyph	Write a number greater than 10 and less than 21 on your glyph

3. How many people are in your family?

	2	3	4	5	More than 5
Add eyelets (shoelace holes) to your shoe	Add 2 eyelets	Add 3 eyelets	Add 4 eyelets	Add 5 eyelets	Add 6 eyelets

4. Are your shoes tied with Velcro or shoelaces?

	Velcro	Shoelaces
Add Shoelaces	White	Black

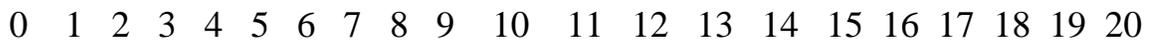
5. How many pairs of shoes do you have at home?

	2	3	4	5	More than 5
Number of stripes	2	3	4	5	6

6. Create your own survey question and add the data to your glyph.

Our Class's Shoe Glyph Line Plot

1. Place an X on the line plot of the number written on each student's shoe glyph.



2. Write two conclusions you can draw about our class's shoe numbers by looking at the line plot.

1. _____

2. _____

3. The typical number chosen by our class is _____.

4. The largest number chosen is _____ and the smallest number chosen is _____.



Our Neat Feet!

Group Worksheet

Names: _____

Directions: Measure each foot pattern in your group using a centimeter ruler and record the data. Plot the information on the Line Plot. Remember to include the graph title, labels and key.

1. Length of Feet (cm)

_____, _____, _____, _____, _____, _____, _____, _____



2. How does your foot size compare to your group's sizes?

3. What is the typical size foot in your group?



Our Neat Feet!

Class Worksheet

Length of Feet (cm)

_____, _____, _____, _____, _____, _____, _____, _____

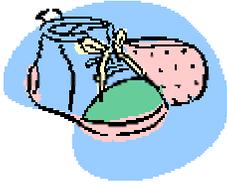
_____, _____, _____, _____, _____, _____, _____, _____

_____, _____, _____, _____, _____, _____, _____, _____



Use the data on the line plot to find the following.

mean _____ median _____ mode _____ range _____



Second Graders' Tiny Feet!

Directions: Plot the data onto the line plot below. Remember to include the graph title and labels.

1. Length of Feet (cm)

12, 7, 10, 11, 7, 10, 12, 13, 12, 12, 11, 9, 15, 17, 13

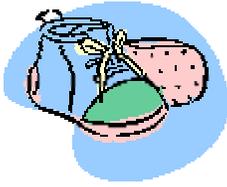


2. Use the data on the line plot to find the following.

mean _____ median _____ mode _____ range _____

3. Write two conclusions you can draw from the Second Graders Tiny Feet line plot?

4. Compare the data from the Second Grader's line plot to the Fourth Grader's line plot. What do you find most interesting about the data?

