

## **Title: Let's Get Graphing!**

### **Brief Overview:**

This unit reviews reading and analyzing of various types of graphs, then continues with activities aimed at practicing application of appropriate scale and plotting points on the coordinate plane.

### **NCTM Content Standard/National Science Education Standard:**

Representation- create and use representations to organize, record, and communicate mathematical ideas; use representations to model and interpret physical, social, and mathematical phenomena.

NCTM AL.a1

Represent, analyze, and generalize a variety of patterns with tables, graphs, words, and, when possible, symbolic rules.

### **Maryland Standards:**

MD 8.1.K

Represent and interpret quantitative relationships in a table or graph.

MD 8.4.B

Interpret, organize and display data using frequency tables, circle graphs, box and whisker plots, scatter plots, and histograms.

MD 8.8

Students will demonstrate their ability to organize and consolidate their mathematical thinking in order to analyze and use information, and will present ideas with words, symbols, visual displays and technology.

MD 8.10 B

Identify the relationships among graphical, numerical, physical and algebraic mathematical models, and concepts.

### **Grade/Level:**

6<sup>th</sup> and 7<sup>th</sup> grade or beginning of the year warm-up for a pre-algebra class

**Duration/Length:**

6-7 days for 50 minute classes

3-4 days for 90 minute classes

**Student Outcomes:**

Students will:

- Recognize and be able to analyze various types of graphs.
- Understand how to choose a scale for their graph
- Know how to plot a graph and identify dependent and independent variables

**Materials and Resources:**

Newspapers or magazines with data tables (Newsweek, Wall Street Journal, USA Today, Consumer Reports, the business section of the local paper, etc. Graphs can also be found on-line and printed out)

Paper for booklets

Scissors (1 pair per student)

Glue (one for every 1-2 students)

Graph paper

Rulers

Sets of poker chips (or other counters) for each student

**Development/Procedures:**

**Lesson 1**

**Preassessment**– Have students brainstorm types of graphs that they know. Let the students take turns sketching examples of different types of graphs at the board. Have a student or the class label each graph with its type. Prompt students to make sure that they have an example of each of the various types (line graph, pie chart, bar graph, pictograph, etc.).

**Launch** – Have students cut out examples of graphs from newspapers and magazines. Each student should cut out 5 to 10 different graphs (depending on time and student speed), trying to find as many types of graphs as possible. Have students staple five pieces of paper into booklet form (cover can be

created if there is time) and paste each graph near the top of a separate page. (Foldables can also be used to create the booklet.)

**Teacher Facilitation** – Copy Teacher Resource pages 1-5 onto transparencies. Place Resource 1 on the overhead. Ask students what type of graph it is (triple bar graph). Ask students to interpret the graph. What does it tell us? Is anything missing? Replace the graph with Resource 2. Ask students what the graph now tells us. Repeat this process for each of the remaining sections. Discuss what information is needed to analyze a graph. (title, labeling, a key, scale, etc.)

**Student Application** – Have students analyze each of their graphs. Using the sketches made during the preassessment, a text book, or other resources, have students identify the type of graph. Have students label the title of the graph, as well as other important parts. *In their booklets under each graph, have students write a paragraph about what their graphs show. Again in their booklets, have students write at least 3 questions about each graph. The questions should be ones that they would expect to see on a test on graphs.* (Section in italics can be assigned for homework if appropriate.)

**Embedded Assessment** – Circulate during student application ensuring student understanding of their graphs. When students have finished labeling the types of graphs, they can share with the class, showing what they found and explaining what type of graph it is. Booklets can be collected at the end of the period or students can take booklets home to complete.

**Reteaching/Extension** –

- Kinesthetic bar graphs. Use the blocks of a sidewalk, a line of desks, floor tiles, etc. as the  $x$ -axis (axes can also be laid out in masking tape on the floor). The  $y$ -axis can be made out of sheets of paper taped together and labeled. Label the  $x$ -axis with the months of the year (chalk works well if using sidewalk). Give each student a piece of paper (and a weight if working outside). Have students stand behind the month they were born. Then have students lay down their papers end to end in their row, then step back to view their bar graph. Discuss the type of graph and what the graph tells us. Other graphs can be made based on birth months of family members, number of siblings, number of pets, etc. A quick version of this activity can be done by having students sit or lie down to form the bars, but the graph is much easier for all students to see if paper is used.

## Lesson 2

**Preassessment/Launch** - Hand each student a set of 100 poker chips, each set containing at least three different colors of chips. Have them count out ten chips of

the same color. Then have them count out twenty chips of the same color. Ask them if there might be an easier way to represent twenty. Teacher Facilitation - Lead them to understand that as numbers get bigger, it might be better to count by tens or twenties or even hundreds to be able to get numbers in a manageable representation. Instead of (or besides) poker chips pennies, dimes and dollar bills can be used, since most students can quickly relate to these.

**Student Application** – Collect the poker chips, money, or other counters in to one large container. Have each student take out one handful of the counters. If using poker chips or counters with no assigned value (i.e. not money), assign a numeric value to each color (for example: blue=1, red=10, and white=100). Have students estimate who has the most (value) in counters. Typically the response will reflect quantity instead of value. Guide students into drawing a bar graph with a bar for the numeric value of each student’s handful. Make sure the students understand the value of an appropriate scale. Next, pair the students up, give each pair a data table from Student Worksheet 1, have them look at the data tables, and decide which scale would best fit their table.

**Embedded Assessment** – Pick one student from each pair to present the choice of scale to the rest of the class, having them explain why this scale is the best choice for this set of data.

**Reteaching/Extension** – Assess each pair’s choices as they present them, engaging the rest of the class in the discussion.

On the overhead projector, display Teacher Resource 6. Show the students (with a frame) how sometimes a graph only displays a portion of the whole graph. After discussing how this graph could be done better, display Teacher Resource 7. Discuss what makes this a better graph (the scale is larger, the range is greater, etc.). Also explain that many times it is helpful to skip the beginning numbers on the scale so the data is more visible. An example of this is the number line: we don’t always start at zero.

### **Lesson 3**

**Preassessment**—Students will have a basic knowledge of the types of graphs and their constituent parts, of how to create an appropriate scale for the  $x$  and  $y$  axes, and how to plot points on a coordinate plane or graph.

**Launch**—Have students read, follow the directions, and complete the “Warm-Up” Sheet. This is to reinforce including a title, labeling, and creating scales. (Transparencies 1-4)

**Teacher Facilitation**—Introduce the concepts of independent and dependent variables being placed on the  $x$  and  $y$  axes. Draw and model that the  $x$ -axis is horizontal and is labeled with the independent variable, while the  $y$ -axis is vertical and is labeled with the dependent variable. Discuss methods of differentiating between the independent and dependent variables. If we are comparing months of the year and amount of rainfall, which would be the dependent variable? Which variable depends more on the other? Again, if we are comparing years and world population, which would be the dependent variable? We see that it doesn't make sense to say that the years change according to how many people there are in the world, but that we can say that the world population changes as the years go by.

**Student Application**—Have students complete the “Independent/Dependent Variables Sheet 1” Worksheet. Provide students with the warm-up data table and have them plot the points on the “Warm-Up” Sheet. (Transparency 5) Have students complete the “Student Practice Sheet 1” Worksheet.

**Embedded Assessment**—Check and assess correct set-up of the graph from the warm-up. Check for 80% accuracy on the “Independent/Dependent Variables Sheet 1” Worksheet. Check and assess the completion of the warm-up graph. Check and assess independent graphing from the “Student Practice Sheet 1” Worksheet.

