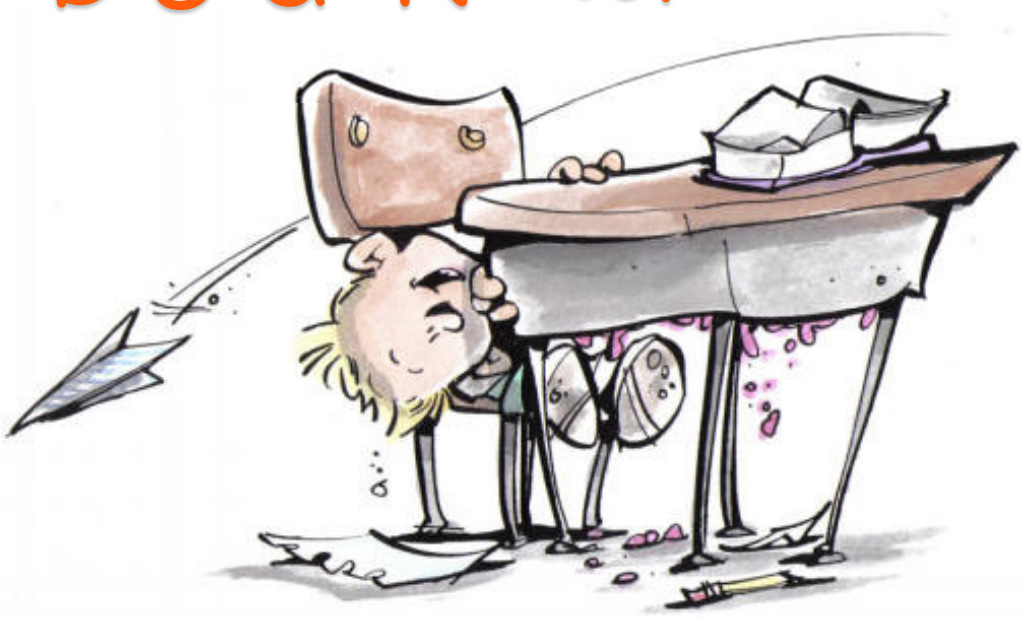
B.U.G. Newsletter



January 2015

THIS NEWSLETTER IS A SERVICE THAT WAS FUNDED BY "NO CHILD LEFT BEHIND" TITLE II PART A HIGHER EDUCATION IMPROVING TEACHER QUALITY HIGHER EDUCATION GRANT ADMINISTERED THROUGH THE UNIVERSITY OF GEORGIA.

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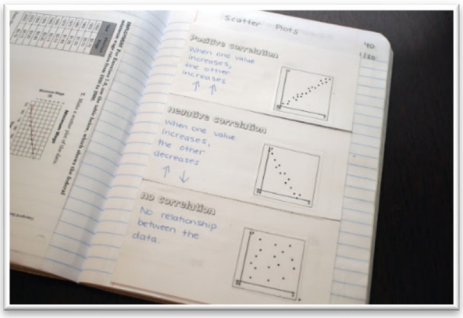
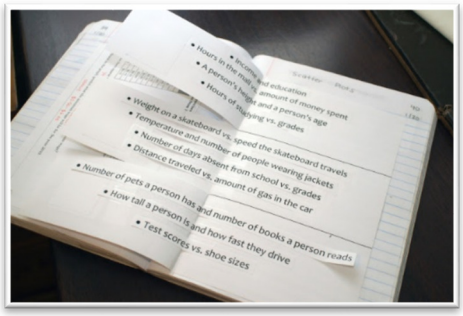
Happy New Year!