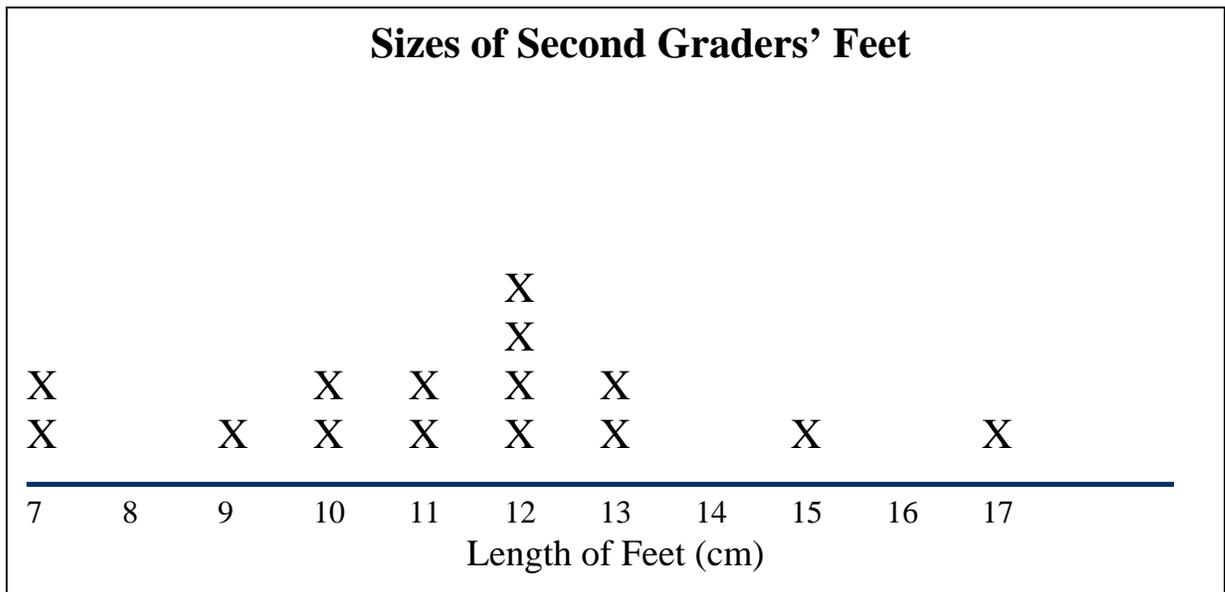


Second Graders' Tiny Feet!

Directions: Plot the data onto the line plot below. Remember to include the graph title, labels and key.

1. Length of Feet (cm)

12, 7, 10, 11, 7, 10, 12, 13, 12, 12, 11, 9, 15, 17, 13



2. Use the data on the line plot to find the following.

mean 9 median 12 mode 12 range 10

3. Write two conclusions you can draw from the Second Graders Tiny Feet line plot?

Answers will vary but should include information showing an understanding of the Data Analysis Vocabulary.

4. Compare the data from the Second Grader's line plot to the Fourth Grader's line plot. What do you find most interesting about the data?

Answers will vary but should include information showing an understanding of the Data Analysis Vocabulary.

Sneakers for the Holidays



Your class has been measuring your feet and creating line plots to display your information. Reebok, Nike, and Converse are all tennis shoe companies and they are interested in the data that you collected. In a couple of months, each shoe company will need your information to plan their holiday inventory. This years' market will target fourth grade students and they need your help. Write a letter to your favorite tennis shoe company's inventory manager. In your letter include the following:

- Explain the mean, median, and mode and why it is important.
- Describe the range and the importance of this information.
- State any conclusions you can draw based on the data. Use data to justify your conclusion.



Meekins' Mighty Feet

Directions: Use the data below to create a line graph showing Meekins' Mighty Foot size growth through the years. Remember to include all the components of a line graph and use an appropriate scale.

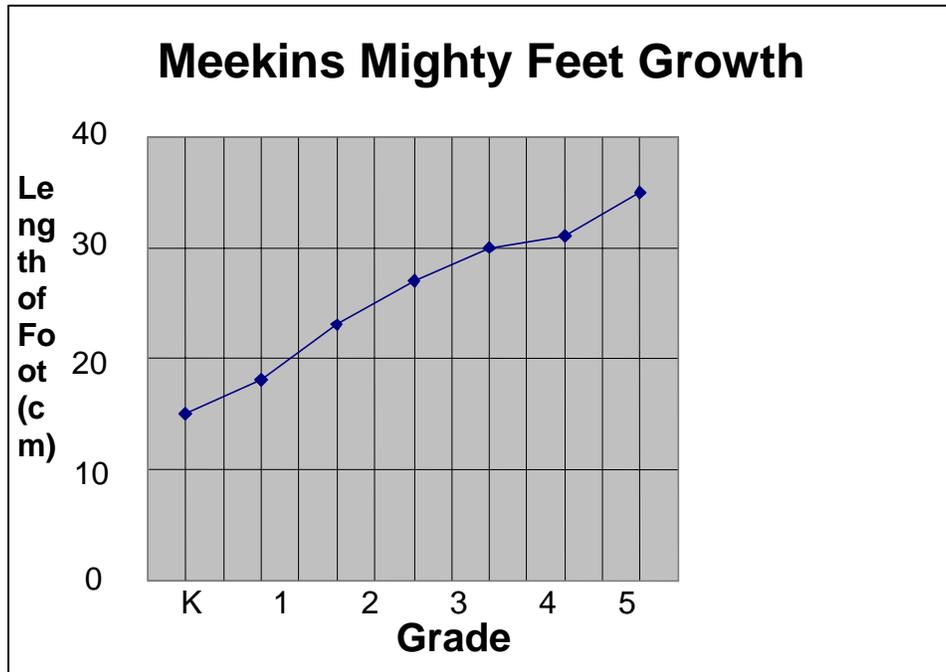
Grade	Length of Foot (cm)
K	15
1	18
2	23
3	27
4	30
5	31
6	35

