

Title: Scatter-Brained

Brief Overview:

These lessons were developed for students who already have some knowledge about graphing and using statistics. In these lessons, students will create and analyze scatterplots. The students will also create a line of best fit and use it to make predictions. The line of best fit in these lessons will be used to show a correlation but will not be connected to finding slope and writing equations as they will be taught later in the curriculum.

NCTM Content Standard/National Science Education Standard:

- Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them.
- Select and use appropriate statistical methods to analyze data
- Develop and evaluate inferences and predictions that are based on data.
- Represent and analyze mathematical situations and structures using algebraic symbols.
- Use mathematical models to represent and understand quantitative relationships.
- Analyze change in various contexts.

Grade/Level:

Grade 7/Pre-Algebra

Duration/Length:

Five 45 minute class periods

Student Outcomes:

Students will:

- Graph ordered pairs on a coordinate plane.
- Create a scatterplot using TAILS
- Determine the relationship between data values (correlation).
- Create a Line of Best Fit for a data set.
- Use the line of best fit to make predictions about the data.

Materials and Resources:

- Painter's tape
- Index cards
- Yarn
- Uncooked spaghetti
- Balls
- Stop Watch
- Access to the following websites
 - <http://nces.ed.gov/nceskids/>
 - <http://argyll.epsb.ca/~jreed/math9/strand4/scatterPlot.htm>
 - http://www.education-world.com/a_tsl/archives/06-1/lesson001.shtml
- Copies of worksheets
 - Human Graphing Index Cards
 - TAILS
 - Handwriting Experiment
 - What's Happening Teacher Directions
 - What's Happening Student Worksheet
 - Crickets and Temperature – A Relationship?
 - Basketball Exit Ticket
 - What's Happening Now Teacher Directions
 - What's Happening Now Student Worksheet
 - Does Too Much TV Hurt Your Grade?
 - Cereal Nutrition Data
 - Sodium and Sugar
 - Pass the Ball!

Development/Procedures:

Day 1

- Pre-assessment:

Tape a large coordinate plane on the floor, prior to the start of class. Copy the ordered pairs from the “Human Graphing Index Cards” worksheet onto respective colored index cards (pink, white, blue, and yellow). Give each one of the students an index card. Invite the students to plot themselves on the ‘human coordinate plane’ taped to the floor. Extend long pieces of yarn between the students to connect the colored index cards. Discuss how the ordered pairs in each color group are related. Challenge the students to realize that together they created a sailboat.
- Exploration

Have the students find similarities between the ordered pairs while the students are part of the human graph. Have each color group stand up separately, if necessary. Ask the students, “What do you notice about the lines the yarn creates? Are any the same? What is the same about the relationship between their ordered pairs?” Prompt the students to compare the change in the x values in relationship to the y values. Encourage the

students to identify which points are collinear, and challenge the students to find the equation of the line that contains the collinear points.

- Explanation
Review the appropriate components of a graph using the mnemonic TAILS. Provide copies of the worksheet, “TAILS” for the students to reference. Explain that TAILS is important when reading a graph and when creating graphs that are not misleading.
- Application
Complete the “Handwriting Experiment” with the students to collect data and generate a scatterplot.
- Differentiation
 - Reteach
Play the “Battleship Game” for more review of graphing ordered pairs on a coordinate plane. Consult the website http://www.education-world.com/a_tsl/archives/06-1/lesson001.shtml for directions on the Battleship Game.
 - Enrich
Have the students create their own picture graph using the Create a Graph Website, <http://nces.ed.gov/nceskids/>.
- Assessment
Have the students complete the quick check to demonstrate their understanding of the coordinate plane and graphing.

Day 2

- Exploration
Revisit the “Handwriting Experiment” from the previous lesson. Engage the students in a discussion about the data collected and the resulting scatterplot. Ask the following questions:
 - Is there a relationship between the number of right handed letters and the number of left handed letters?
 - If we draw a line where all the y values are equal to the x values (the $y = x$ line), what does that represent for our data?
 - What do the ordered pairs above the line represent?
 - What do the ordered pairs below the line represent?
- Explanation
Identify the $y = x$ line as the line of best fit for the data, and explain how this line can be used to analyze the relationship between the variables in the data. Discuss how a line of best fit is used to show a positive or negative relationship between the variables, so that predictions about the

data can be made. Emphasize that knowing what type of correlation exists between the variables is important before creating a line of best fit. Ask the students to identify if the correlation in the handwriting experiment is positive or negative, and have the students explain what this relationship means in terms of the variables in the experiment.

Provide access to the internet, and have the students visit the website, <http://argyll.epsb.ca/jreed/math9/strand4/scatterPlot.htm>. Follow the teacher directions for “What’s Happening?”, as the students complete the student worksheet, “What’s Happening?” Use these activities to have the students discover the different types of correlation for scatterplots.

- Application

Have the students apply what they know about graphing scatterplots, identifying correlation, and analyzing data using the “Crickets and Temperature – A Relationship?” worksheet. Provide time for the students to share answers, especially the questions that have the students make predictions based of the scatterplot and the data. t

- Differentiation

- Reteach

Provide additional data samples for the students to graph and analyze.

- Enrich

Create another Handwriting Experiment scatterplot, with the left-handed letters as x and the right-handed values as y . Have the students describe its affect on graph.

- Assessment

Have the students apply what they know about graphing scatterplots, identifying correlation, and analyzing data using the “Basketball Exit Ticket.”

Day 3

- Exploration

Return the “Crickets and Temperature – A Relationship?” to the students. Hand out a piece of uncooked spaghetti to each student. Ask the students to lay the spaghetti on the graph so that approximately half the data points lay above and below the line. Ask, “What slope does this line have? Why does this make sense in relationship to this problem?” Identify the spaghetti as the trend line, or the line of best fit. Revisit questions six and seven, and have the students use their spaghetti lines of best fit to verify their predictions.

Return the “Basketball Exit Ticket” to the students. Have the students find the line of best fit using the spaghetti, and have them verify their predictions with number four.

- Explanation
Review the scatterplot vocabulary from the previous days, adding in trend line and line of best fit.