### **Reteaching/Extension**

- Exit Ticket Strips: To reinforce and assess the concepts of independent and dependent variable placement, give students strips in random order and have the students put them in the correct groups. Copy exit ticket strips onto card stock paper, cut out the strips, and place each group of strips in a plastic bag.
- Independent/Dependent Variables Sheet 2: To differentiate between the independent and dependent variables.
- Student Practice Sheet 2: To provide students with further practice in creating a complete graph.
- Student Data Collection and Extra Practice Sheets 1-4: To engage students in data collection and provide them with further practice in creating a complete graph.

### **Summative Assessment:**

Have students create their own graphs, either individually or in groups. Single graphs can be done on posters for display, or sets of graphs can be completed in another booklet or as a more traditional style classroom exam. The data below can be used, or data can be supplied from other sources (such as the web, an almanac, or student surveys). Students can all make the same type of graph, be assigned different types, or be allowed to choose any appropriate type of graph.

Number of Students Using the Library by Period

|                    |   |   |   |   |   |   |    |
|--------------------|---|---|---|---|---|---|----|
| Period             | 1 | 2 | 3 | 4 | 5 | 6 | 7  |
| Number of students | 5 | 3 | 4 | 7 | 9 | 8 | 15 |

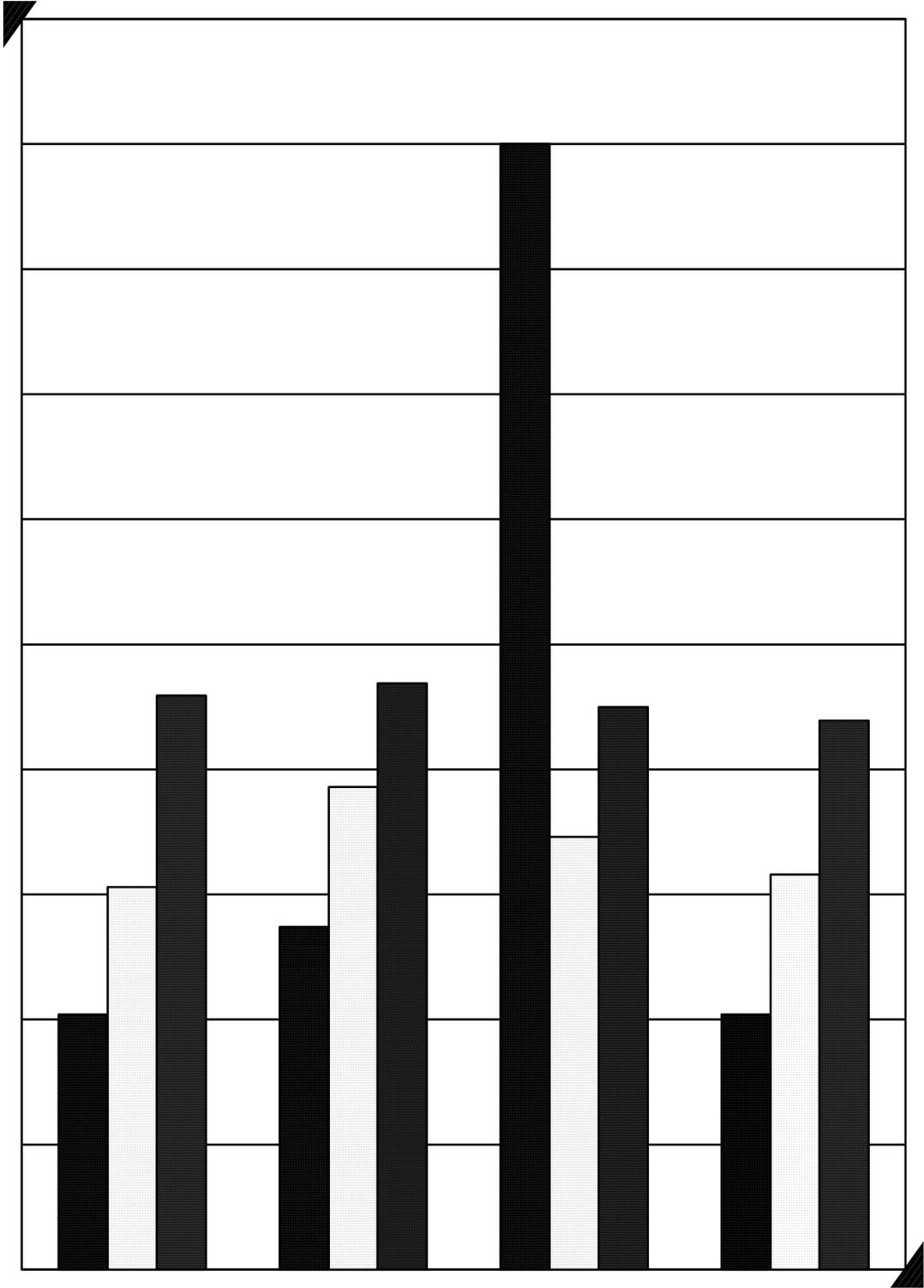
The included grading rubric is taken from *Components of Exemplary Line Graphs and Scatter Plots* ([http://www.mdk12.org/instruction/curriculum/mathematics/graph\\_line-scatter.html](http://www.mdk12.org/instruction/curriculum/mathematics/graph_line-scatter.html)). It will need to be modified for use with other types of graphs.