- Title
- Labels
- X-axis (time increments)
- Y-axis (scale)
- Accurate Data



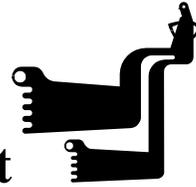
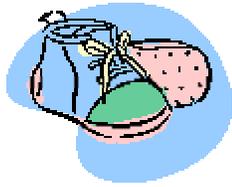
Meekins' Mighty Feet

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Grade	Length of Foot (cm)
K	15
1	18
2	23
3	27
4	30
5	31
6	35

- Title
- Labels
- X-axis (time increments)
- Y-axis (scale)
- Accurate Data

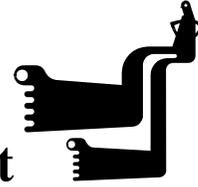
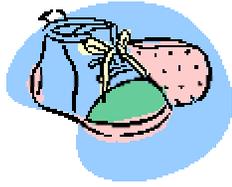


Baby Steps to Big Foot

Directions: Big Foot Billy has enormous feet. His mom has been tracking the length of them since he was a baby. Use the data below to create a line graph showing Big Foot Billy's foot size through the years. Remember to include all the components of a line graph and use an appropriate scale.

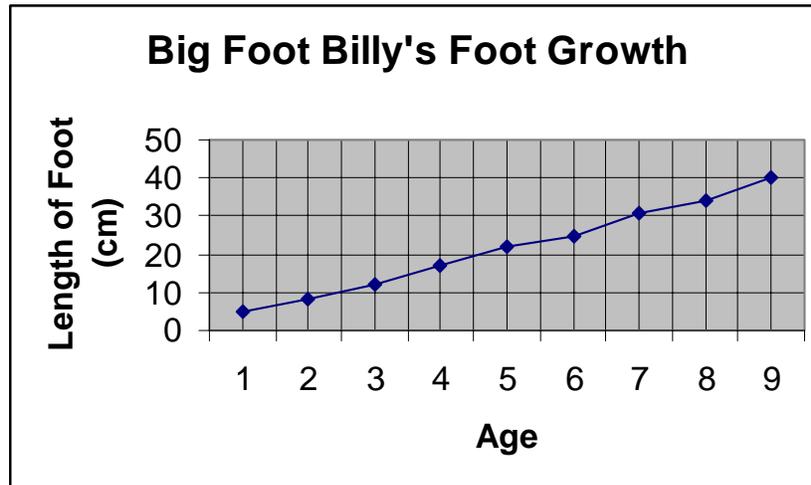
Age (Years)	Length of Foot (cm)
1	5
2	8
3	12
4	17
5	22
6	25
7	31
8	34
9	40

- Title
- Labels
- X-axis (time increments)
- Y-axis (scale)
- Accurate Data



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Age (Years)	Length of Foot (cm)
1	5
2	8
3	12
4	17
5	22
6	25
7	31
8	34
9	40

- Title
- Labels
- X-axis (time increments)
- Y-axis (scale)
- Accurate Data



Little League Tennis Shoes

Directions: Coach Johnson bought tennis shoes for his little league teams. Every year he had a different number of players and bought new shoes for everyone. Use the data below to create a line graph showing how many shoes he bought each year. Graph Coach Johnson’s purchases to create a line graph. Remember to include all the component of a line graph and use an appropriate scale.