Distribute copies of the “What’s Happening Now?” student worksheet. Follow the “What’s Happening Now Teacher Directions” to explore how correlation affects the line of best fit. Use this activity to introduce the correlation coefficient.

- Application
Have the students apply what they know about graphing scatterplots, identifying correlation, analyzing data, and graphing lines of best fit using the “Does Too Much TV Hurt Your Grade?” worksheet. Provide time for the students to share answers, especially the questions that have the students make predictions based of the scatterplot and the data. t
- Differentiation
 - Reteach
Provide additional data samples for the students to graph and analyze.
 - Enrich
Have the students create a misleading graph using the G.P.A. vs. T.V. Watching data and describe what changes they made and how it would be misleading.
- Assessment
Evaluate students’ justifications of their lines of best fit. Access the website, <http://argyll.epsb.ca/jreed/math9/strand4/scatterPlot.htm>. Use the scatterplot vocabulary drag and drop application and a Smart Board, have the students come up to the board and drag the vocabulary words to their corresponding definition.

Day 4

- Exploration
Present the questions, “Is there a relationship between sodium and sugar content in our favorite breakfast cereals? How can we analyze large sets of data to look for patterns and make predictions?” Project a transparency of “Cereal Nutrition Data” and have the students analyze the data. Ask the students leading questions, such as, “Do you see any patterns with the data? What do you notice about the calorie content of ALL the cereals? Is it easy or difficult to tell if there is a relationship between sodium and sugar? Would we want to create a scatterplot from this data by hand?”

- Explanation
Transition from the discussion in the exploration to the explanation by introducing the need for the graphing calculator. Model the steps for graphing scatterplots using the graphing calculator using the “Cereal Nutrition Data” and the calorie versus sugar content of cereals. Have the students will follow along using their graphing calculators. Demonstrate how to calculate the regression line (line of best fit) using the graphing calculator. Use the line of best fit to complete the prediction questions concerning calorie content and sugar content of cereals.
- Application
Have the students use the graphing calculator to graph and analyze sodium content and sugar content of cereals. Assign the worksheet, “Sodium and Sugar” for the students to use the line of best fit to answer questions and make predictions about the data.
- Differentiation
 - Reteach
Use data from previous days to give additional practice entering data and creating scatterplots on the graphing calculator. Note that the steps are not intuitive, at first, for most students. Create a Foldable with the students that contains the steps for graphing scatterplots and calculating lines of best fit. Allow the students to use the Foldable when completing problems.
 - Enrich
Have the students research data on the internet and use lines of best fit to make their own predictions.

Summative Assessment:

Students work collaboratively to gather data, perform analysis and make predictions based on the “Pass the Ball” experiment. They are asked to use their knowledge and extend what they’ve found to make predictions of a similar experiment. This experiment is a two day summative assessment. The students will complete the experiment on the first and review their responses after receiving teacher feedback on the second day. Since answers will vary the students will be graded using the included rubric.

Authors:

Stacie Paré
Patapsco Middle School
Howard County Public Schools

Krystle Smith
Chesapeake Bay Middle School
Anne Arundel County Public Schools

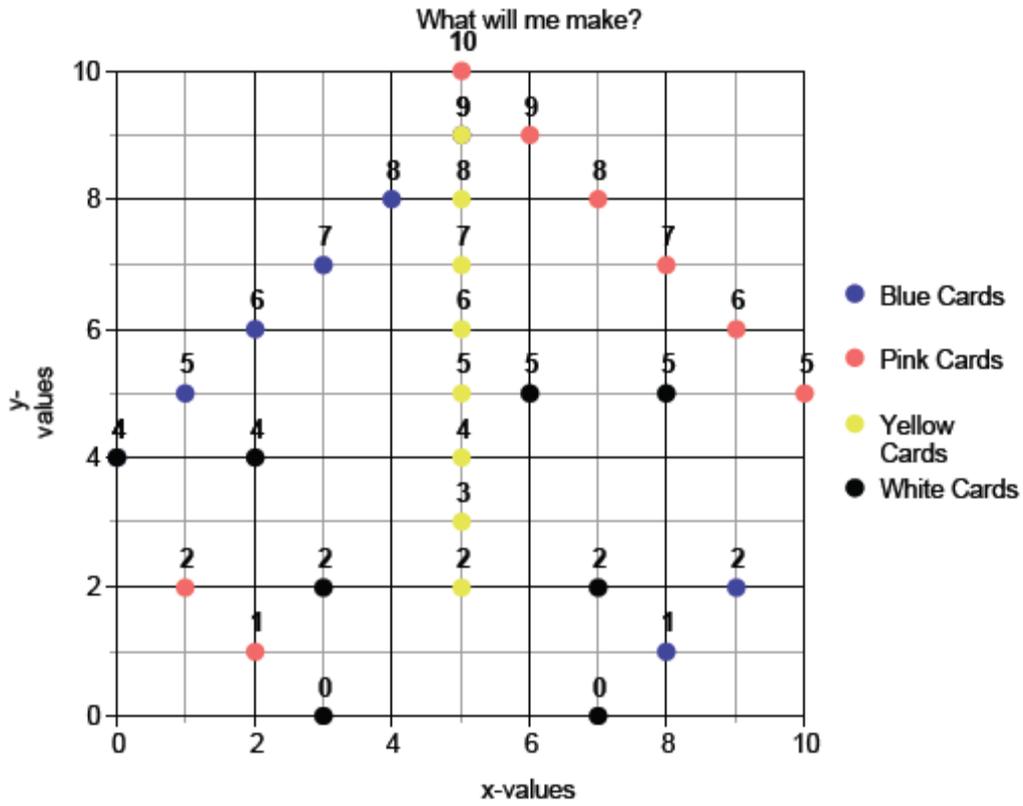
Human Graphing Index Cards

$(9, 2)$	$(10, 5)$
$(8, 2)$	$(2, 1)$
$(0, 4)$	$(1, 2)$
$(1, 5)$	$(5, 10)$
$(2, 6)$	$(6, 9)$
$(3, 7)$	$(7, 8)$
$(4, 8)$	$(8, 7)$
$(5, 9)$	$(9, 6)$

$(5, 2)$	$(3, 0)$
$(5, 3)$	$(0, 4)$
$(5, 4)$	$(6, 5)$
$(5, 5)$	$(8, 5)$
$(5, 6)$	$(3, 2)$
$(5, 7)$	$(2, 4)$
$(5, 8)$	$(7, 2)$
$(5, 9)$	$(7, 0)$

Human Graphing Index Cards

Answer Key



TAILS

Name: _____

T	.
A	.
I	.
	.
L	.
	.
S	.

