LESSON 1: Analyzing Data From "How Much Screen Time?" Survey

8th grade Math

LESSON DESCRIPTION: Eighth grade math students learn about different kinds of data and suitable graphs for different kinds of data. They summarize raw survey data collected by 6th grade students, consider hypotheses about the research posed by the 6th grade students, and make graphs that will help 6th graders accept or reject their hypotheses.

> Teacher's Note: You will need to coordinate closely between 6th grade social studies classes which are collecting the data and 8th grade math classes which are graphing the appropriate data for the 6th grade classes. Be sure to pass the data back and forth in a timely manner.

FOCUS QUESTIONS: How does a data analyst choose and graph data to answer a question? How can data be communicated effectively? What are the local patterns in screen use?

OBJECTIVE: Students will:
- summarize and analyze raw data collected in a survey.
- graph data to match specific hypotheses.

COMMON CORE STATE STANDARDS

- **MATHEMATICS**
  - * **CCSS.8.SP.8** Investigate patterns of association in bivariate data. Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables.

LESSON LENGTH: Activity 1 takes one day. Activity 2 takes two days.

MATERIALS NEEDED:
- Handout: How do types of data and graphs match? – one per student
- Set of graphs from media: line, bar, and circle graph (You could ask students to bring these in.) You will need 4 – 5 for each group of four.
- Blank paper, scissors, tape for each group of four
- Blank datasheet for How Much Screen Time? survey from 6th grade – one per student
- Chart paper and marker

- <u>For the Teacher</u> resource (Types of data three column chart and Graphing Ideas for How Much Screen Time data, and Making Pie Charts or Circle Graphs)
- Bar graph, line graph, and circle graph rubrics, one set per group of four
- Completed Class Tally sheets from a 6th grade class – one for each day of the survey (a blank has been provided for teacher reference)
- Data Summary Sheet – one, preferably made into a transparency.
- Four completed Data Summary Sheets – one per student
- Three hypotheses **from the same 6th grade class as the data** on Our Three Hypotheses About How Much Screen Time? survey
- Clear plastic circle compass, one per group of four OR Excel for making a circle graph (Available from www.dickblick.com) OR a 100% or 360° paper circle protractor (provided)
- Graph paper for bar and line graphs, five sheets per group of four
- Your Ticket – one per student

VOCABULARY:

survey	statistics	continuous data
data processing team	hypothesis, hypotheses	totals data
data analysis team	researcher	discreet data
interpret	research team	line graph
test the hypothesis	data	circle graph
results	datasheet	bar graph
conclusion	components	raw data
rubric	data collection	accurate
data	communicate	

Activity 1: Students will match types of data to types of graphs.

Teacher's Note: It is important in this lesson for the teacher to guide the students as they decide how to graph the raw data. It would be easy to tell students exactly what graphs to make, but the idea is for students to examine the 6th grade raw data and the 6th grade hypotheses and decide what graphs are needed. When the 6th grade classes pass the raw data to the 8th grade classes, graph the data in 3 days and return the data and the graphs to the 6th graders.

1. **Anticipatory Set**:
    -What is *data?* Accept responses. Compare student responses to the Webster's New World College Dictionary definition: facts or figures to be processed; evidence, records, statistics from which conclusions can be inferred; information.
    -If someone is researching people's use of TV and video games, what data might she collect?
    -What does a researcher do with data once it is collected?

2. **Tell Students**: When data is collected, researchers use it to make charts and graphs so that people can learn from it. The charts and graphs *communicate* the data. You have to think about what kind of data you have before you can decide what kind of graph to make.

    Give a copy of the How do types of data and graphs match? handout to each student. Read the handout with students as they take notes in the margins.

3. Divide students into *data processing teams* of 3 or 4. Provide each group with a set of three graphs from media: a line graph, a bar graph, and a circle graph, as well as scissors, tape, and blank paper. (You can provide the graphs or have students bring examples to class.)
    -Groups should tape each graph on a piece of paper.
    -Groups study and discuss each graph and the handout about data types and graphs. Then, students should label data on the graphs as *continuous data, discreet data,* or *totals data*. (Some graphs have two kinds of data.)
    -On another sheet of paper, each group should list *components* of a good graph. As students are doing this, the teacher circulates among groups and checks on comprehension.

4. Bring the class back together and discuss the graphs and the types of data they represent. On chart paper, write the title "What Makes a Good Graph." Take suggestions from groups. Be certain that all components listed on the three graph rubrics are on this large chart.

Activity 2: Students will create graphs from raw data

Teacher's Note: 6th grade classes will give the 8th grade classes four Class Tally Sheets. Try pairing one 6th grade class with one 8th grade class. These need to be summarized on the Data Summary Sheet. This could be done by the teacher, by a team of competent students, or on a transparency for the whole class to see.