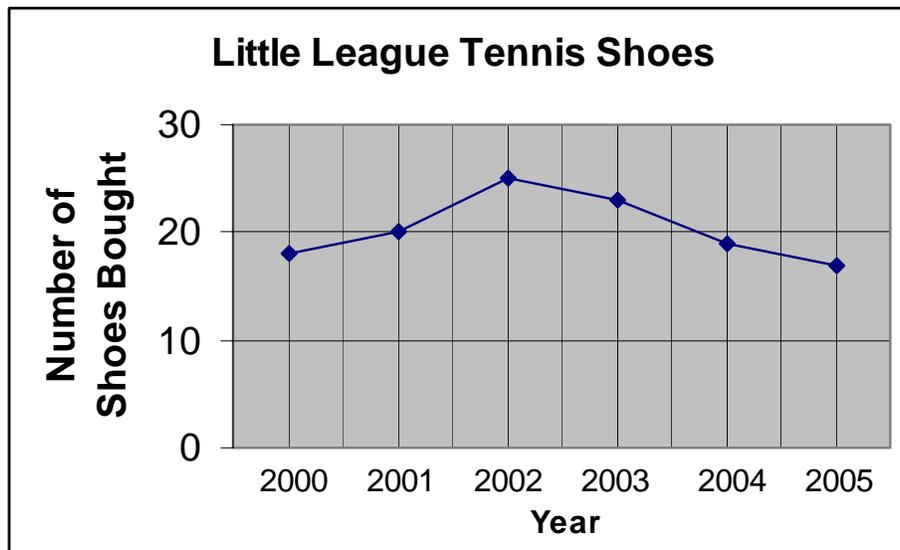
Year	Number of shoes bought
2000	18
2001	20
2002	25
2003	23
2004	19
2005	27

- Title
- Labels
- X-axis (time increments)
- Y-axis (scale)
- Accurate Data



Little League Tennis Shoes

Directions: Coach Johnson bought tennis shoes for his little league teams. Every year he had a different number of players and bought new shoes for everyone. Use the data below to create a line graph showing how many shoes he bought each year. Graph Coach Johnson's purchases to create a line graph. Remember to include all the component of a line graph and use an appropriate scale.



Year	Number of shoes bought
2000	18
2001	20
2002	25
2003	23
2004	19
2005	17

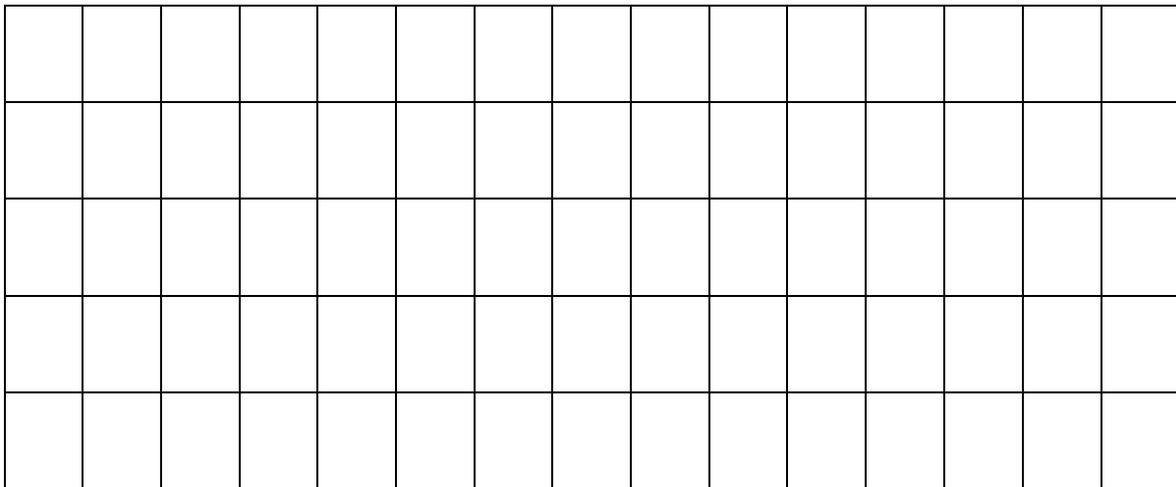
- Title
- Labels
- X-axis (time increments)
- Y-axis (scale)
- Accurate Data



Shopping for Shoes

Directions:

Ms. Andreozzi and Ms. Meekins went shopping for shoes over a 6-month period. Use the data below to create a line graph showing how many shoes they bought each month. Graph Ms. Andreozzi’s and Ms. Meekins’ purchases separately to create a double line graph. Remember to include all the component of a line graph and use an appropriate scale.



Month	Ms. Andreozzi	Ms. Meekins
September	8	7
October	4	6
November	3	9
December	6	12
January	6	5
February	10	10

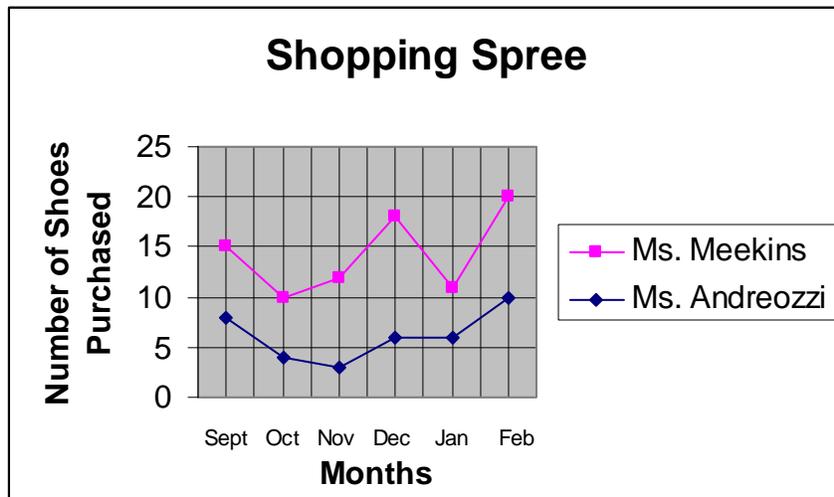
- Title
- Labels
- X-axis (time increments)
- Y-axis (scale)
- Accurate Data
- Legend



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Ms. Andreozzi and Ms. Meekins went shopping for shoes over a 6-month period. Use the data below to create a line graph showing how many shoes they bought each month. Graph Ms. Andreozzi's and Ms. Meekins' purchases separately to create a double line graph. Remember to include all the component of a line graph and use an appropriate scale.



Month	Ms. Andreozzi	Ms. Meekins
September	8	7
October	4	6
November	3	9
December	6	12
January	6	5
February	10	10

- Title
- Labels
- X-axis (time increments)
- Y-axis (scale)
- Accurate Data
- Legend

Summative Assessment

1. Use your calculator to find the mean of the data set:

12, 7, 10, 11, 7, 10, 12, 13, 12, 12, 11, 9, 15, 17, 13

- Ⓐ 5
- Ⓑ 8
- Ⓒ 9
- Ⓓ 12

2. Find the mode of the data set.

- Ⓐ 15
- Ⓑ 13
- Ⓒ 12
- Ⓓ 11

3. Find the range of the data set.

- Ⓐ 13
- Ⓑ 12
- Ⓒ 11
- Ⓓ 10

Name _____ Date _____

4. Sally's Shoe Company is taking inventory of their shoe sales. They wanted to complete a line graph to see if their sales are increasing monthly. In January they sold 5 pair of shoes, In February and March they sold 25 pairs, and April they sold 30, and in June – August they sold 25. Did they have an increase in shoe sales? Circle Yes or NO. Does the graph display the data properly?

Part A

SHOE SALES

45								
35								
25								
15								
10								
5								
	January	February	March	April	May	June	July	August

Part B

Use what you know about line graphs to explain why your answer is correct. Use numbers, words, and /or pictures in your explanation.

Summative Assessment

1. Use your calculator to find the mean of the data set:

12, 7, 10, 11, 7, 10, 12, 13, 12, 12, 11, 9, 15, 17, 13

- Ⓐ 5
- Ⓑ 8
- Ⓒ 9
- Ⓓ 12 correct answer

2. Find the mode of the data set.

- Ⓐ 15
- Ⓑ 13
- Ⓒ 12 correct answer
- Ⓓ 11

3. Find the range of the data set.

- Ⓐ 13
- Ⓑ 12
- Ⓒ 11
- Ⓓ 10 correct answer

Name _____ Date _____

4. Sally's Shoe Company is taking inventory of their shoe sales. They wanted to complete a line graph to see if their sales are increasing monthly. In January they sold 5 pair of shoes, In February and March they sold 25 pairs, and April they sold 30, and in June – August they sold 25. Did they have an increase in shoe sales? Circle Yes or NO. Does the graph display the data properly?

Part A

SHOE SALES

45									
35									
25									
15									
10									
5									
	January	February	March	April	May	June	July	August	

Do you think this line graph is displayed correctly? Check Yes or No

_____Yes

_____X_____No

Part B

Use what you know about line graphs to explain why your answer is correct. Use numbers, words, and /or pictures in your explanation.

No, the line graph is not correct. First, of all the scale is not written appropriately on the lines. The x and y axes are not labeled and the scale does not begin with zero nor is their a break to indicate that the line graphs scale begins with zero.

Also, labels on the x-axis are not centered under lines. The scale is placed in spaces and not on lines