T	Title
	<ul style="list-style-type: none"> • Make sure your graph has a title that lets the reader know what the graph's data is about.
A	Axes
	<ul style="list-style-type: none"> • The x and y axes are clearly defined.
I	Increments
	<ul style="list-style-type: none"> • What are you counting by?
	<ul style="list-style-type: none"> • Look at the ranges of your data values.
L	Labels
	<ul style="list-style-type: none"> • What do the x values represent?
	<ul style="list-style-type: none"> • What do the y values represent?
S	Spacing
	<ul style="list-style-type: none"> • Make sure the spacing between increments on an axis is equal.

Quick Check!

Show what you know about: The Coordinate Plane

1. Write the coordinates of a point in Quadrant 3:

2. Write the coordinates of a point in Quadrant 2:

3. Why are the coordinates of the origin $(0,0)$:

Quick Check Answer Key

Show what you know about: The Coordinate Plane

1. Write the coordinates of a point in Quadrant 3:
Answers will vary; x-values should be negative and y values should be negative.
2. Write the coordinates of a point in Quadrant 2:
Answers will vary; x-values should be negative and y-values should be positive.
3. Why are the coordinates of the origin (0,0):
That is where the x and y axes intersect.



*How Many People in your class are
Right-Handed? Left-Handed?*



Collect the Data

Using your right hand, write the first letter of your last name in the square grids below as many times as you can in twenty seconds.

Right Hand:

Using your left hand, write the first letter of your last name in the square grids below as many times as you can in twenty seconds.

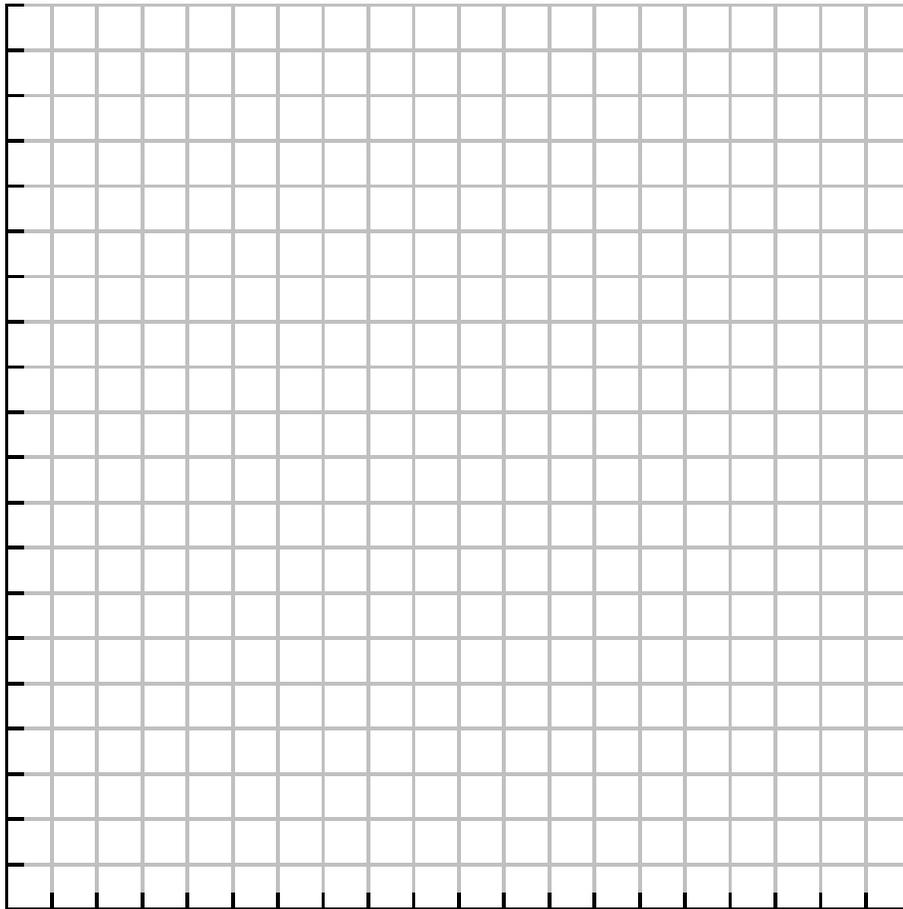
Left Hand:

Graphing the Data

Graph the data on the grid below.



- Apply TAILS.
- The x -axis should represent the number of letters made with the right hand
- The y -axis should represent the number of letters made with the left hand.
- Plot each person's data as an ordered pair. There should be the same number of ordered pairs as there are people in the class, including yourself.



What's Happening?

Teacher Directions

1. Assign the students individually to a computer with internet access.
2. Have the students visit the website:
<http://argyll.epsb.ca/jreed/math9/strand4/scatterPlot.htm>
3. Instruct the students to use the website to plot several points that illustrate a positive correlation. Ask the students raise their hands, without talking, when they see a pattern.
4. Direct the students to answer questions one through three on the “What’s Happening” student worksheet.
5. Have the students share their responses with a partner.
6. Invite various students to the Smartboard and ask them to plot more points on the graph that enhance the positive correlation and accentuate the pattern identified.
7. Instruct the students to reset their graphs on the website. Have the students plot several points that illustrate a negative correlation. Ask the students raise their hands, without talking, when they see a pattern.
8. Direct the students to answer questions four through six on the “What’s Happening” student worksheet.
9. Have the students share their responses with a partner.
10. Invite various students to the Smartboard and ask them to plot more points on the graph that enhance the negative correlation and accentuate the pattern identified.
11. Repeat the above with a scatterplot with no correlation.