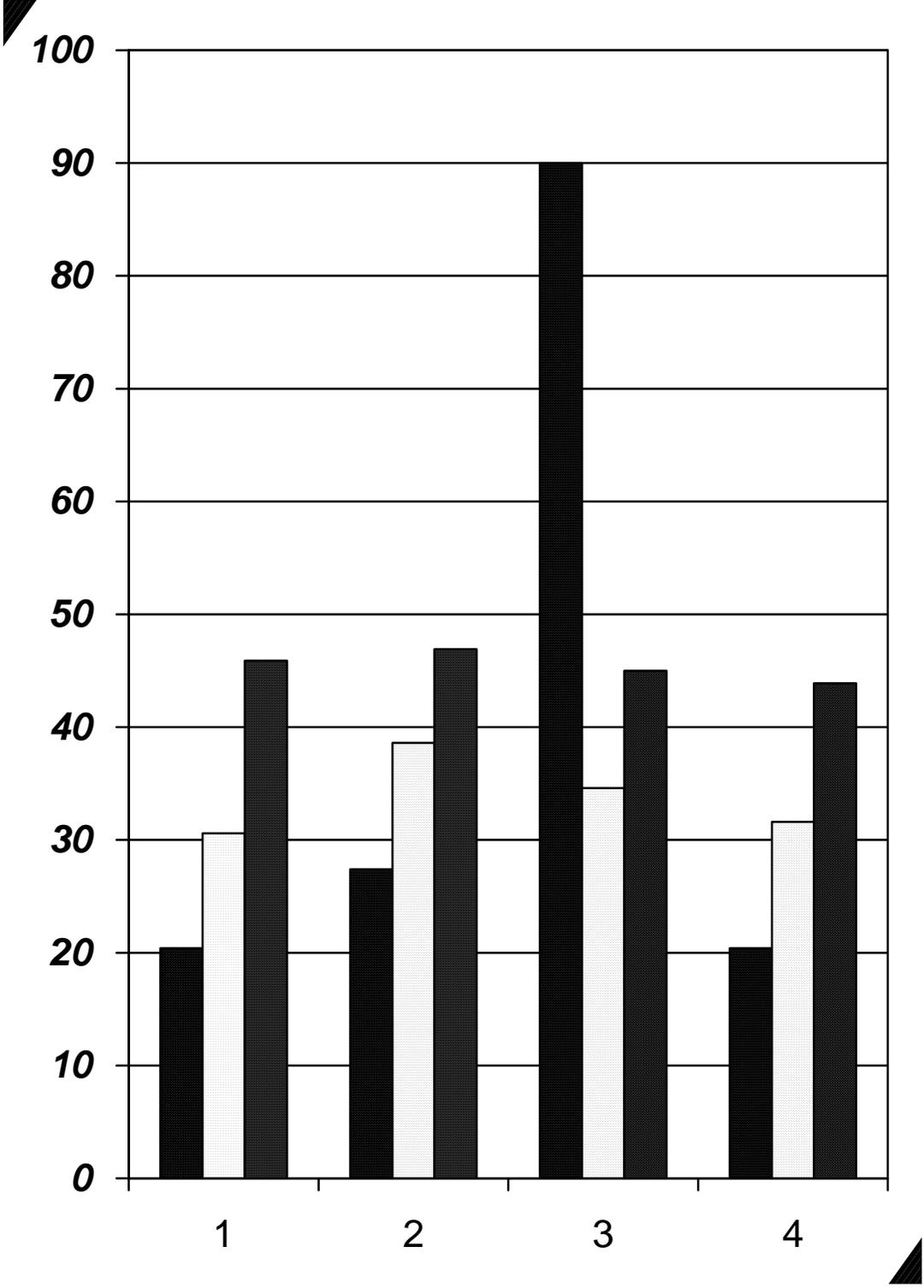
**Authors:**

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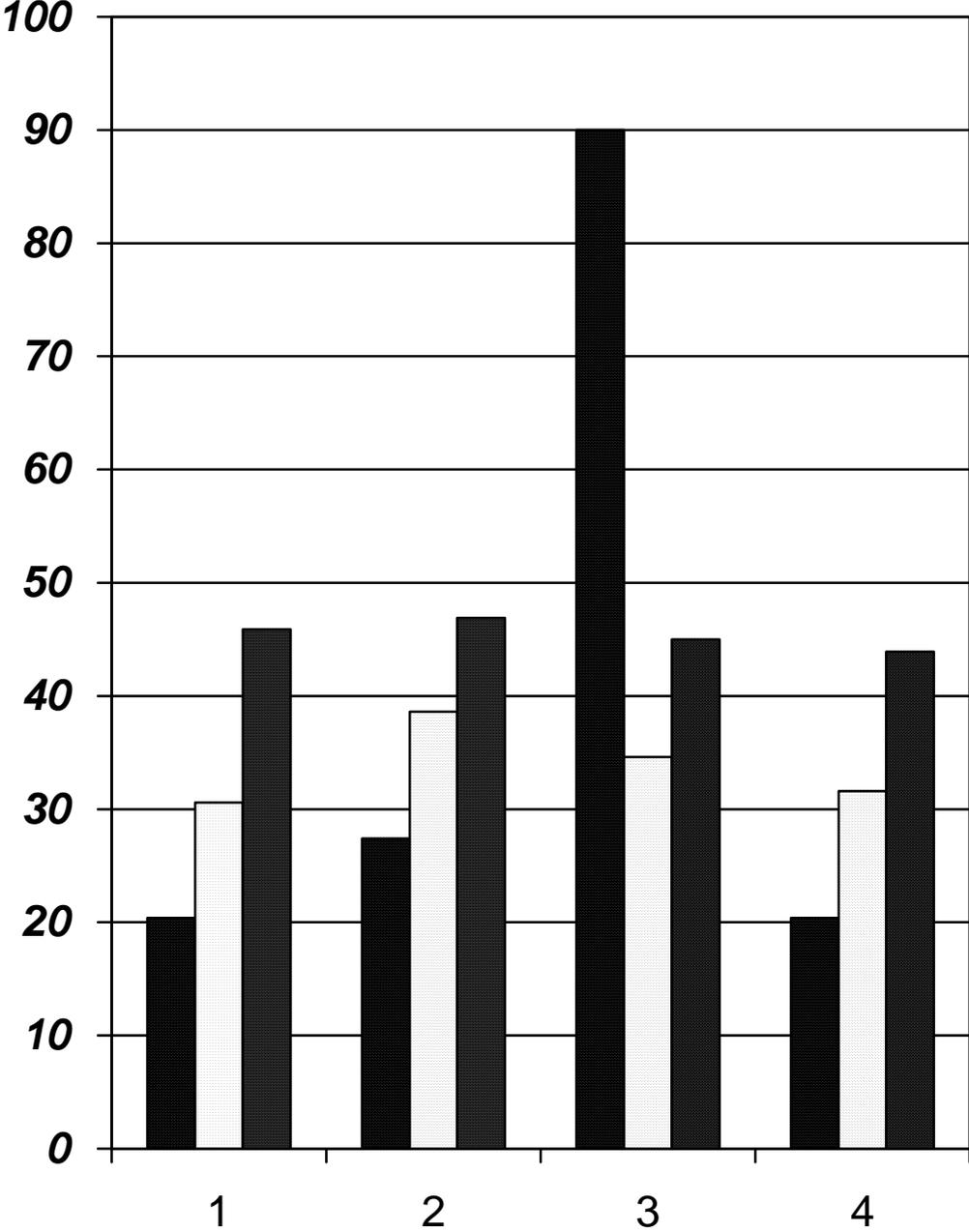
Alma Waskey  
New Covenant Schools of Bedford  
Bedford, VA

Candace Kirksey  
Dr. Boland N. Patterson Sr. Academy  
Baltimore City Public School System