The teacher will need to look at the 6th grade data and at Our Three Hypotheses to determine what graphs the 8th graders should make. The 8th grade students should have the experience of making a bar graph, a line graph, and a circle graph, if time allows. The graphs they make, however, will depend upon the hypotheses written by the 6th graders. The teacher may need to assign an extra graph or two if one type is not required by the hypotheses.

1. Divide students into *data processing teams* of three to four students. Give each student a blank copy of the 6th grade How Much Screen Time? datasheet.

    Tell Students: The 6th graders collected data in a *survey* about TV and video game usage. You are going to assist in their research by *processing the data.* Each *data team* is going to make graphs using different types of data the 6th grade *research team* collected. Before deciding what type of graph to make, you must first know what types of data the 6th graders collected.

    Make a three column chart on the board (an example is provided). Have groups look at the different kinds of data on the blank Survey datasheet and discuss whether it is continuous, discreet, or totals data.

2. **Tell Students:** The 6th graders have tallied class data for each day of the survey. The 8th graders now need to get all of the data in one place.

Teacher's Note: There are several ways to do this depending on how much of the process you want students to see. You may use the four Class Tally Sheets and complete the Data Summary Sheet yourself, assign the task to a small group of competent students, or use copies of the four Class Tally Sheets for each student ans a transparency of the Data Summary Sheet to compile the data.

Teacher's Note: In a column, the A totals for people and B totals for people should be the same, and this is the number that should go in the cell at the bottom of the column. this is because every person surveyed has data in category A and category B.

    Complete the Data Summary Sheet.

3. Hand out the completed Our Three Hypotheses form from the 6th graders and the completed Data Summary Sheet, one copy per group.

    Tell Students: The 6th graders wrote *hypotheses* before they began collecting data. These are their predictions about what they thought they would find. They have collected a lot of data and it is your job to use the data that will help them test each *hypothesis*. Their hypotheses are written on the Our Three Hypotheses form.

For each hypothesis, your team should determine 1)what data you will need to make a graph, and 2)what kind of graph to make. Use the three column chart, the blank datasheet, and the How do data and graphs match? handout to help you.

4. Hold a class discussion about the graphs needed. List the graphs on the board. If one of the three types of graphs is missing, assign an additional graph so that students make all three kinds. Graph ideas are listed on the For the Teacher resource. One of the graphs should compare TV program/video/DVD time to Video/Computer Game time.

5. **Tell Students:** You are going to be creating graphs that will *communicate data.* It is very important that the graphs can be read and understood by their audience, which is the 6th graders.
   - Give each group a completed Data Summary Sheet.
   - Hand out the Line Graph, Bar Graph, and Circle Graph Rubrics which you have customized by filling in the Possible Points column. Refer to the "What Makes a Good Graph" chart from Activity 1 as you discuss the rubrics.
   - You may want to divide the work, giving group members different responsibilities such as title, axis labels, patterns for lines or bars, spreading numbers along the axes, graphing, and checker. All group members should use the rubric, and the checker does the final check. A rough draft may be necessary.
   - Each group should make all of the assigned graphs.
   - When they are through with a rough draft, have two groups exchange graphs and score each other. Groups should use the feedback to make a final draft, or choose a select team to make the final graphs.

6. **Closure** Have students do the Your Ticket about graphs. Use this as a ticket out of class or into class.

Teacher's Note: Choose the best example of each of the graphs to pass back to the 6th graders.

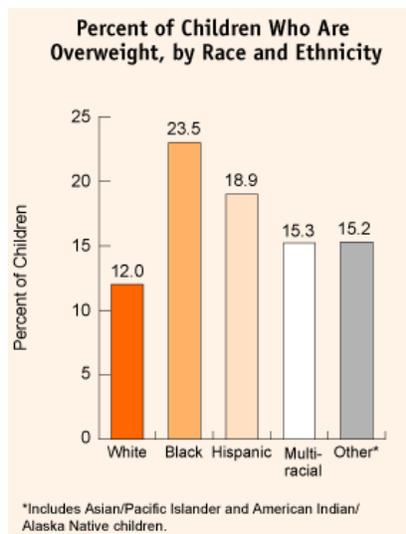**HOW DO TYPES OF DATA AND GRAPHS MATCH?**

Data is information gathered by a *researcher*. *Raw data* is usually written in a table. Then, the researcher decides what type of graph to make to help people understand the data. This handout focuses on three kinds of data.

Continuous data is the amount of something that increases, starting from zero. Continuous data is the amount of something that is increasing. Examples include time (number of seconds, minutes, hours, days), distances (centimeters, miles), and percentage. Continuous data can be on the *x* or *y* axis. The following graph shows Kilocalories from Snacks increasing on the *y-axis*, and Hours of TV Watched increasing on the *x-axis*.