**What's Happening?
Student Worksheet**

Name: _____

1. The first scatterplot created had a positive correlation. Describe any patterns observed in the scatterplot.

2. Identify any relationship between the x and y coordinates of the ordered pairs for the scatterplot with a positive correlation.

3. Define *positive correlation*.

4. The second scatterplot created had a negative correlation. Describe any patterns observed in the scatterplot.

5. Identify any relationship between the x and y coordinates of the ordered pairs for the scatterplot with a negative correlation.

6. Define *negative correlation*.

7. The third scatterplot created had no correlation. Describe any patterns observed in the scatterplot.

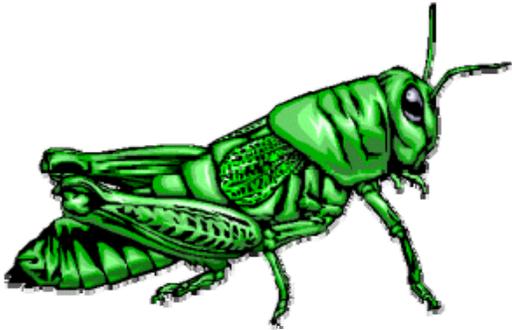
8. Identify any relationship between the x and y coordinates of the ordered pairs for the scatterplot with no correlation.

9. Define *no correlation*.

Crickets and Temperature – A Relationship?

Name: _____

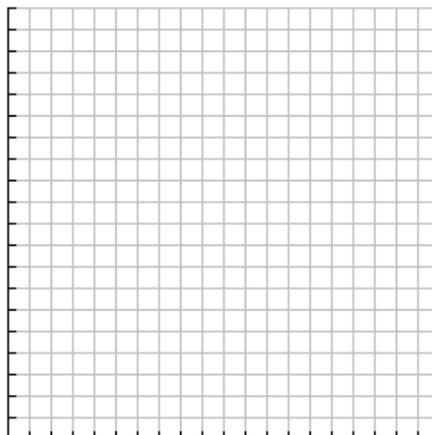
The following data shows the relationship between chirps per second of a ground cricket and the corresponding ground temperature.



Temperature (° F)	Chirps/Second
88.6	20.0
71.6	16.0
93.3	19.8
84.3	18.4
80.6	17.1
75.2	15.5
69.7	14.7
82.0	17.1
69.4	15.4
83.3	16.2
78.6	15.0
82.6	17.2
80.6	16.0

<http://mathbits.com/MathBits/TISection/Statistics2/line arREAL.htm>

1. What is the independent variable in this data? _____
2. What is the dependent variable in this data? _____
3. Graph the data as a scatterplot using the grid below. Remember TAILS.



4. What type of correlation does there appear to be between the number of chirps per second and the ground temperature? Use mathematics to explain how you determined your answer. Use words, symbols, or both in your explanation.

5. What does the correlation say about the temperature and how it may affect the number of chirps per second?

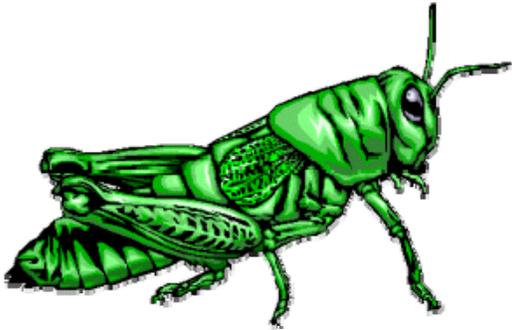
6. The weather forecast for tonight is 76°F . Predict the number of chirps that might be heard from a cricket tonight based upon the data given. Use mathematics to justify your answer.

7. A boy scout reports that, while camping, he heard a cricket chirp only five times when the ground temperature was 85°F . Is this boy scout telling the truth? Use mathematics to justify your answer.

Crickets and Temperature – A Relationship?

Name: ANSWER KEY

The following data shows the relationship between chirps per second of a ground cricket and the corresponding ground temperature.

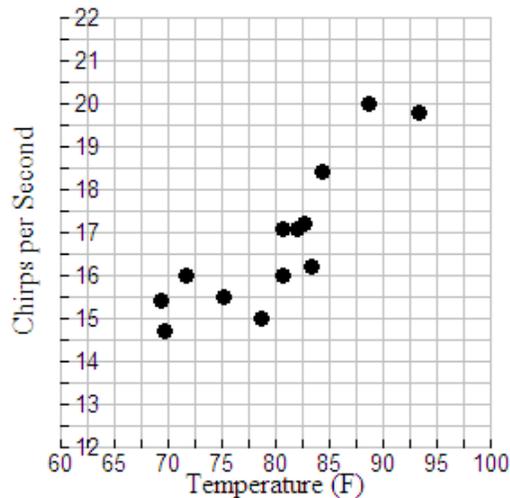


Temperature (° F)	Chirps/Second
88.6	20.0
71.6	16.0
93.3	19.8
84.3	18.4
80.6	17.1
75.2	15.5
69.7	14.7
82.0	17.1
69.4	15.4
83.3	16.2
78.6	15.0
82.6	17.2
80.6	16.0

<http://mathbits.com/MathBits/TISection/Statistics2/linearREAL.htm>

1. What is the independent variable in this data? Temperature (°F)
2. What is the dependent variable in this data? Chirps/Second
3. Graph the data as a scatterplot using the grid below. Remember TAILS.

Cricket Chirps



4. What type of correlation does there appear to be between the number of chirps per second and the ground temperature? Use mathematics to explain how you determined your answer. Use words, symbols, or both in your explanation.

Positive correlation. As the temperature rises, the number of chirps per second generally rises. The points in the scatterplot follow a rising trend.

5. What does the correlation say about the temperature and how it may affect the number of chirps per second?

As the temperature rises, the number of chirps per second generally rises.

6. The weather forecast for tonight is 76°F . Predict the number of chirps that might be heard from a cricket tonight based upon the data given. Use mathematics to justify your answer.

The data around 76°F shows between 15 and 16 chirps per minute. Three data points fall within this range.