by Jennifer L. Brown

Happy New Year! The new year will bring new excitement into the classroom – hopefully. This month's newsletter will continue to focus on the first units for second semester. For Coordinate Algebra, I am focusing on Unit 4, Describing Data. This activity for this month is a foldable that I found on "Everybody is a Genius" blog. First, you begin by giving the students an overview of correlations and the definitions for



each type (on the outside of the foldable). See the picture above. Second, you give each student a strip of paper with the three scatterplot graphs, and he/she will match and tape down the graph next to the type of correlation it depicts. Third and lastly, you distribute a sheet of paper with a bunch of scenarios. After the students cut apart the scenarios, they will read each scenario and think about which type of correlation is being described. Then,



they will tape or glue it down inside the foldable within the appropriate section. See the picture above. The editable PowerPoint is available on my website. For Analytic Geometry, I am focusing on Unit 5, Quadratic Functions. This activity combined quadratic functions with the statistics. The students will trace their hand, foot, and bite mark from a "smart" cookie, which I would call my students. After locating 11 points and entering them into the graphing calculator, the students will run a quadratic regression to obtain the equation. Next, they will describe the characteristics for each of the graphs. My students loved collecting data in the classroom, especially this activity. The accompanying PowerPoint is posted on my website. In Advanced Algebra, I am focusing on Unit 4, Exponential and Logarithmic Functions. I found this activity from TeachEngineering, a lesson plan digital library that was created and maintained by the University of Colorado – Boulder. This activity shows the students how light intensity is used with bone density. It is a great application for natural base e! The accompanying PowerPoint is posted on my website. If you have any questions, please let me know.

Dr. Brown ☺

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Prior Knowledge

Unit 4 in Coordinate Algebra

- Know how to compute the mean, median, interquartile range, and mean standard deviation by hand in simple cases and using technology with larger data sets.
- Find the lower extreme (minimum), upper extreme (maximum), and quartiles.
- Create a graphical representation of a data set.
- Present data in a frequency table.
- Plot data on a coordinate grid and graph linear functions.
- Recognize characteristics of linear and exponential functions.
- Write an equation of a line given two points.
- Graph data in a scatterplot and determine a trend.
- Determine the slope of a line from any representation.
- Identify the y intercept from any representation.
- Be able to use graphing technology.
- Understand the meaning of correlation.

Unit 5 in Analytic Geometry

- Use function notation.
- Put data into tables.
- Graph data from tables.
- Solve one variable linear equations.
- Determine domain of a problem situation.
- Solve for any variable in a multi-variable equation.
- Recognize slope of a linear function as a rate of change.
- Graph linear functions.
- Use of complex numbers.
- Graph inequalities.

Unit 4 in Advanced Algebra

- Apply the concept of a function.
- Apply various representations of functions.
- Understand exponential functions and the characteristics of their graphs.
- Solve linear equations using algebra and graphing methods.
- Familiar with graphing technology.
- Use patterns to write a function to model a situation.

FOR MORE IDEAS AND ACTIVITIES

www.bugforteachers.com/crmc.html

Common Student Misconceptions

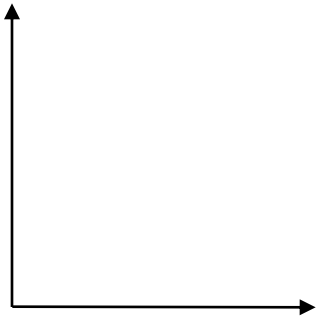
BY Jennifer L. Brown

Algebra. Students really struggle to see the purpose of graphing. Often, they feel as if it is an isolated skill Thus, they did not see how to use graphs to solve equations. It is always a good idea to show the students the purpose of those graphing characteristics and the various terms that mean the same thing, such as roots, zeros, solutions, and x-intercepts. Another suggestion is to show the students real-world applications for equations and functions. These applications will help them see that variables represent "something" as well as the usefulness of math.

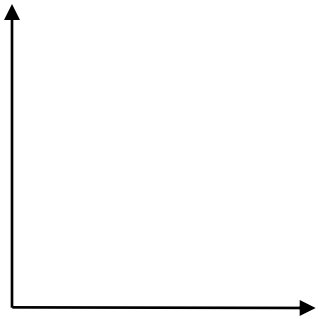
When I was in the classroom and working with polynomials, the students seem to forget that the degree is associated to the number of solutions. For example, in Analytic Geometry, quadratic functions have two solutions, such as the square root of 16 is 4 and -4. The rule applies to solutions involving complex numbers, too. In addition, when I taught algebra, especially quadratics, I really saw that students did not understand combining like terms. Some of the common errors were forgetting the coefficient of 1 in front of variables, changing the degree when combining like terms or applying the rules of exponents incorrectly, combining everything together instead of only the like terms, and forgetting to give every little kid a piece of candy (distributing) when multiplying.