Snacking and TV Watching
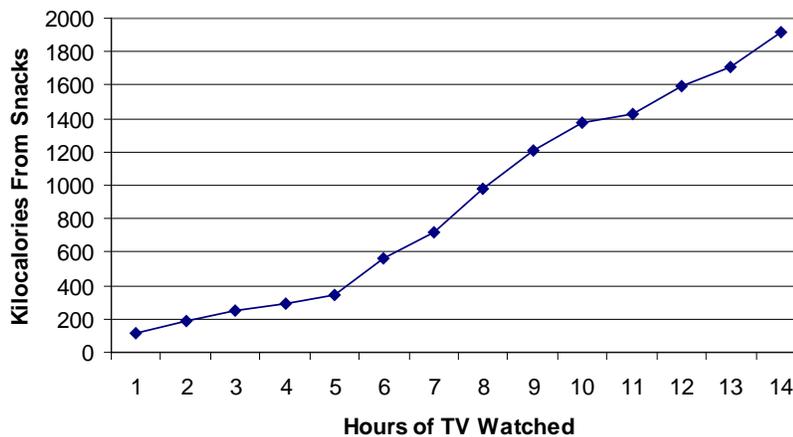
Discreet data has separate categories. Discreet data shows how much of something there is in each category. Examples of categories include gender (male or female), days of the week (Su,M,T,W,Th,F,Sa), age group, and behavior. In this graph, the *y-axis*, Percent of Children, has continuous data. The *x-axis* has discreet data: separate categories of race.

Percent of Children Who Are Overweight, by Race and Ethnicity

*Includes Asian/Pacific Islander and American Indian/ Alaska Native children.

Source: Maternal and Child Health Bureau of the Health Resources and Services Administration of the U.S. Government.
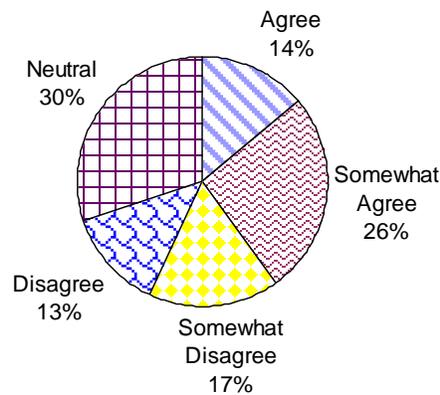
Totals data is shown in the graph below. Two hundred teenage girls were asked to respond to this question:

How well do you agree with this: "I think there is too much violence on TV."
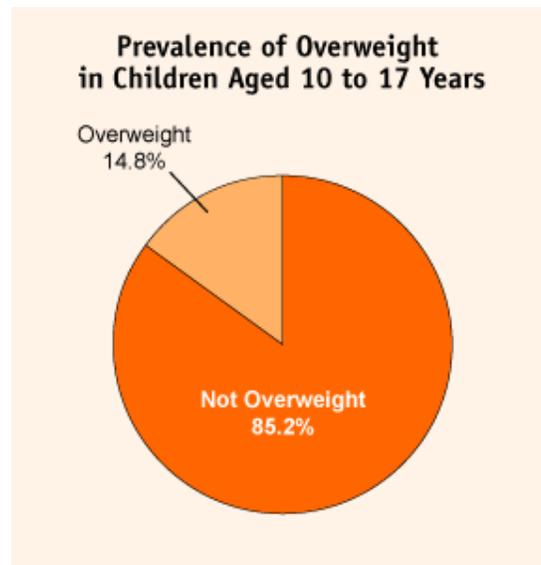- a. agree
- b. somewhat agree
- c. somewhat disagree
- d. disagree
- e. neutral

The *circle graph* shows the percentage of girls who chose each answer.

Teenage girls: There is too much violence on TV

Here is another example with only two categories:

Source: Maternal and Child Health Bureau of the Health Resources and Services Administration of the U.S. Government.

Researcher: _____   Start date of survey: _____

Survey one person from three age levels for four days. If someone did not use screens, put zero.
If you did not survey an age group, draw a line. Add the hours and write that in the appropriate
box. Take this sheet home and to school each day.