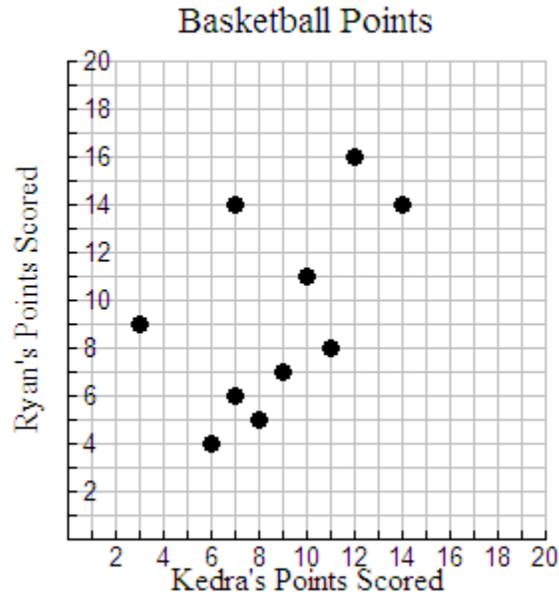
7. A boy scout reports that, while camping, he heard a cricket chirp only five times when the ground temperature was 85°F . Is this boy scout telling the truth? Use mathematics to justify your answer.

The boy scout is mistaken. According to the graph, most of the data points around 85°F show between 16 to 19 chirps per minute.

**Basketball
Exit Ticket**

Name: _____

The scatter plot below represents the number of points scored by Ryan and Kendra in the last 10 basketball games.

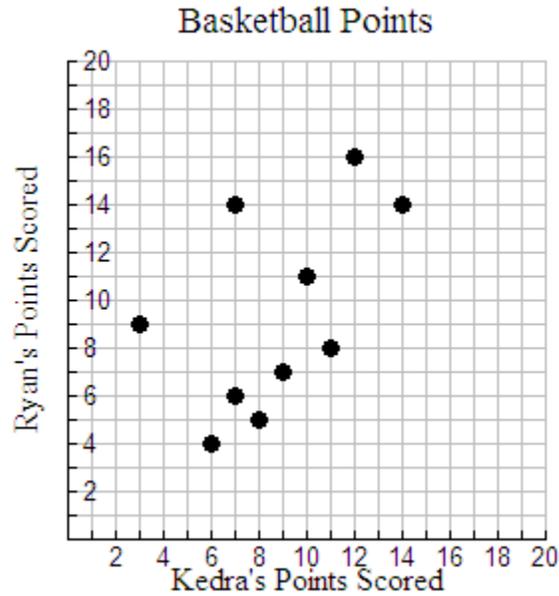


1. In how many games did Kendra earn more points than Ryan? _____
2. What is the correlation between the number of points Kendra scored and the number of points Ryan scored? _____
3. In the eleventh game, Kendra scored 13 points. Approximately how many points would Ryan score? Use mathematics to explain how you determined your answer. Use words, symbols, or both in your explanation.

**Basketball
Exit Ticket**

Name: ANSWER KEY

The scatter plot below represents the number of points scored by Ryan and Kendra in the last 10 basketball games.



1. In how many games did Kendra earn more points than Ryan? 5
4. What is the correlation between the number of points Kendra scored and the number of points Ryan scored? Positive Correlation
5. In the eleventh game, Kendra scored 13 points. Approximately how many points would Ryan score? Use mathematics to explain how you determined your answer. Use words, symbols, or both in your explanation.

While these two variables are not truly dependent on each other, based on the data, Ryan will most likely score around 10 to 14 points. This is because there is a cluster of points around this area when Kendra score of 13 points.

What's Happening Now? Teacher Directions

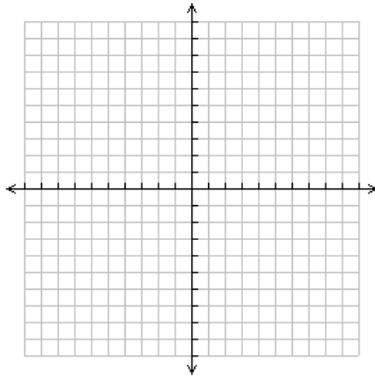
1. Assign the students individually to a computer with internet access.
2. Have the students visit the website:
<http://argyll.epsb.ca/jreed/math9/strand4/scatterPlot.htm>
3. Instruct the students to use the “Line of Best Fit” application on the website, to show a strong positive correlation. Ask the students to observe what makes the site prompt a ‘strong correlation’ and ask the students to describe the relationship between the x and y coordinates.
4. Reset the graph and repeat the activity with a strong negative correlation. Ask the students to observe what makes the site prompt a ‘strong correlation’ and ask the students to describe the relationship between the x and y coordinates.
5. Allow the students time to explore the “Line of Best Fit” application, and what makes correlations weak and strong. Have the students explore the affects on the line of best fit as the correlation changes. Encourage the students to add extreme outliers in the data.
6. Have the students sketch scatterplots on the student worksheet, “What’s Happening Now?” Allow the students to use the website to verify their graphs.
7. Scroll down to the very last application on the website, “Scatterplot Correlation” application. Use this application to introduce the correlation coefficient.
8. Drag the red arrow down to .7. Discuss how the spread of the points changes. Drag the arrow down to -1.0 and ask how the line changes. Drag to -0.7 and discuss the changes.
9. Show the students the 0.7 and the -0.7 and ask them to pay attention to the spread of the data around the line.
10. Ask the students to discuss with partners how they think the line should be drawn for any given set of data, asking “How do you know where the line goes?” Give the students a few minutes to discuss and then share with the class.

What's Happening Now?
Student Worksheet

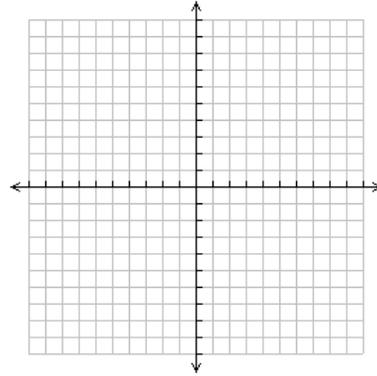
Name: _____

For each graph, sketch the indicated type of scatterplot. Include the line of best fit.