Statistics. I discussed many student misconceptions related to statistics in the August 2014 Newsletter. In Coordinate Algebra, students seem to have difficulties with box and whisker plots. The intervals between the minimum, quartiles, and maximum are thought to be equal. When they see a large spread in the data, they do not think variation. I found that collecting real-world data then analyzing it by creating a box and whisker plot helped with this issue. I would tell my students that "real-world data does not always make a pretty picture." Another issue with correlations, if there is a correlation or relationship, is the fact that it does not mean one variable caused the other.

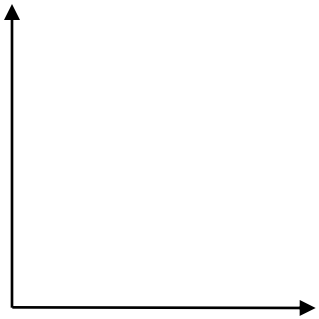
positive Correlation



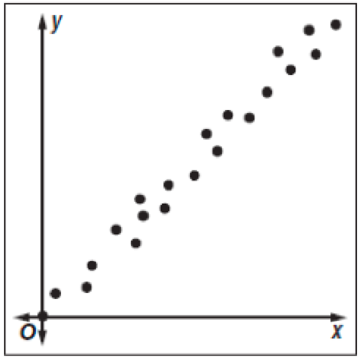
negative Correlation



no Correlation



Retrieved from