Day 1   Circle day of Week: M   T   W   Th   F   S   Su

Age Group	4-9 yrs.	10-15 yrs.	16-21 yrs.	28-Older yrs.
TV Program Video or DVD				
Videogame or Computer Game				
Total Hours (nearest ½ hour)				

Day 2   Circle day of Week: M   T   W   Th   F   S   Su

Age Group	4-9 yrs.	10-15 yrs.	16-21 yrs.	28-Older yrs.
TV Program Video or DVD				
Videogame or Computer Game				
Total Hours (nearest ½ hour)				

Day 3   Circle day of Week: M   T   W   Th   F   S   Su

Age Group	4-9 yrs.	10-15 yrs.	16-21 yrs.	28-Older yrs.
TV Program Video or DVD				
Videogame or Computer Game				
Total Hours (nearest ½ hour)				

Day 4   Circle day of Week: M   T   W   Th   F   S   Su

Age Group	4-9 yrs.	10-15 yrs.	16-21 yrs.	28-Older yrs.
TV Program Video or DVD				
Videogame or Computer Game				
Total Hours (nearest ½ hour)				

Class Tally Sheet

Class: _____

Circle Day: 1   2   3   4

Circle Day of Week: M   T   W   Th   F   S   Su

Enter totals from each Chairperson Tally Sheet below. There will be a Class Tally Sheet for each day of the survey. Enter zero if no screen is used. If no one was surveyed, draw a line. The number of people surveyed in A and B should be the same - check this! Re-write the number in the bottom cell.

Age Group	4-9 yrs.			10-15 yrs.			16-21 yrs.			28-Older yrs.		
	Group	Hrs.	People	Group	Hrs	People	Group	Hrs.	People	Group	Hrs.	People
A TV Program Video or DVD	1.			1.			1.			1.		
	2.			2.			2.			2.		
	3.			3.			3.			3.		
	4.			4.			4.			4.		
	5.			5.			5.			5.		
	6.			6.			6.			6.		
A Totals	▨			▨			▨			▨		
	Group	Hrs.	People	Group	Hrs	People	Group	Hrs.	People	Group	Hrs.	People
B Videogame or Computer Game	1.			1.			1.			1.		
	2.			2.			2.			2.		
	3.			3.			3.			3.		
	4.			4.			4.			4.		
	5.			5.			5.			5.		
	6.			6.			6.			6.		
B Totals	▨			▨			▨			▨		
Whole Class Total Hours (A + B) (nearest ½ hour)												
Whole Class Total People surveyed (A+B)												

DAILY TOTAL HOURS OF ALL AGE GROUPS: _____

DAILY TOTAL NUMBER OF PEOPLE SURVEYED: _____

Data Summary Sheet

Take the Challenge TAKE CHARGE — Turn Screens OFF....Turn Life ON

8th Grade Class: _____   From 6th Grade Class: _____

Age Group	4-9 yrs.				10-15 yrs.				16-21 yrs.				28-Older yrs.				Day of Week Total	
	Day of Week	Day	Hrs.	People	Day of Week	Day	Hrs.	People	Day of Week	Day	Hrs.	People	Day of Week	Day	Hrs.	People	Hours	People
Screen Category A TV Program Video or DVD		1				1				1				1				
		2				2				2				2				
		3				3				3				3				
		4				4				4				4				
A Totals	▨▨	▨▨			▨▨	▨▨			▨▨	▨▨			▨▨	▨▨			▨▨	
	Day of Week	Day	Hrs.	People	Day of Week	Day	Hrs.	People	Day of Week	Day	Hrs.	People	Day of Week	Day	Hrs.	People	**Day of Week Total**	
																	Hours	People
Screen Category B Videogame or Computer Game		1				1				1				1				
		2				2				2				2				
		3				3				3				3				
		4				4				4				4				
B Totals	▨▨	▨▨		= A Totals	▨▨	▨▨		= A Totals	▨▨	▨▨		= A Totals	▨▨	▨▨		= A Totals	▨▨	
Whole Class Total Hours (A +B) (nearest ½ hr)																	Total Hours	
Total People surveyed per age group (A totals)																	Total People Surveyed	

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To the 8th Grade Mathematics Teacher: The 6th Grade classes will give you three hypotheses on a form like this along with their data.

OUR THREE HYPOTHESES ABOUT HOW MUCH SCREEN TIME? SURVEY

Teacher:_____ Hour:_____

HYPOTHESIS ONE:

HYPOTHESIS TWO:

HYPOTHESIS THREE:

Three Column Chart: Types of Data from Survey

Continuous data	Discreet data	Totals Data
Number of days Number of hours for each age group Number of hours for each type of screen use	Days of week Type of screen use (TV program, video, DVD; Video or computer game) Age groups	Total hours, combining all age groups Total hours for one age group for all days of the week Total hours for one age group for seven days for both categories of screen use

Graphing Ideas for the How Much Screen Time? survey data

Bar Graphs
x-axis: total hours, *y-axis:* days of week
x-axis: total hours, *y-axis:* age groups
x-axis: total hours, *y-axis:* TV program, video, DVD and video or computer games
x-axis: hours, *y-axis:* days of week, *multiple bars per day:* age groups