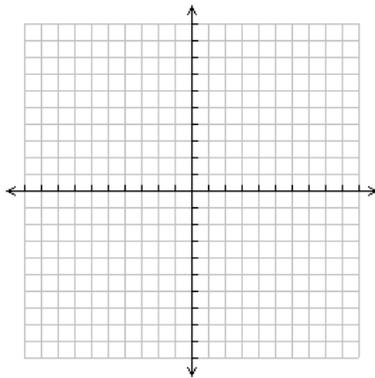
1. Strong Positive Correlations



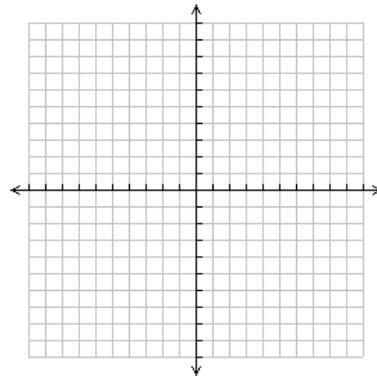
Weak Positive Correlation



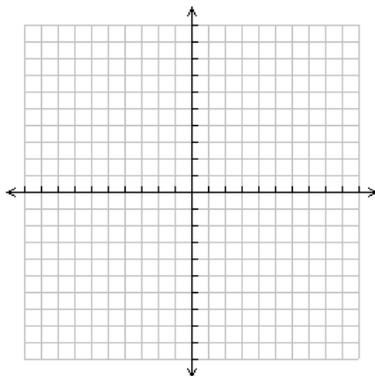
2. Strong Negative Correlations



Weak Negative Correlation



3. No Correlation



Does Too Much TV Hurt Your Grades?

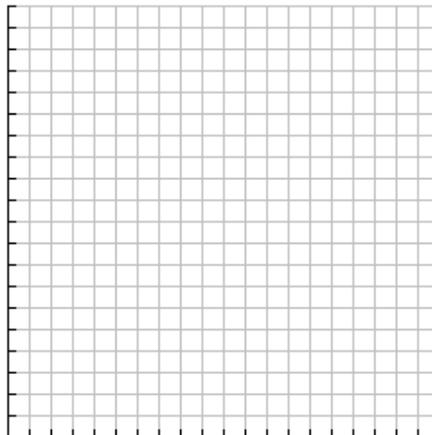
Name: _____

The principal at Lake Woods High School wants to know if watching too much television during the school week is hurting her students' GPA. The table below shows the results of a survey the principal conducted with ten randomly selected students.

GPA	Number of Hours Watching Television
3.1	14
2.4	10
2.0	20
3.8	7
2.2	25
3.4	9
2.9	15
3.2	13
3.7	4
3.5	21

<http://www.nvcc.edu/home/elanthier/methods/correlation.htm>

1. What is the independent variable in this data? _____
2. What is the dependent variable in this data? _____
3. Graph the data as a scatterplot using the grid below. Remember TAILS.



4. Estimate a line of best fit for the data you have graphed. Make sure that the data is equally distributed above and below the line.

5. Jenny has a 4.0 (perfect) GPA. Use the line of best fit to approximate how many hours of television Jenny watches in a week. Use mathematics to explain how you determined your answer. Use words, symbols, or both in your explanation.

6. Sam watches 18 hours of television each week. Use the line of best fit to approximate Sam's GPA. Use mathematics to explain how you determined your answer. Use words, symbols, or both in your explanation.

7. Estimate the number of hours you spend watching television in a week. . Use the line of best fit to approximate your GPA. Use mathematics to explain how you determined your answer. Use words, symbols, or both in your explanation.

Does Too Much TV Hurt Your Grades?

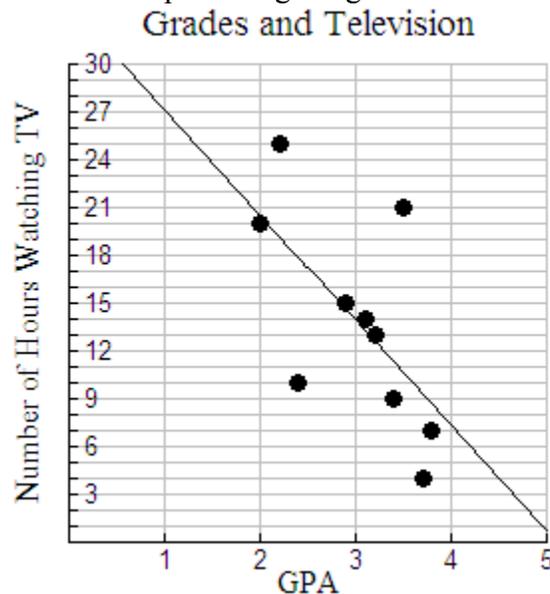
Name: ANSWER KEY

The principal at Lake Woods High School wants to know if watching too much television during the school week is hurting her students' GPA. The table below shows the results of a survey the principal conducted with ten randomly selected students.

GPA	Number of Hours Watching Television
3.1	14
2.4	10
2.0	20
3.8	7
2.2	25
3.4	9
2.9	15
3.2	13
3.7	4
3.5	21

<http://www.nvcc.edu/home/elanthier/methods/correlation.htm>

1. What is the independent variable in this data? GPA
2. What is the dependent variable in this data? Number of Hours Watching TV
3. Graph the data as a scatterplot using the grid below. Remember TAILS.



4. Estimate a line of best fit for the data you have graphed. Make sure that the data is equally distributed above and below the line.

5. Jenny has a 4.0 (perfect) GPA. Use the line of best fit to approximate how many hours of television Jenny watches in a week. Use mathematics to explain how you determined your answer. Use words, symbols, or both in your explanation.

Jenny watches approximately 7 to 8 hours of television in the week. The line of best fit at a 4 point GPA corresponds to the 7 to 8 hours.

6. Sam watches 18 hours of television each week. Use the line of best fit to approximate Sam's GPA. Use mathematics to explain how you determined your answer. Use words, symbols, or both in your explanation.

Sam has an approximate GPA of 2.5 The line of best fit lines up with this GPA at 18 hours of television.

7. Estimate the number of hours you spend watching television in a week. . Use the line of best fit to approximate your GPA. Use mathematics to explain how you determined your answer. Use words, symbols, or both in your explanation.

Answers will vary.

Cereal Nutrition Data

Brand	Calorie s	Sodium	Sugar
Cheerios	110	290	1
Cocoa Puffs	110	180	13
Golden Grahams	110	280	9
Honey Nut Cheerios	110	250	10
Kix	110	260	3
Lucky Charms	110	180	12
Oatmeal Raisin Crisp	130	170	10
Total – Whole Grain	100	200	3
Trix	110	140	12
All Bran	70	260	5
Apple Jacks	110	125	14
Corn Flakes	100	290	2
Crispix	110	220	3
Fruit Loops	110	125	13
Frosted Flakes	100	200	11
Frosted Mini Wheats	100	0	7
Product 19	100	320	3
Raisin Bran	120	210	12
Rice Krispies	100	290	3
Sugar Smacks	100	70	15
Special K	100	230	3
120	120	220	12
Life	100	150	6
Puffed Rice	50	0	0

Sodium and Sugar

Name: _____



Is there a Relationship between Sodium and Sugar?



Cereal Nutrition Data

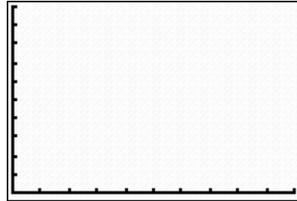
Brand	Calories	Sodium	Sugar
Cheerios	110	290	1
Cocoa Puffs	110	180	13
Golden Grahams	110	280	9
Honey Nut Cheerios	110	250	10
Kix	110	260	3
Lucky Charms	110	180	12
Oatmeal Raisin Crisp	130	170	10
Total – Whole Grain	100	200	3
Trix	110	140	12
All Bran	70	260	5
Apple Jacks	110	125	14
Corn Flakes	100	290	2
Crispix	110	220	3
Fruit Loops	110	125	13
Frosted Flakes	100	200	11
Frosted Mini Wheats	100	0	7
Product 19	100	320	3
Raisin Bran	120	210	12
Rice Krispies	100	290	3
Sugar Smacks	100	70	15
Special K	100	230	3
120	120	220	12
Life	100	150	6
Puffed Rice	50	0	0
Corn Pops	110	90	12

http://www.stat.ucla.edu/~dinov/courses_students.dir/data.dir/NutritionalValueCerealDataset.html

Graphing and Analyzing the Data

1. Enter the data for sodium in L_1 and sugar in L_2 of the graphing calculator.
2. Predict the correlation between the sodium and the sugar. Use mathematics to explain your reasoning.

3. Test your prediction by creating the scatterplot in your graphing calculator. Make a sketch of your graph below. Remember TAILS!



4. Describe the relationship between sodium and sugar content in a cereal:

5. Use the graphing calculator to calculate the line of best fit for the data.
 - Write the equation for the line of best fit here → _____
 - Graph the line of best fit in the graphing calculator and sketch the line in the graph of question 3 above.

6. Use the line of best fit to predict the amount of sugar a cereal would contain with 225 mg of sodium. Use mathematics to justify your answer.

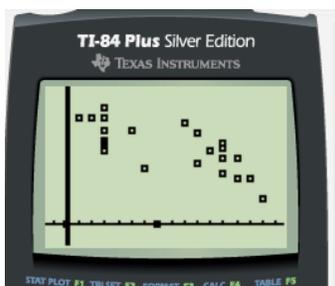
7. Use the line of best fit to predict the amount of sodium a cereal would contain if it had 16 grams of sugar. Use mathematics to justify your answer.

Graphing and Analyzing the Data Answer Key

1. Enter the data for sodium in L_1 and sugar in L_2 of the graphing calculator.
2. Predict the correlation between the sodium and the sugar. Use mathematics to explain your reasoning.

Answers will vary.

3. Test your prediction by creating the scatterplot in your graphing calculator. Make a sketch of your graph below. Remember TAILS!



4. Describe the relationship between sodium and sugar content in a cereal:
As the x-values increase, the y values decrease so there is a negative correlation.
5. Use the graphing calculator to calculate the line of best fit for the data.
 - Write the equation for the line of best fit here $\rightarrow y = -.02x + 11.37$
 - Graph the line of best fit in the graphing calculator and sketch the line in the graph of question 3 above.
6. Use the line of best fit to predict the amount of sugar a cereal would contain with 225 mg of sodium. Use mathematics to justify your answer. **Let $x = 225$ and find y . $y = 6.8$**
7. Use the line of best fit to predict the amount of sodium a cereal would contain if it had 16 grams of sugar. Use mathematics to justify your answer. **Let $y = 16$ and find x . $x = -231.5$. Lead the students in a discussion of why the x-value is negative.**

Pass the Ball!
Performance Assessment
Teacher's Guide

For this activity, students will work in pairs to complete the assignment, but will need to team up with other pairs for the data gathering section.

1. Announce the title of the activity – “Pass the Ball”. Have students think about what they anticipate the activity to be. Discuss.
2. After handing out the assessment, but before the materials are distributed, demonstrate the activity by having four students stand up and show everyone else the activity. The starting student will bounce, catch and pass the ball to the next person. They continue bouncing, catching and passing the ball until it is back to the one who started. Explain to students the importance of working at a consistent pace, rather than working too quickly.
3. They must start and stop with the same person.
4. While they are bouncing, catching and passing the ball, another teammate will keep time with a stopwatch.
5. They will conduct the same experiment three times, and average the time it took. This average is recorded in their table. Each student is responsible for recording the data on their own sheet.
6. They need to re-group and complete the exercise with at least five different sets of students. For instance, the first time they could have four students, then 5, then 7, then 3, then 8 for the subsequent trials. There is no mandated number to each of these groups, as long as they are all different.
7. For the last row in each table, have everyone in the room participate. Before timing the trial, have students predict how long they think it will take and record this answer on their worksheets.
8. The Data analysis portion of the assessment will be completed in pairs. Students should have access to graphing calculators to perform the analysis, but should not be required to use them.
9. This assessment may take more than one day to complete. The first day would be the data gathering, and they might begin to perform the analysis. The second day they would complete the activity.
10. You should plan to look over the assessments after the students have completed one “pass”, and write comments, questions and feedback on them. Students should have another opportunity to work on their activity and improve their answers based on your feedback before they are given a final grade.