http://everybodyisageniusblog.blogspot.com/2012/08/scatter-plots-correlation.html
(MCC9-12.S.ID.8; MCC9-12.S.ID.9)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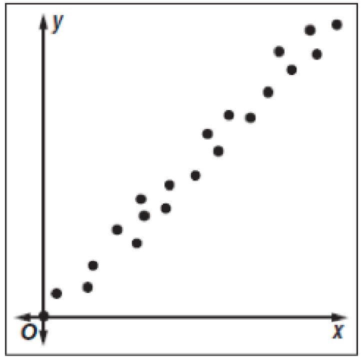
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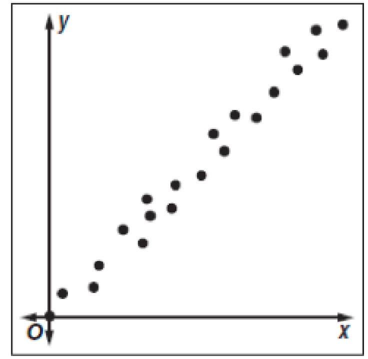
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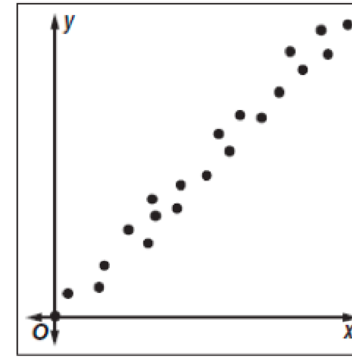
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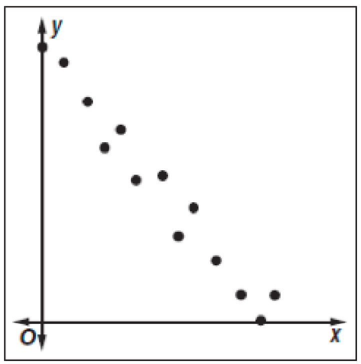
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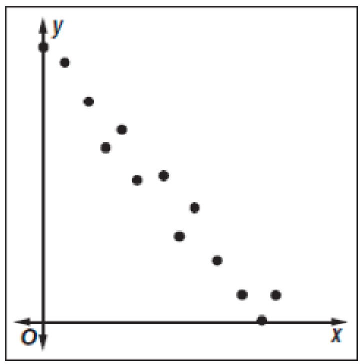
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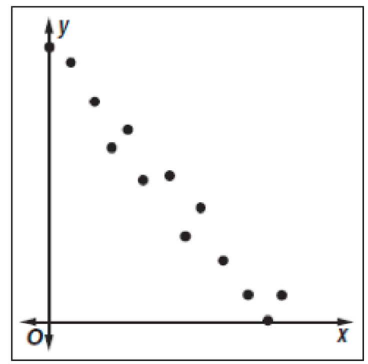
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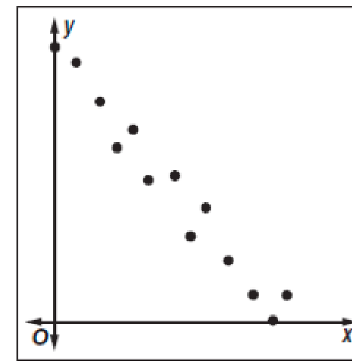
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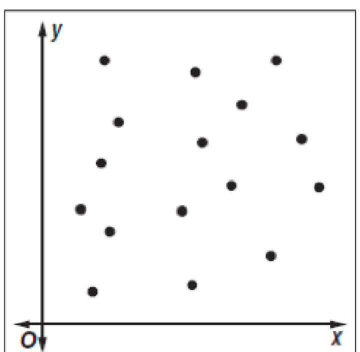
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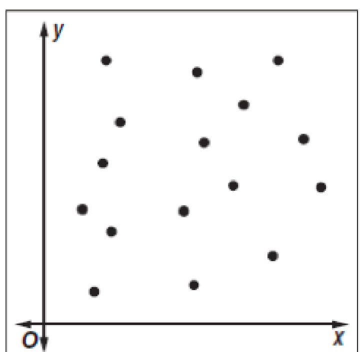
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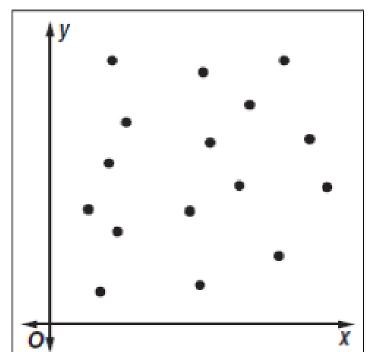
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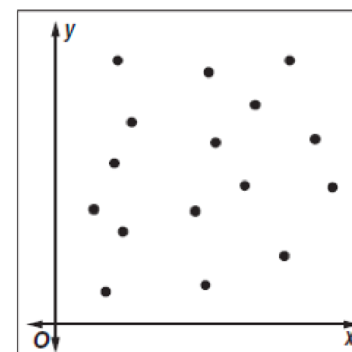
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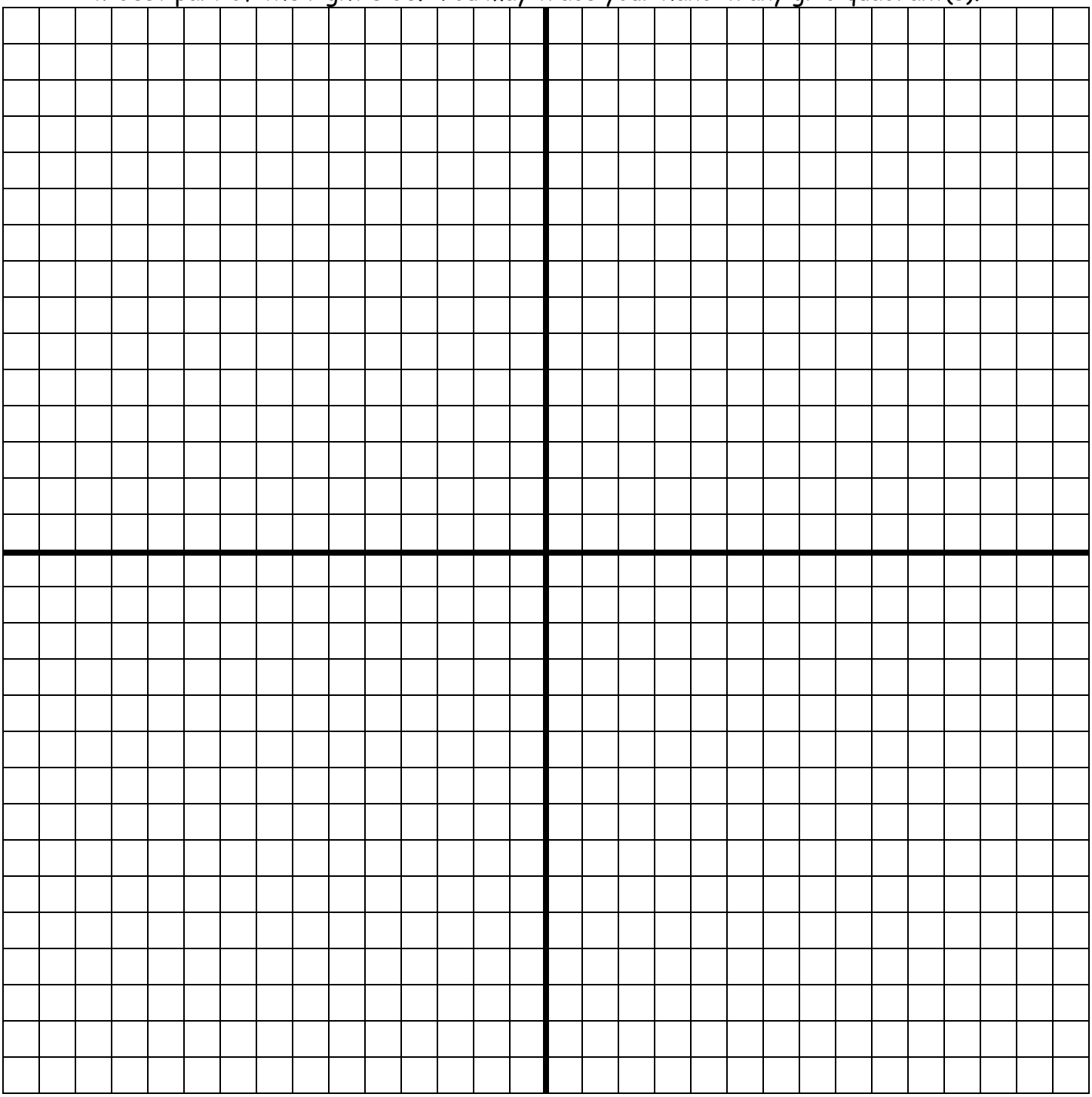
- Education and income
- Number of pets a person has and number of books a person has read
- Number of days absent from school vs. math average
- Test scores vs. shoe sizes
- Distance traveled vs. amount of gas in the car
- Hours of studying vs. grades
- Hours in the mall vs. amount of money spent
- Weight on a skateboard vs. speed of the skateboard
- A person's height and a person's age
- How tall a person is and how fast they drive
- Temperature and number of people wearing jackets

Body Modeling Lab Activity Name _____

Objective: Collect data, create a scatter plot of the data, and find the equation of "best-fit".
Materials: Lab sheet, marker, graphing calculator, "smart" cookie, hand, foot, and mouth.

Activity #1 – Hand Modeling

Step 1 – Use the grid below to trace around your hand with a marker. Make sure your fingers are together so that no space is between them and your hand is perpendicular to the bottom of the lab sheet. Trace from the widest part of your hand's left side to the widest part of the right side. You may trace your hand in any grid quadrant(s).



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(MCC9-12.A.CED.2; MCC9-12.F.IF.4)

Step 2 – Select 11 points around the tracing of your hand which intersect at grid lines. List your selected coordinates in the table provided below.

X	Y

Step 3 – Input your data in a graphing calculator, create a scatterplot of the data, and find the regression equation that best fits your hand tracing.

Record your equation: _____

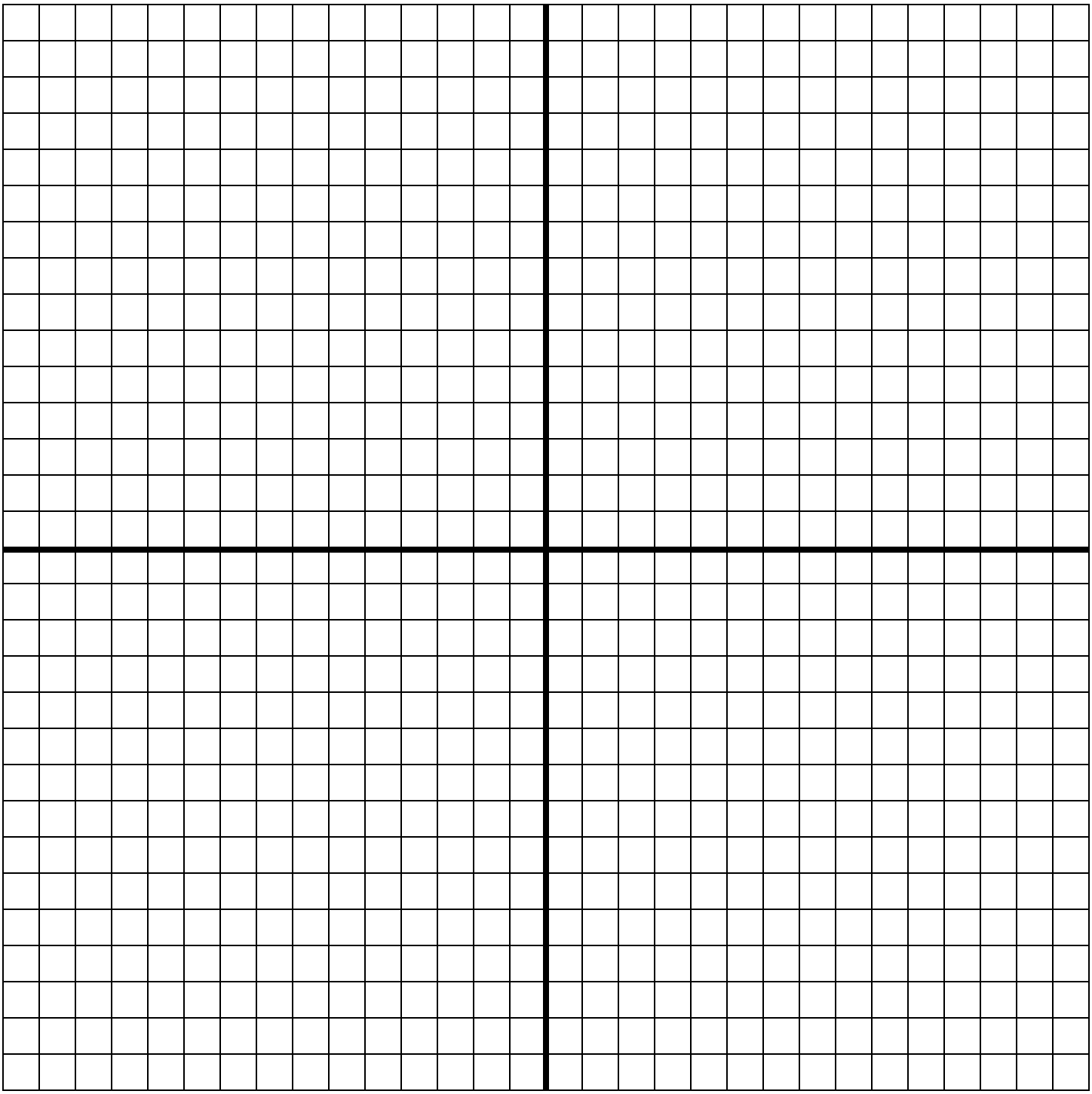
Questions

Identify each of the following characteristics for your graph.

1. Maximum _____
2. Minimum _____
3. Interval of increasing _____
4. Interval of decreasing _____
5. x-intercept(s) _____
6. y-intercept _____
7. End behavior _____
8. Line of symmetry _____

Activity #2 – Foot Modeling

Step 1 – Use the grid below to trace around your foot with a marker. Make sure your toes are together so that no space is between them and your foot is perpendicular to the bottom of the lab sheet. Trace from the widest part of your foot's left side to the widest part of the right side. You may trace your foot in any grid quadrant(s).



(MCC9-12.A.CED.2; MCC9-12.F.IF.4)

Step 2 – Select 11 points around the tracing of your foot which intersect at grid lines. List your selected coordinates in the table provided below.

X	Y

Step 3 – Input your data in a graphing calculator, create a scatterplot of the data, and find the regression equation that best fits your foot tracing.

Record your equation: _____

Questions

Identify each of the following characteristics for your graph.

1. Maximum _____
2. Minimum _____
3. Interval of increasing _____
4. Interval of decreasing _____
5. x-intercept(s) _____
6. y-intercept _____
7. End behavior _____
8. Line of symmetry _____

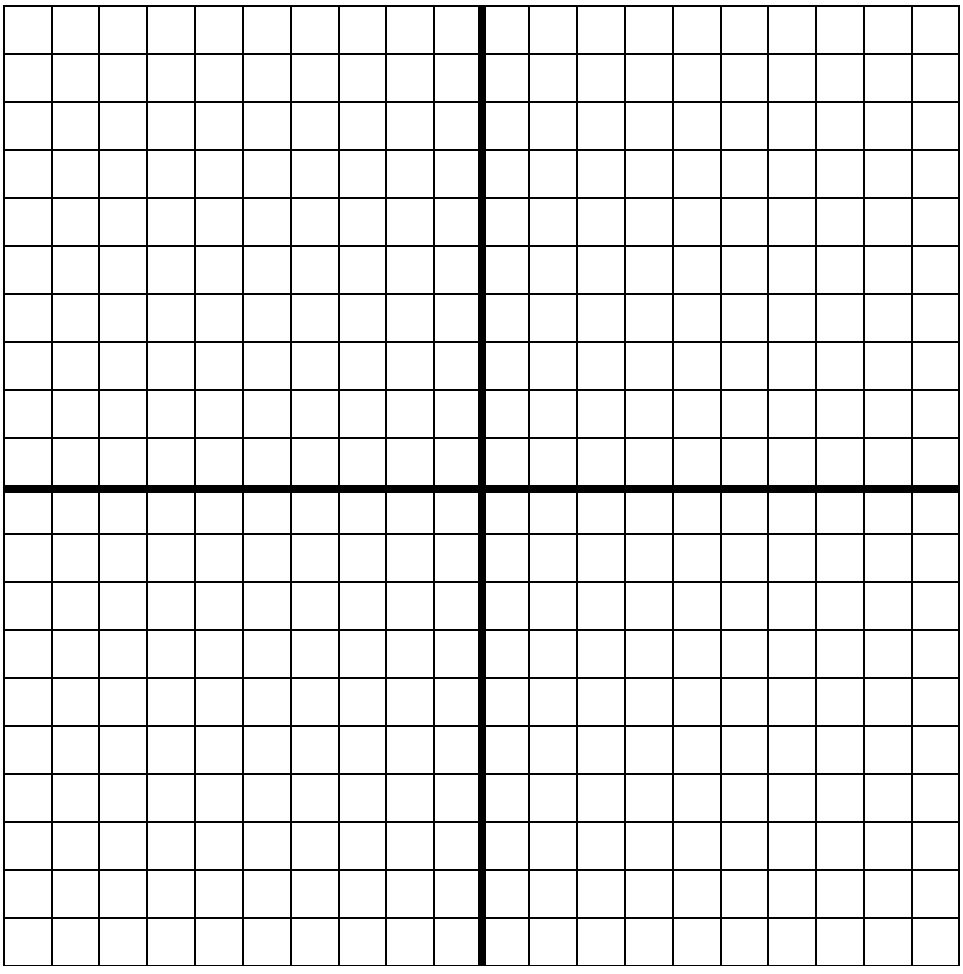
Activity #3 – Mouth Modeling

Step 1 – Take a large bite of the "smart" cookie. Place the remaining portion of your cookie anywhere on the grid below. Make sure that the bite mark faces either up or down, not left or right. Trace around your inside bite mark with a marker.

Step 2 – Select 9 points around the tracing of your bite mark which intersect at grid lines. List your selected coordinates in the table provided below.

Step 3 – Input your data in a graphing calculator, create a scatterplot of the data, and find the regression equation that best fits your bite mark tracing.

Record your equation: _____



X	Y

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Questions

Identify each of the following characteristics for your graph.

1. Maximum _____
2. Minimum _____
3. Interval of increasing _____
4. Interval of decreasing _____
5. x-intercept(s) _____
6. y-intercept _____
7. End behavior _____
8. Line of symmetry _____

Light Experiment: Attenuation

Objective:

This lab shows the mathematical relationship between the attenuation of x-rays through an object and the thickness of the object. This relationship will be used to find the attenuation coefficient, a measure of a material's ability to absorb and scatter x-rays, of transparency film.

Thoughtful Questions:

1. How is a shadow like an x-ray image?

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2. How do you think the shadow of a transparent object will change as the thickness of the object increases?

Materials:

- Incandescent lamp with 60 watt bulb
- 12" by 12 " piece of aluminum foil
- Transparency sheet cut into 8 equal rectangles
- Light intensity scale
- Masking tape
- Ruler
- Scissors
- Graphing calculator

Procedure:

1. Tape the light intensity scale to a wall.
2. Set up the lamp to shine on the scale. (Do not turn on the lamp yet.)
3. Take a piece of foil and cut a five mm diameter hole in the center of it.
4. Cover the face of the lamp by wrapping the aluminum foil around it. (Make sure that the hole is in the center of the face of the lamp and that the aluminum foil does not cover up the vents in the back of the lamp.)
   Safety Tip: Do not leave the lamp on for more than a minute at a time.
5. Darken the room and turn on the lamp apparatus.

Original Source from TeachEngineering; Contributing Authors were Cynthia Paschal, Stacy Klein, Sean Brophy, Chris Garay, Hunt McKelvey, Stephen Schleicher, Rachael Shevin, Rebecca Zambon, Kristyn Shaffer, and Megan Johnston from VU Bioengineering RET Program, School of Engineering, Vanderbilt University (MCC9-12.F.LE.4)

6. Hold up a piece of transparency 2 to 3 inches from the wall to cast a shadow near the scale (but not on the scale).
7. Match the intensity of the resulting shadow with a square on the scale. *Tip: It is easier to distinguish the shade of gray in the shadow when one steps back to look at it.*
8. Record the intensity on the table.
9. Repeat steps 5 through 8 until the table is filled.

Thickness (# of sheets)	Light Intensity (% white)
0	100
1	
2	
3	
4	
5	
6	
7	
8	

Data Analysis:

1. Clear all lists from the calculator (STAT → Clearlist → 2^{nd} L_1 → 2^{nd} L_2 → 2^{nd} L_3 → Enter).
2. Enter "Thickness" in L_1.
3. Enter "Light Intensity" in L_2.
4. Calculate the natural log of the light intensity.
    - In the L3 column, arrow up.
    - Enter Ln (L_2).
5. Create a scatterplot using a trendline with the thickness (L_1) and intensity of the attenuator (L_3) data.
6. Turn on the Diagnostics (2^{nd} Catalog → "DiagnosticsOn" → Enter).

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7. Conduct a linear regression (STAT → CALC → LinReg → Enter → 2nd L1, → 2nd L3, → VARS→ Function → Y_1).
8. Record your analysis below:

   y = ax + b

   a = _____

   b = _____

   R^2 = _____

   r = _____

9. Write the linear function. y = _____ x + _____
10. Graph your line of best fit.

- Do your data points fall along a relatively straight line? _____
- What does the equation of the best fit line tell you about the relationship between the attenuator thickness and the light intensity of the shadow?

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11. Convert Beer's Law, shown below, to y = mx + b format.

$$\frac{Intensity}{I_0} = e^{-\mu * Thickness}$$

12. Compare the converted formula to the equation on your graph.

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13. What is the attenuation coefficient, μ, of the transparency film? _____

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