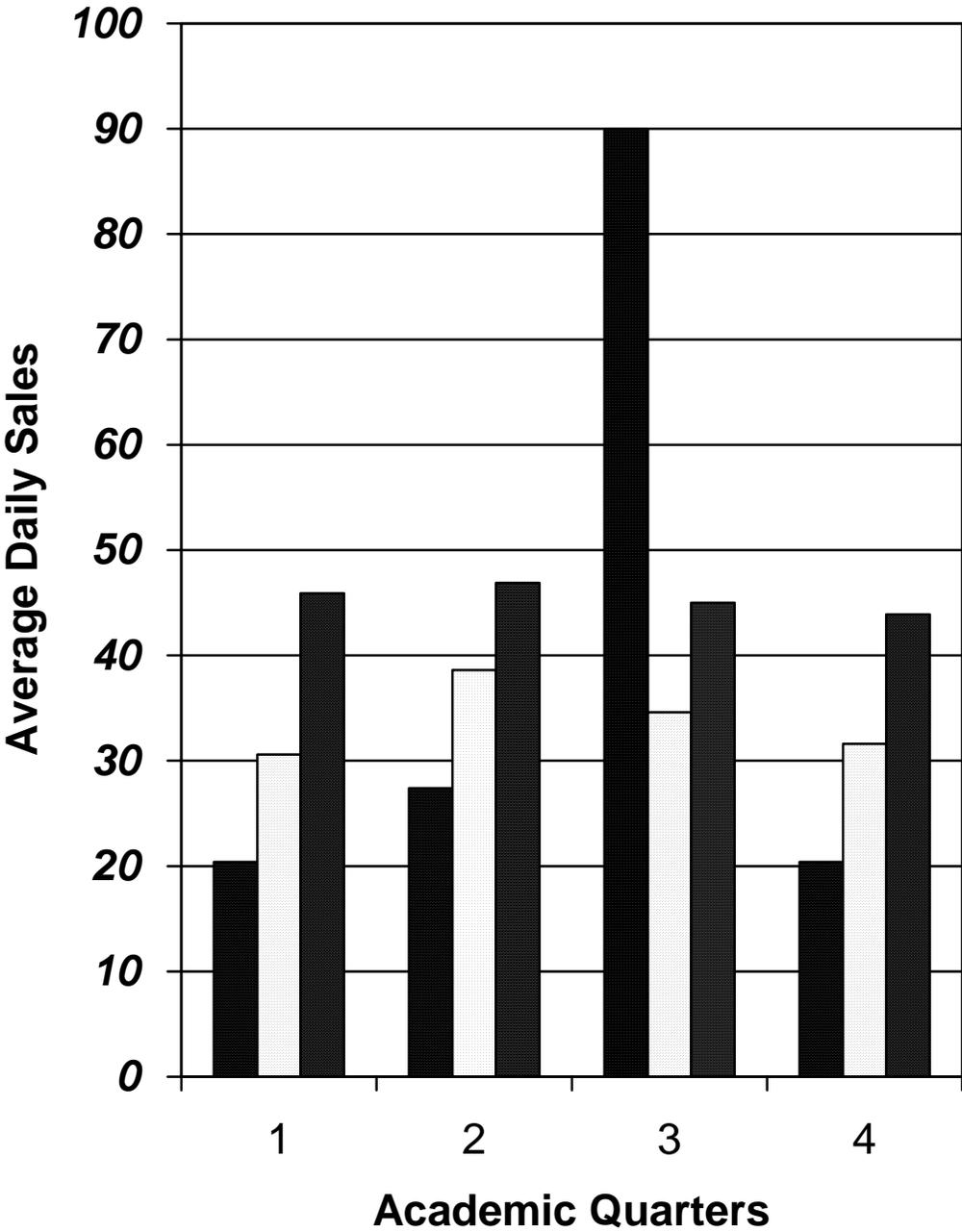




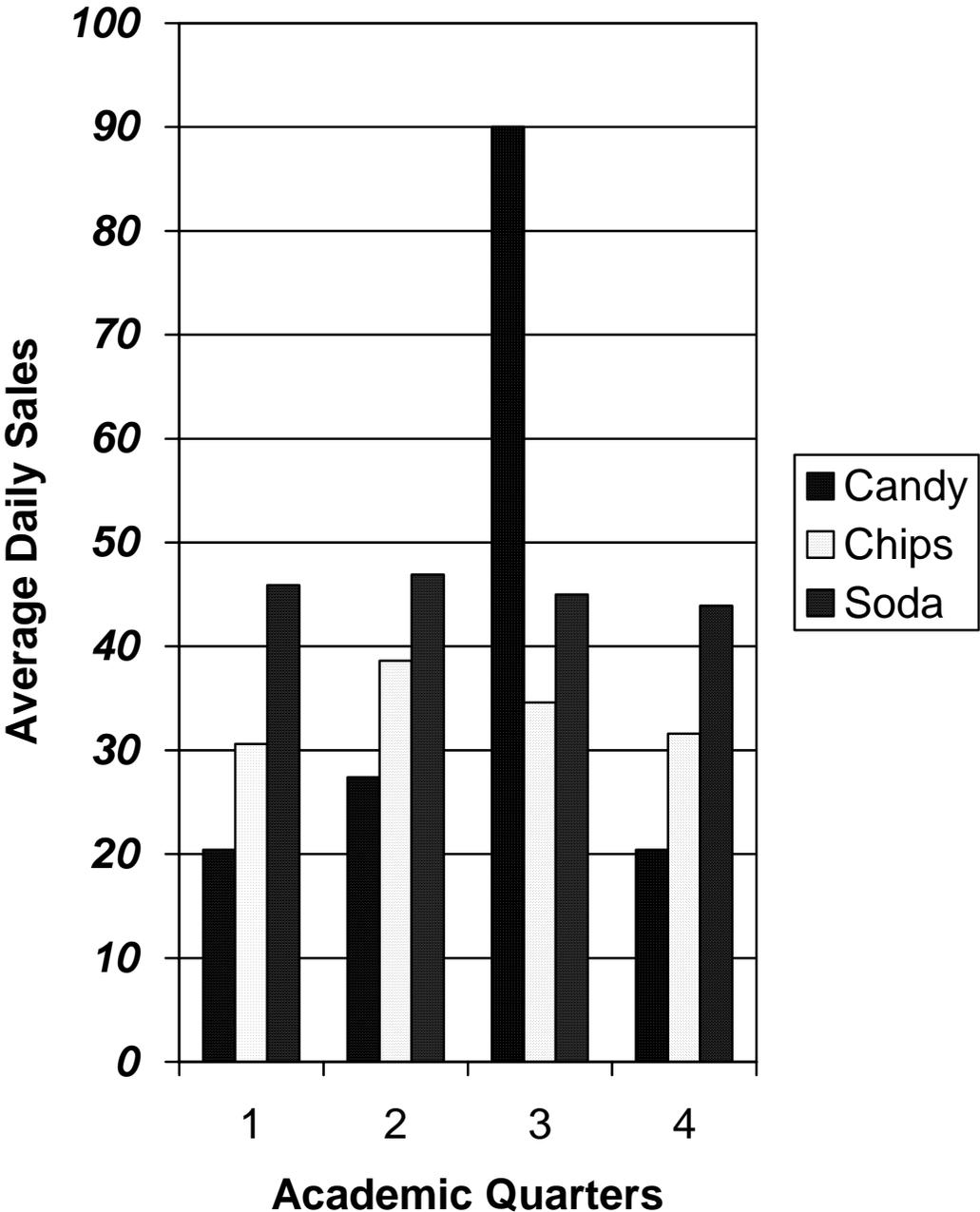
# Snack Food Sales for Our School



# Snack Food Sales for Our School

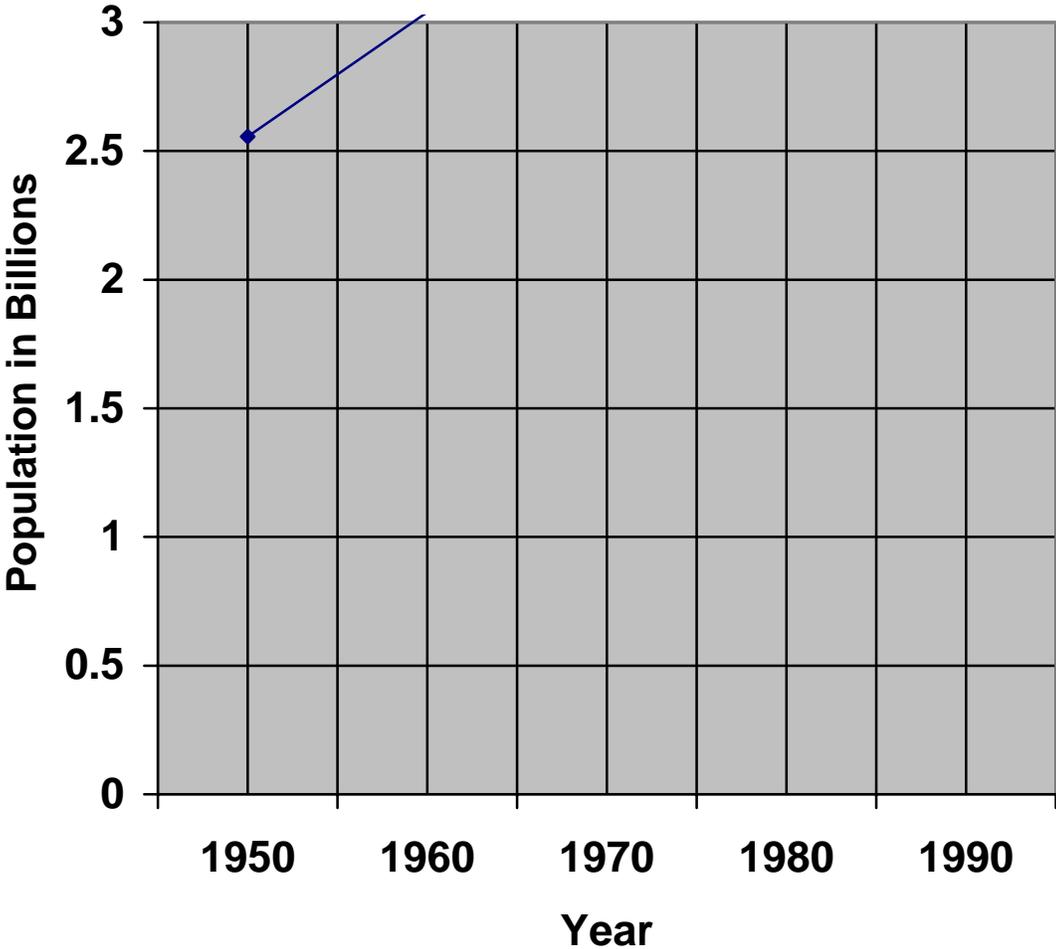


# Snack Food Sales for Our School



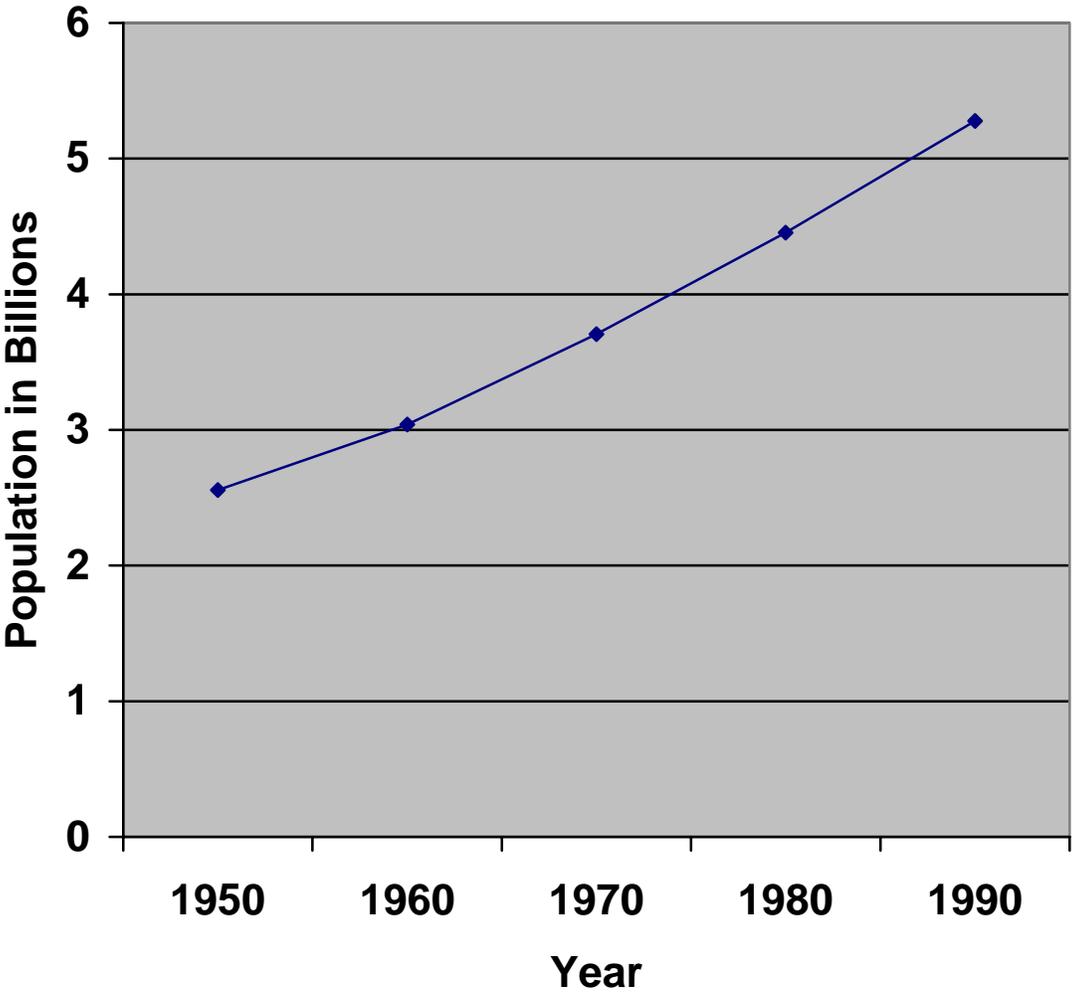
| YEAR       | 1950          | 1960          | 1970          | 1980          | 1990          |
|------------|---------------|---------------|---------------|---------------|---------------|
| Population | 2,556,000,000 | 3,039,500,000 | 3,706,600,000 | 4,453,800,000 | 5,278,600,000 |

### World Population



| <b>YEAR</b> | <b>1950</b>   | <b>1960</b>   | <b>1970</b>   | <b>1980</b>   | <b>1990</b>   |
|-------------|---------------|---------------|---------------|---------------|---------------|
| Population  | 2,556,000,000 | 3,039,500,000 | 3,706,600,000 | 4,453,800,000 | 5,278,600,000 |

### World Population



## Grading Rubric for Summative Assessment

### **Plotting of Points**

|   |   |
|---|---|
| 4 | All points are correctly plotted  |
| 3 | 75% or more of the points are correctly plotted   |
| 2 | 50% or more of the points are correctly plotted   |
| 1 | Some points are correctly plotted or all points are incorrect due to inversion of the values or shifting of all data points |
| 0 | Points are incorrectly plotted and work demonstrates lack of understanding of the plotting process                          |

### **Components of the Y-axis**

#### **Units**

|   |                                     |
|---|-------------------------------------|
| 2 | Units appropriately represent data  |
| 1 | Units included, but not appropriate |
| 0 | Units not included                  |

#### **Label**

|   |  |
|---|--|
| 2 | Descriptive label includes the variable or quantity that changes |
| 1 | y-axis labeled, but undistruptive or incorrect                   |
| 0 | Axis unlabeled   |

#### **Scale**

|   |  |
|---|--|
| 2 | Scale is appropriate for data                                      |
| 1 | Graph can be plotted at the scale used, but is not the best choice |
| 0 | Scale is inappropriate for the data                                |

|   |  |
|---|--|
| 2 | Number interval is consistent (but may include a break)    |
| 1 | Interval is generally consistent, but may include mistakes |
| 0 | Interval is inconsistent                                   |

|   |   |
|---|---|
| 2 | Spacing of scale is consistent along y-axis |
| 1 | Spacing of scale is generally consistent    |
| 0 | Spacing of scale is inconsistent            |

### Components of the x-axis

#### Units

|   |                                     |
|---|-------------------------------------|
| 2 | Units appropriately represent data  |
| 1 | Units included, but not appropriate |
| 0 | Units not included                  |

#### Label

|   |  |
|---|--|
| 2 | Descriptive label includes the variable or quantity that changes |
| 1 | x-axis labeled, but undistruptive or incorrect                   |
| 0 | Axis unlabeled   |

#### Scale

|   |  |
|---|--|
| 2 | Scale is appropriate for data                                      |
| 1 | Graph can be plotted at the scale used, but is not the best choice |
| 0 | Scale is inappropriate for the data                                |

|   |  |
|---|--|
| 2 | Number interval is consistent (but may include a break)    |
| 1 | Interval is generally consistent, but may include mistakes |
| 0 | Interval is inconsistent                                   |

|   |   |
|---|---|
| 2 | Spacing of scale is consistent along x-axis |
| 1 | Spacing of scale is generally consistent    |
| 0 | Spacing of scale is inconsistent            |