Line Graphs
x-axis: days of study (0 – 8 on axis), *y-axis:* hours, *multiple lines:* age groups
x-axis: days of study, *y-axis:* cumulative hours, *multiple lines:* type of screen use for an age group
x-axis: days of study, *y-axis:* cumulative hours, *multiple lines:* each age group

Circle Graphs
Percentages of total hours for types of screen use for an age group
Percentages of total hours divided into total hours for each day of the week
Percentages of total hours divided into total hours for each age group

Making Pie Charts or Circle Graphs

Circle graphs are the biggest challenge for this age student. A 100%, 360^0, and blank paper, circle protractors are provided. The raw data will need to be converted into percentages or into percentages and then into degrees. Choose the method best suited to your students. You may demonstrate this on the board and then make a paper graph for the whole class to use, or assign the task to more advanced students, or have all students do this. You could also use Excel.

Each wedge of the circle graph will be a percentage of the total. The formula is:

Total hours for category x 100% = percentage for the category
Total hours

An example is:

Total hours for Wednesday   = $\underline{386}$ x 100% = 13.3%
Total hours for whole week   2902

 If you would like to convert to degrees, the formula for one wedge is:

$\dfrac{\text{Total hours for Wednesday}}{\text{Total hours for whole week}} = \dfrac{x}{360^0}$

$\dfrac{386}{2902} = \dfrac{x}{360^0}$ $2902x = 138{,}960$ $x = 47.8^0$

Division should be carried out to two decimal places and then round the number.

Students may need to make a chart before graphing:

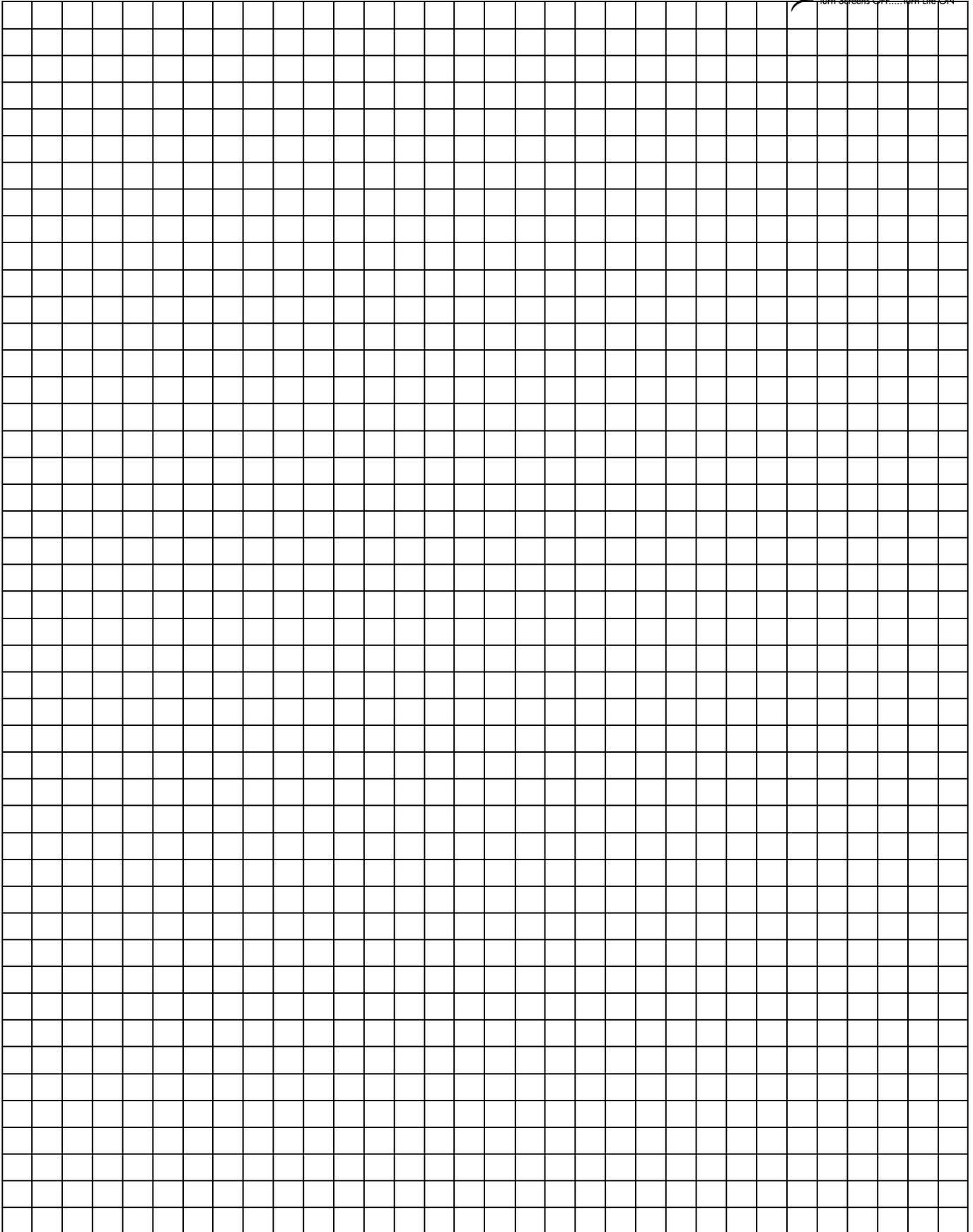| Category	Hours for category/Total hours	Per cent of Total	Degrees
Monday	304/2902	10.5%	37.7^0
Tuesday			
Totals (may need adjusting to make 100% and 360^0)			