Assessment adapted from the Texas Instruments Activity Exchange “Pass The Ball”:
<http://education.ti.com/educationportal/activityexchange/Activity.do?cid=US&aId=6472>

**Pass the Ball!
Grading Rubric**

Item	4-Excellent	3-Good	2-Satisfactory	1-Needs Improvement	0- Not Acceptable
Data Gathering – Process	Worked well in groups, on-task 90-100% of time.	Worked well in groups, on-task 70-90% of the time	Worked fairly well in groups, on-task 50-70% of the time	Did not work well in groups, on-task less than 50% of the time	Did not work with assigned group, off task or not working <50% of the time.
Data Gathering – Product	90-100% of data recorded, correctly and according to instructions	70-90% of data recorded correctly and according to instructions	50-70% of data recorded, did not always follow instructions	Less than 50% of data recorded, did not always follow instructions	No data recorded.
Scatter-plot	All data included, followed TAILS guideline	90% of data included, followed TAILS guideline	90% of data included, missing one of TAILS	90% of data included missing two or more of TAILS	No graph
Line of Best Fit	Line fits data, same number of data points above and below, follows pattern of data	Line fits data according to slope, placed too high or low	Line does not fit data according to slope, placed within the data	Line does not fit data according to slope, placed too high or too low.	No line of best fit.
Description of relationship	Accurate description, complete justification	Accurate description, incomplete justification	Accurate description, incorrect justification	Inaccurate description, incorrect justification.	No description or justification.
Prediction for 2 people	Accurate prediction, includes justification	Accurate prediction, incomplete justification	Inaccurate prediction, complete justification	Inaccurate prediction, incomplete justification	No prediction.
Prediction for 40 people	Accurate prediction, includes justification	Accurate prediction, incomplete justification	Inaccurate prediction, complete justification	Inaccurate prediction, incomplete justification	No prediction.
Comparison of prediction to actual	Accurate prediction, includes justification	Accurate prediction, incomplete justification	Inaccurate prediction, complete justification	Inaccurate prediction, incomplete justification	No prediction.
Analysis of new scenario	Correct analysis, includes accurate justification	Correct analysis, slightly inaccurate justification	Correct analysis, no justification	Incorrect analysis, no justification	No analysis.

Pass the Ball!
Performance Assessment

Name: _____

There are two portions to this assignment. You will need to work in groups of various sizes to gather the data, then with a partner to perform the analysis.



Gather the Data.

- This experiment involves recording the amount of time it takes for a group of kids to bounce, catch and pass a ball to the next person.
- You will time this activity for groups of various sizes.
- You are timing how long it takes for the ball to go around the group one time.
- Each person is responsible for recording the data on their own paper.

Number of People		Times for each trial		Average Time in Seconds

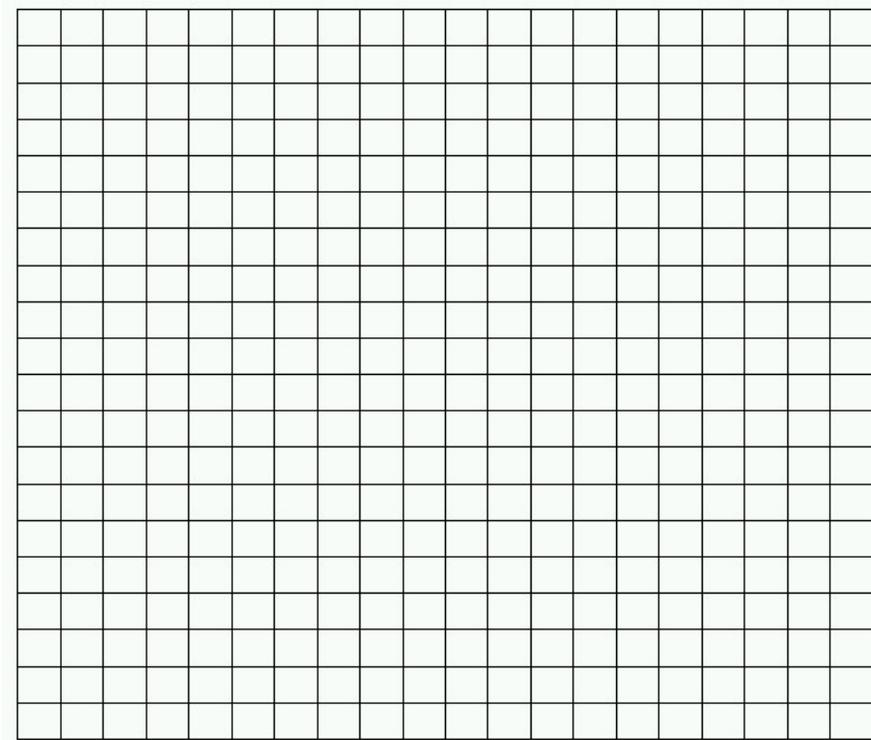
Predictions

- Prediction for whole class average time: _____

Analyze the Data

Work with a partner to analyze the data you have just gathered.

- a. Create a scatterplot of the data (TAILS!).
 - i. The x -axis is: _____
 - ii. The y -axis is: _____



- b. Draw the line of best fit for your scatterplot.
- c. Describe the relationship you see in your data and scatterplot. Be sure to justify your answer.

- d. If you had only two students passing the ball between them, how long do you think it would take? Be sure to justify your answer.

- e. How did your prediction compare to the actual time it took the entire class to complete the activity? Please describe in complete sentences.

- f. If two classes of twenty each were to combine to perform the activity, how long do you think it would take them to finish? Justify your answer.

- g. If the exercise were changed, so students just passed the ball without bouncing it, describe how your data would change. Be sure to include what you think the new correlation would be between the data, and how the line of best fit would change