### Main Title for Graph

|   |  |
|---|--|
| 2 | Main title for the graph is appropriate                    |
| 1 | Main title is included, but undistruptive or inappropriate |
| 0 | Main title in not included                                 |

Student Worksheet 1

Data Table 1:

| Grade | % Attendance |
|-------|--------------|
| 1     | 100          |
| 2     | 95           |
| 3     | 100          |
| 4     | 98           |
| 5     | 96           |
| 6     | 89           |
| 7     | 92           |
| 8     | 100          |

Data Table 2:

| January | April | July | October |
|---------|-------|------|---------|
| 87      | 87    | 89   | 89      |

Data Table 3:

| State       | Temp.<br>°F | Temp.<br>°C |
|-------------|-------------|-------------|
| Alabama     | 112         | 44          |
| Alaska      | 100         | 38          |
| Arizona     | 128         | 53          |
| Arkansas    | 120         | 49          |
| California  | 134         | 57          |
| Colorado    | 118         | 48          |
| Connecticut | 106         | 41          |
| Delaware    | 110         | 43          |
| D.C.        | 106         | 41          |

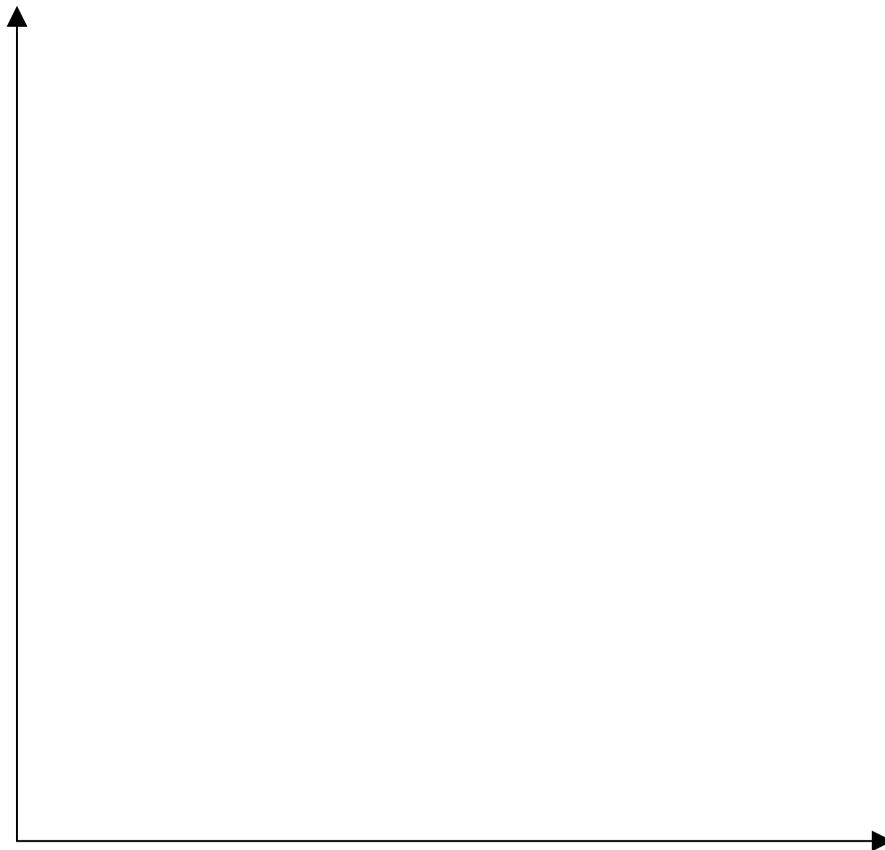
Data Table 4:

| Luxury           | 2002 |
|------------------|------|
| 1. Med./Dk. Gray | 7.2  |
| 2. Silver        | 32.1 |
| 3. White Met.    | 17.7 |
| 4. White         | 11.8 |
| 5. Black         | 8.5  |
| 6. Med. Red      | 6.0  |
| 7. Med./Dk. Blue | 8.6  |
| 8. Gold          | 3.0  |
| 9. Lt. Blue      | n.a. |
| 10. Lt. Brown    | 1.7  |

**WARM-UP SHEET**

You want to graph the amount of rainfall that Maryland received for the last ten years. Some years received as much as 52 inches of rain, and some years received as little as 17 inches of rain.

First, give your **line** graph a title. Now you have to label your axes. Label the horizontal axis as “Years”. Label the vertical axis as “Amount of Rainfall”. Then, you need to create a scale for both the horizontal and vertical axes.



|                    |    |    |    |    |    |    |    |    |    |    |
|--------------------|----|----|----|----|----|----|----|----|----|----|
| Year               | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 |
| Rainfall in inches | 47 | 45 | 38 | 42 | 52 | 37 | 17 | 40 | 25 | 40 |

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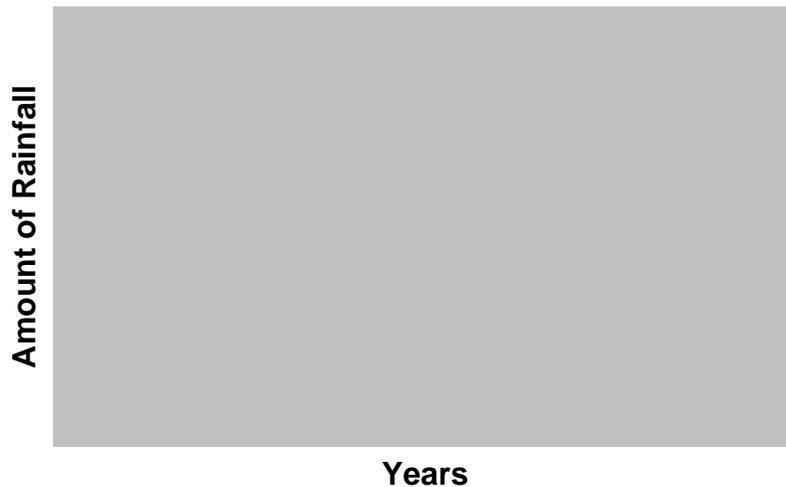
## RAINDROPS KEEP FALLIN'



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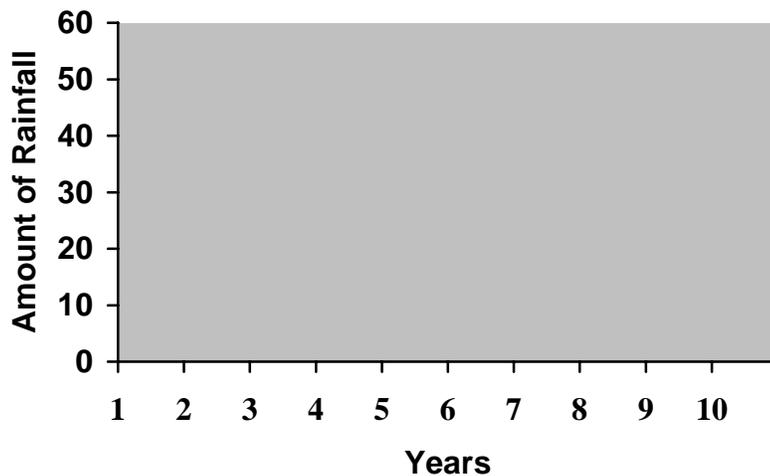
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### RAINDROPS KEEP FALLIN'



NAME \_\_\_\_\_

DATE \_\_\_\_\_

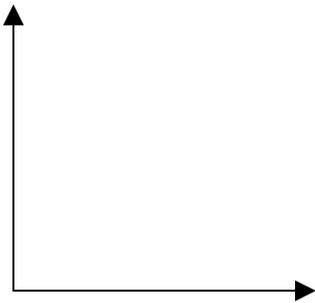
**INDEPENDENT/DEPENDENT VARIABLE WORKSHEET 1**

For questions 1-4, **circle** the independent variable and underline the dependent variable.

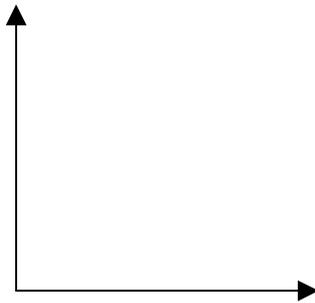
1. depth                      temperature
2. distance                  time
3. age                          height
4. cost                          number of books

For graphs 5-8, label the x and y axes and put the labels on the correct axis.

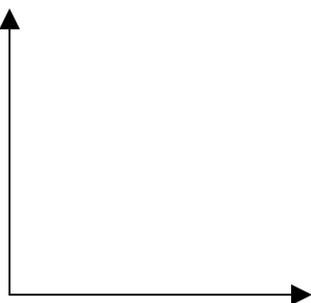
5. (depth)(temperature)



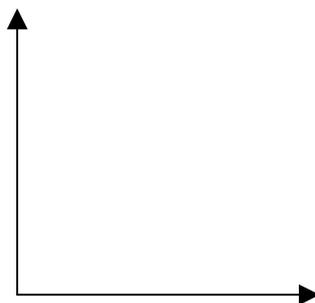
6. (distance)(time)



7. (age)(height)



8. (cost)(number of books)



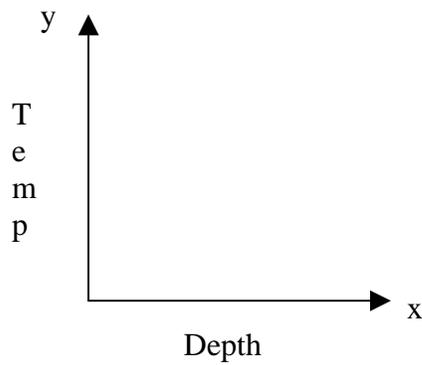
**INDEPENDENT/DEPENDENT VARIABLE WORKSHEET 1**

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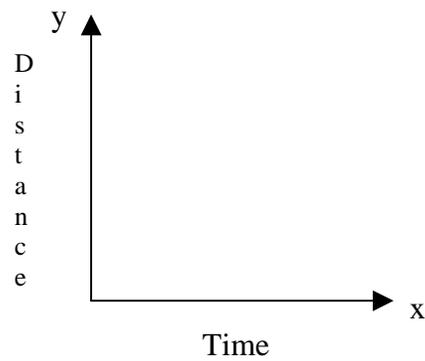
- 1.  temperature
- 2. distance
- 3.  height
- 4. cost

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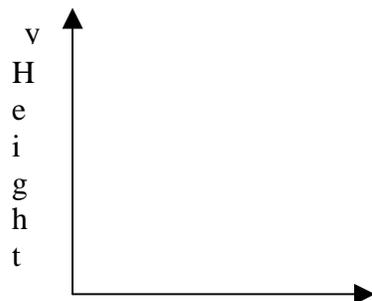
5. (depth)(temperature)



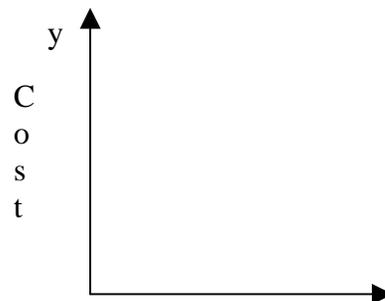
6. (distance)(time)



7. (age)(height)



8. (cost)(number of books)



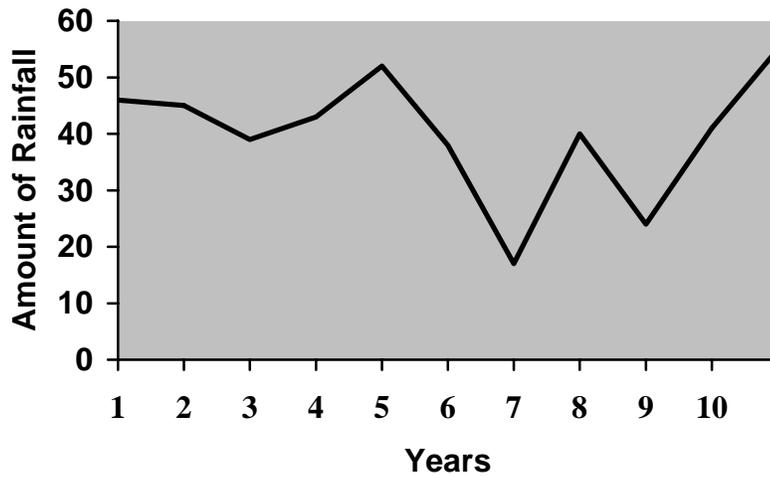
Age  $\times$

Number of Books  $\times$

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### RAINDROPS KEEP FALLIN'



NAME \_\_\_\_\_ DATE \_\_\_\_\_

**STUDENT PRACTICE SHEET 1**

Use the following data table to create a **line** graph. Make sure that your labels are on the correct axes and that your scales are appropriate. Don't forget your title.

| Number of Toppings | Price of Pizza |
|--------------------|----------------|
| 1                  | \$8.00         |
| 2                  | \$9.25         |
| 3                  | \$10.50        |
| 4                  | \$11.75        |
| 5                  | \$13.00        |

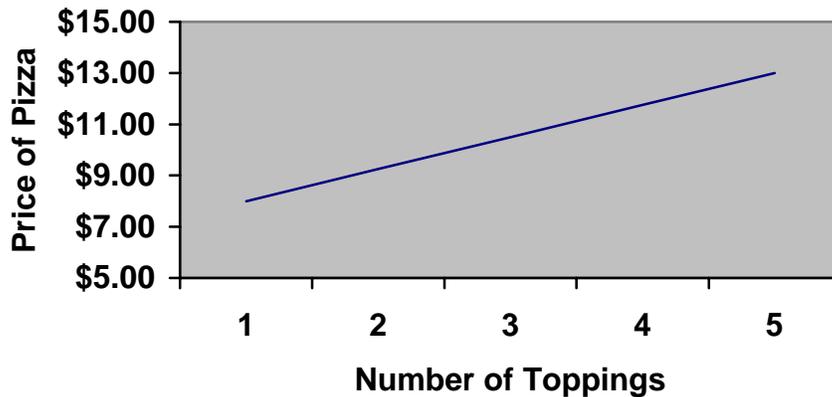


1. What do you observe about the relationship between the number of toppings on a pizza and how much it costs? \_\_\_\_\_  
\_\_\_\_\_
2. How much is an extra topping? \_\_\_\_\_
3. How much would an 8-topping pizza cost? \_\_\_\_\_

**STUDENT PRACTICE SHEET 1**

Use the following data table to create a **line** graph. Make sure that your labels are on the correct axes and that your scales are appropriate. Don't forget your title.

| Number of Toppings | Price of Pizza |
|--------------------|----------------|
| 1                  | \$8.00         |
| 2                  | \$9.25         |
| 3                  | \$10.50        |
| 4                  | \$11.75        |
| 5                  | \$13.00        |

**PILE IT ON!**

1. What do you observe about the relationship between the number of toppings on a pizza and how much it costs? **The more toppings that you add, the more the pizza costs.**
2. How much is an extra topping? **Each topping costs \$1.25.**
3. How much would an 8-topping pizza cost? **It would cost \$16.75.**

**EXIT TICKET STRIPS**

(Copy onto card stock paper.)

|   |   |
|---|---|
| <b>X</b>  | <b>Y</b>  |
| <b>INDEPENDENT</b>  | <b>DEPENDENT</b>  |
| <b>HORIZONTAL</b>   | <b>VERTICAL</b>   |
|    |   |
| <b>X</b>  | <b>Y</b>  |
| <b>INDEPENDENT</b>  | <b>DEPENDENT</b>  |
| <b>HORIZONTAL</b>   | <b>VERTICAL</b>   |
|  |  |

**EXIT TICKET STRIPS GROUPING**

|   |
|---|
| <b>GROUP 1</b>  |
| X   |
| INDEPENDENT   |
| HORIZONTAL  |
|  |

|   |
|---|
| <b>GROUP 2</b>  |
| Y   |
| DEPENDENT   |
| VERTICAL  |
|  |

NAME \_\_\_\_\_ DATE \_\_\_\_\_

**STUDENT PRACTICE SHEET 2**

Use the following data table to create a **line** graph. Make sure that your labels are on the correct axes and that your scales are appropriate. Don't forget your title.

| <b>Age</b> | <b>Height</b> |
|------------|---------------|
| 5          | 76            |
| 16         | 170           |
| 21         | 180           |
| 30         | 181           |
| 49         | 180           |
| 65         | 177           |
| 75         | 174           |



1. How does a person's height change according to his age? \_\_\_\_\_  
\_\_\_\_\_
2. At what age does a person's height begin to decrease? \_\_\_\_\_

3. What do you predict the height will be at age 80? \_\_\_\_\_

NAME \_\_\_\_\_

DATE \_\_\_\_\_

## **INDEPENDENT/DEPENDENT VARIABLE WORKSHEET 2**

For questions 1-8, **circle** the independent variable and underline the dependent variable.

1. amount of money in wallet

number of students

2. points earned

team

3. height

mountain

4. city

temperature

5. class section

number of students

6. number of moons

planet

7. CD sales

type of music

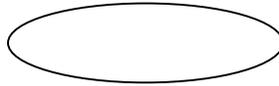
8. time

weight

**INDEPENDENT/DEPENDENT VARIABLE WORKSHEET 2**

For questions 1-8, **circle** the independent variable and underline the dependent variable.

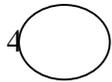
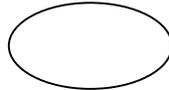
1. amount of money in wallet



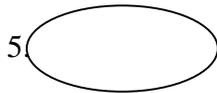
2. points earned



3. height

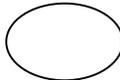


temperature

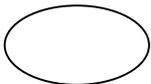
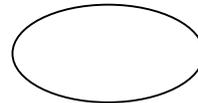


number of students

6. number of moons



7. CD sales



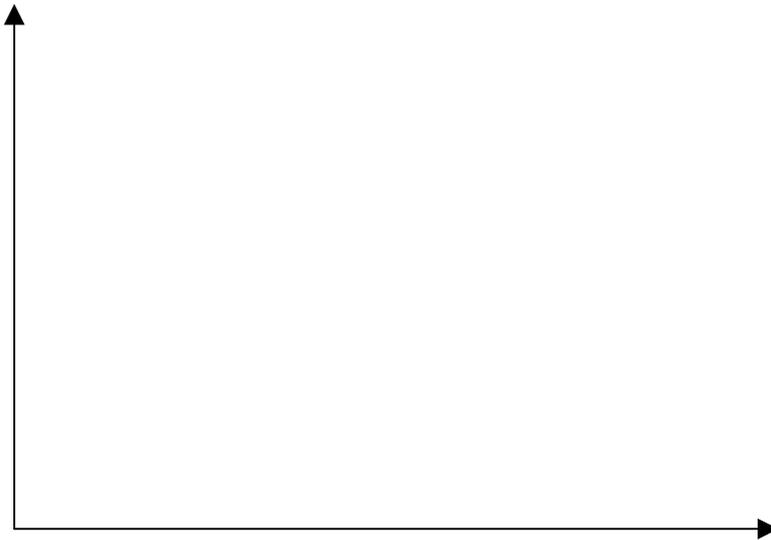
weight

NAME \_\_\_\_\_ DATE \_\_\_\_\_

**EXTRA PRACTICE 1: Student Data Collection**

You are going to conduct a survey with your classmates. You want to know which is the most popular color out of red, yellow, green, and blue. You can use the data table below to help you collect your data. Use your data table to create a **line** graph. Make sure that your labels are on the correct axes and that your scales are appropriate. Don't forget your title.

| COLOR  | NUMBER OF STUDENTS |
|--------|--------------------|
| RED    |                    |
| GREEN  |                    |
| BLUE   |                    |
| YELLOW |                    |

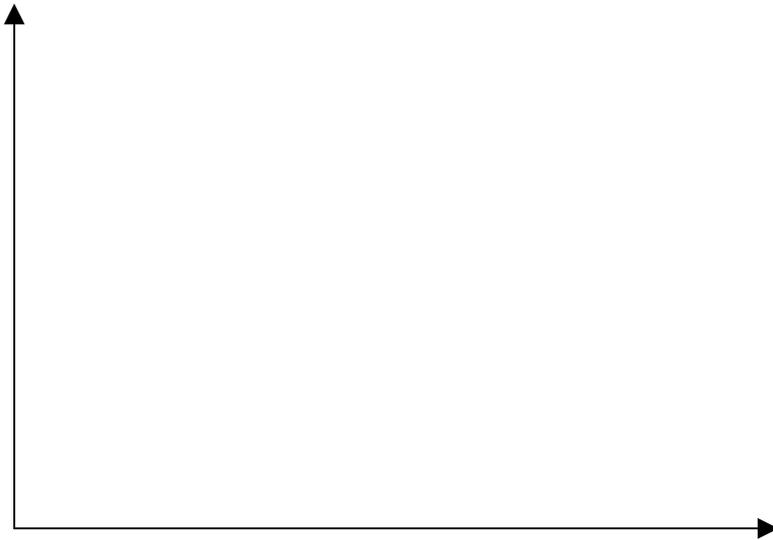


1. What is the most popular color? \_\_\_\_\_
2. What is the least popular color? \_\_\_\_\_

NAME \_\_\_\_\_ DATE \_\_\_\_\_

**EXTRA PRACTICE 2: Student Data Collection**

You are going to conduct a survey with your classmates and create a data table. You want to know how many brothers each of your classmates has. Use your data table to create a **bar** graph. Make sure that your labels are on the correct axes and that your scales are appropriate. Don't forget your title.



1. How many students have more than two brothers? \_\_\_\_\_

2. How many students have no brothers? \_\_\_\_\_

NAME \_\_\_\_\_ DATE \_\_\_\_\_

**EXTRA PRACTICE 3: Student Data Collection**

You are going to conduct a survey with your classmates and create a data table. You want to know how many sisters each of your classmates has. Use your data table to create a **bar** graph. Make sure that your labels are on the correct axes and that your scales are appropriate. Don't forget your title.



1. How many students have more than two sisters? \_\_\_\_\_
2. How many students have no sisters? \_\_\_\_\_

NAME \_\_\_\_\_ DATE \_\_\_\_\_

**EXTRA PRACTICE 4: Student Data Collection**

You are going to conduct a survey with your classmates and create a data table. You want to know how many brothers *and* sisters each of your classmates has. Use your data table to create a **double bar** graph. Make sure that your labels are on the correct axes and that your scales are appropriate. Don't forget your title.



1. How many students have more than five brothers and sisters? \_\_\_\_\_
2. How many students are only children? \_\_\_\_\_