Bar Graph Rubric

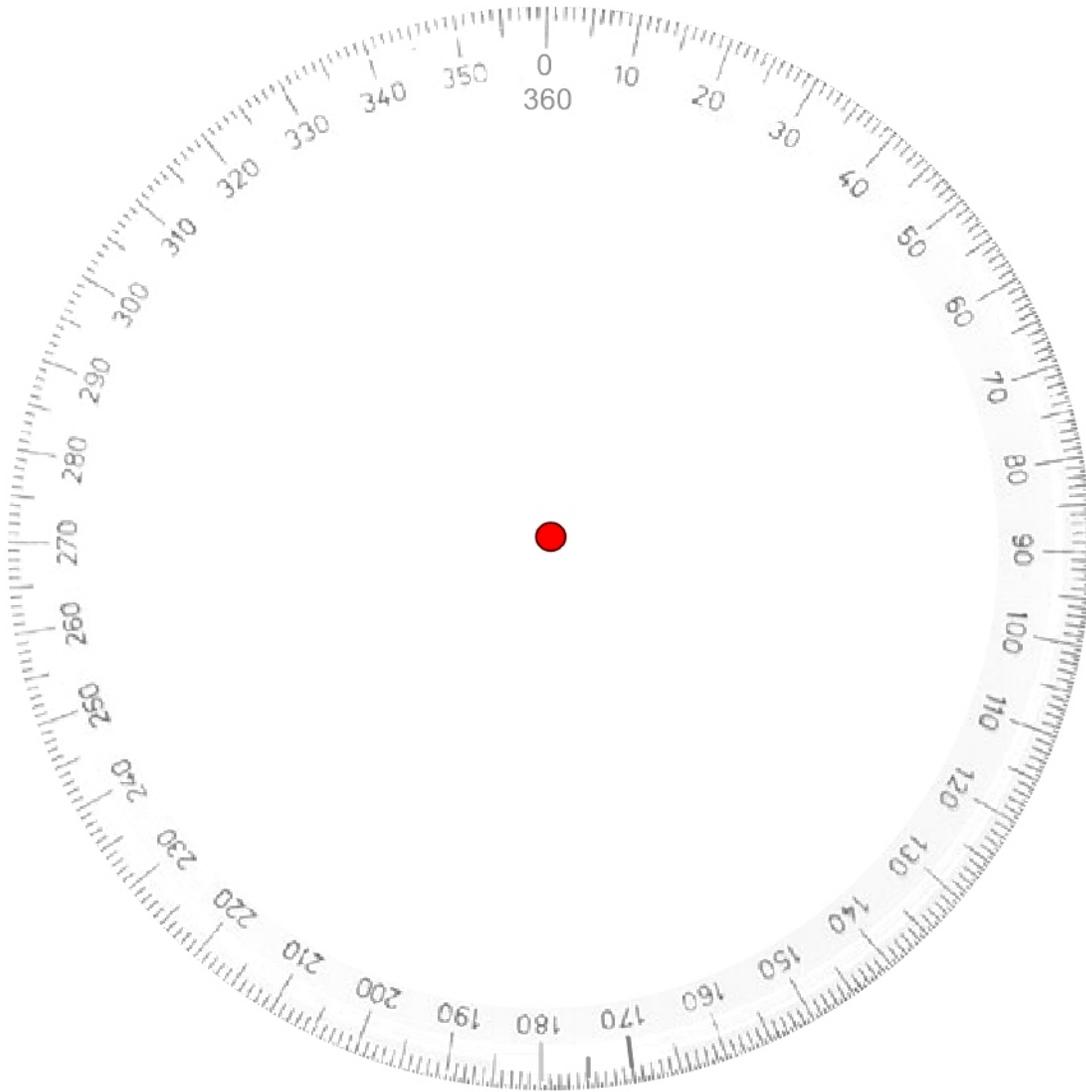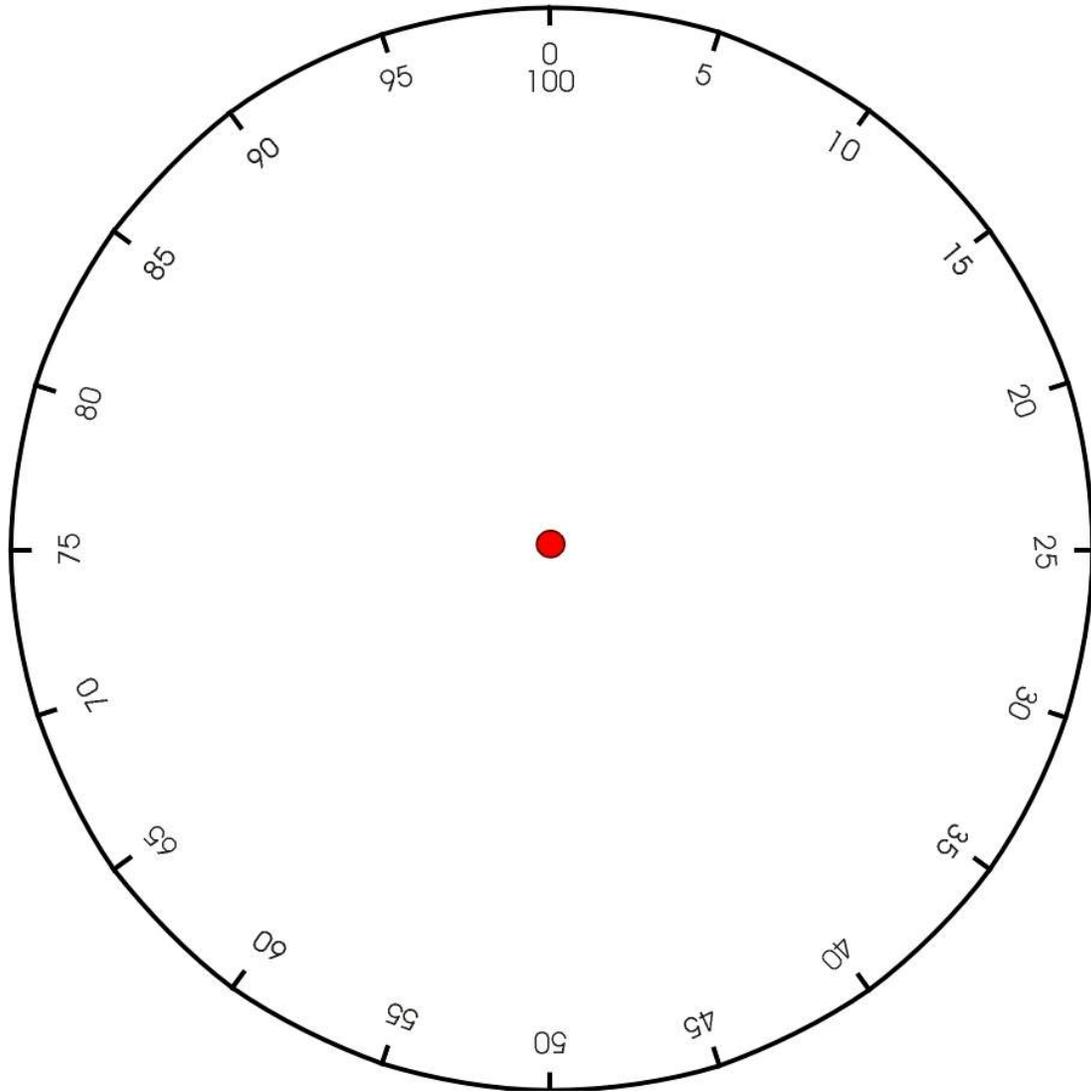| Element	Possible Points	Earned Assessment	
		Self	Teacher
Title The title is bold, top and centered, and briefly states what the graph is about.			
Accuracy The graph shows the data accurately and completely.			
Axis Labels The y-axis must be labeled with what the data measured and the unit of measure. The x-axis must label each bar and also have a title such as Age Groups.			
Number Spacing For continuous data (the y-axis on a bar graph) the numbers on an axis must start with zero and be spread along the axis to a number one higher than the highest number.			
Bars Bars are clear and dark. If there is more than one bar, the bars are different and there is a key. The bar do not rely on color. The graph would photocopy well.			
Mechanics (C-U-P-S) There are no errors in capitalization, usage, punctuation, or spelling.			
Layout and Design The overall organization, design, use of pattern, neatness, and use of space help to make the graph easy to understand.			

Line Graph Rubric

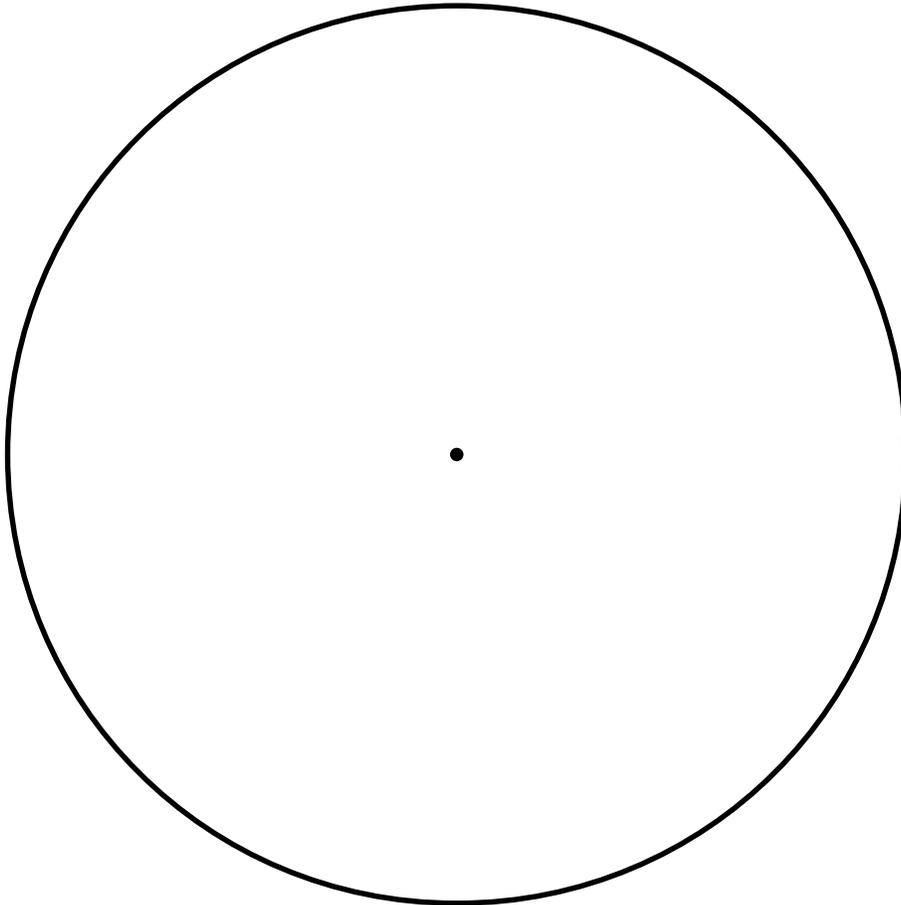| Element	Possible Points	Earned Assessment	
		Self	**Teacher**
Title The title is bold, top and centered, and briefly states what the graph is about.			
Accuracy The graph shows the data accurately and completely.			
Axis Labels Each axis must be labeled with what the data measured and the unit of measure.			
Number Spacing For continuous data, the numbers on an axis must start with zero and be spread along the axis to a number one higher than the highest number.			
Number Interval For continuous data, the range of numbers fits on the axis. (for example, 0,5,10,15,20 or 0,1,2,3,4, depending on the data)			
Lines Lines are clear and dark. If there is more than one line, the lines are different and there is a key. The lines do not rely on color. The graph would photocopy well.			
Mechanics (C-U-P-S) There are no errors in capitalization, usage, punctuation, or spelling.			
Layout and Design The overall organization, design, use of pattern, neatness, and use of space help to make the graph easy to understand.			

Circle Graph Rubric

Element	Possible Points	Earned Assessment	
		Self	Teacher
Title The title is bold, top and centered, and briefly states what the graph is about.			
Accuracy The graph shows the data accurately and completely.			
Wedge Labels Each wedge of the circle must be labeled with the percentage it represents.			
Lines and Printing Lines and printing are clear and dark. If there is more than one line, the lines are different and there is a key. The lines do not rely on color. The graph would photocopy well.			
Mechanics (C-U-P-S) There are no errors in capitalization, usage, punctuation, or spelling.			
Layout and Design The overall organization, design, use of pattern, neatness, and use of space help to make the graph easy to understand.			

A circular dial numbered in increments of 5 from 0/100 at the top, proceeding clockwise: 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, and back to 0/100. A red dot marks the center.

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Your Ticket

3 things I learned about data and graphs:

2 big ideas from How Much TV? data:

1 thing about being on a data team: