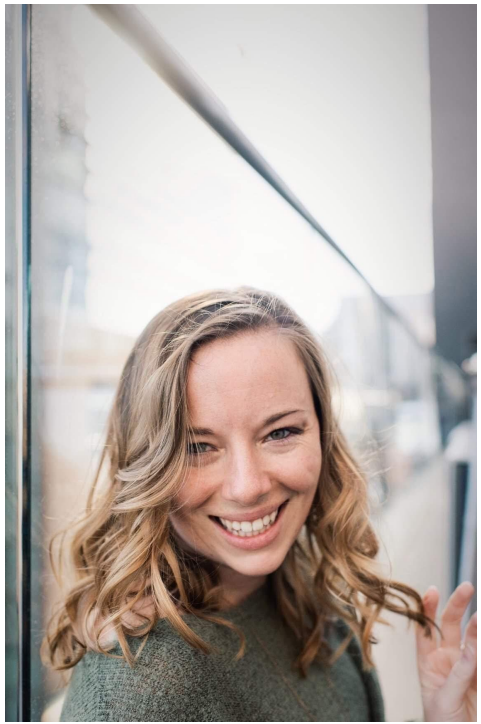
Engaging Students through Problems, Projects, and Inquiry

Charlotte Ihme
Greenville Technical Charter HS
Greenville, SC



Hello!

Charlotte Ihme

Twitter: @CJIhme

Instagram: @mathwithihme

Email: cihme@staff.gtchs.org

Website: gg.gg/mathwithihme

Today's Presentation:
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A little about my classroom:

- Algebra 1, Geometry, Algebra 2, Math Strategies
- Public Charter HS, Public School
- A/B, CP, Honors, Semester, Block

Problem # 1

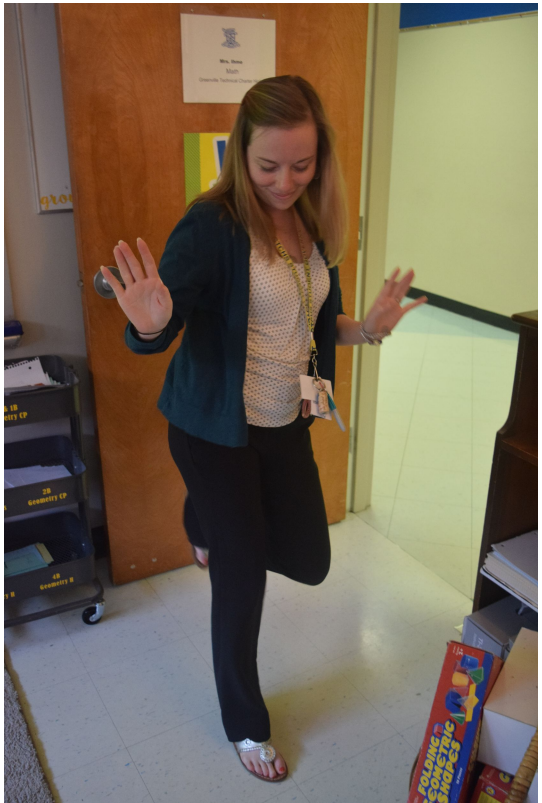
You want to describe to a friend how to do the Cupid Shuffle, but you can’t use numbers or letters.

Using pencil and paper, explain the dance moves.

Where do I use this?

- Vectors
- Test Activity
- Differentiation:
    - Use just basic steps and pair with directions to identify if students truly understand magnitude and direction.
    - Have students use trigonometry to justify their magnitude and direction.

How does this look?



How does this look?

How does this look?

Problem # 2

Mrs. Anthony has approved an educational road trip with some of your friends and you get to miss school! You can choose anywhere you want to go as long as you go through 10 different states in the United States. She has decided that it will be most cost efficient if you only make 5 overnight stops as you travel. It is your job to find the distance the group will travel over the course of the trip.

How does this look?

New Hampshire

On our way to Franconia, New Hampshire we will make a pit stop in Montpelier, Vermont(22.75,20.75). While we are there we will stop and visit the Vermont State House. When we are finished there we will continue on to Franconia. When we arrive in Franconia we will visit White Mountain National Forest.

After we stay the night in Franconia we will travel to Augusta, Maine.

Problem # 3, Part 1

You've been given a pen pal. They would like to try a peanut butter and jelly sandwich, but they don't know how to make it. In your letter, write out instructions for how to make a peanut butter and jelly.

Problem # 3, Part 2

You've been given a pen pal. They would like to know what your day is like. Please give them thorough instructions.

You must also provide a why to what you are doing. Your medium may be anything of your choosing!

How does this look?

- Student Sample

Project # 1, Part 1

You have been hired as the new city planner by the mayor of Greenville, Mr. White. He has asked you to redesign the city to meet his expectations. He has provided you with a list of requirements for the new city.

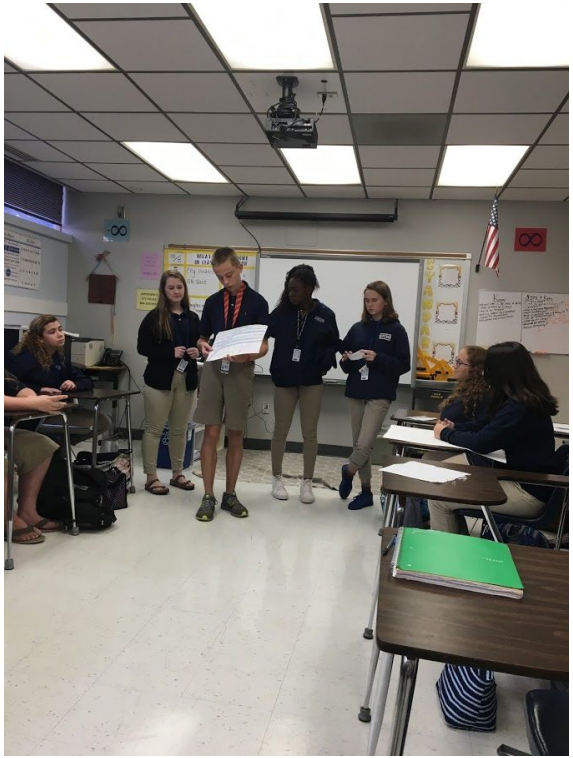
Project # 1, Part 2

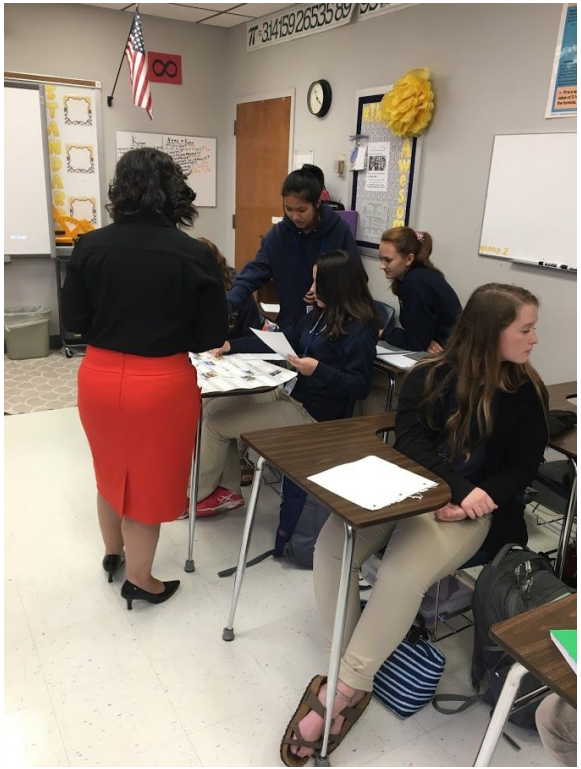
The mayor has given you a list of requirements that you need to meet for the project. He has also asked that you have your design complete and ready for him by 9:00am Friday. Your design must be tangible, but the items on it may be created by computer.

- At the top of the drawing, place the name of the city and give it a population.
- 6 parallel streets – all named.
- 2 transversal streets that are not parallel to each other- named.
- Traffic lights or stop signs at 4 intersections.
- A gas station and a restaurant at congruent alternate exterior angles.
- Your house and your school at supplementary same side interior angles.
- The courthouse and bank at non-congruent alternate interior angles.
- A department store and a grocery store at congruent corresponding angles.
- The fire department and police station at congruent alternate interior angles.
- A movie theater and park at supplementary same side exterior angles.

How does this look?

How does this look?



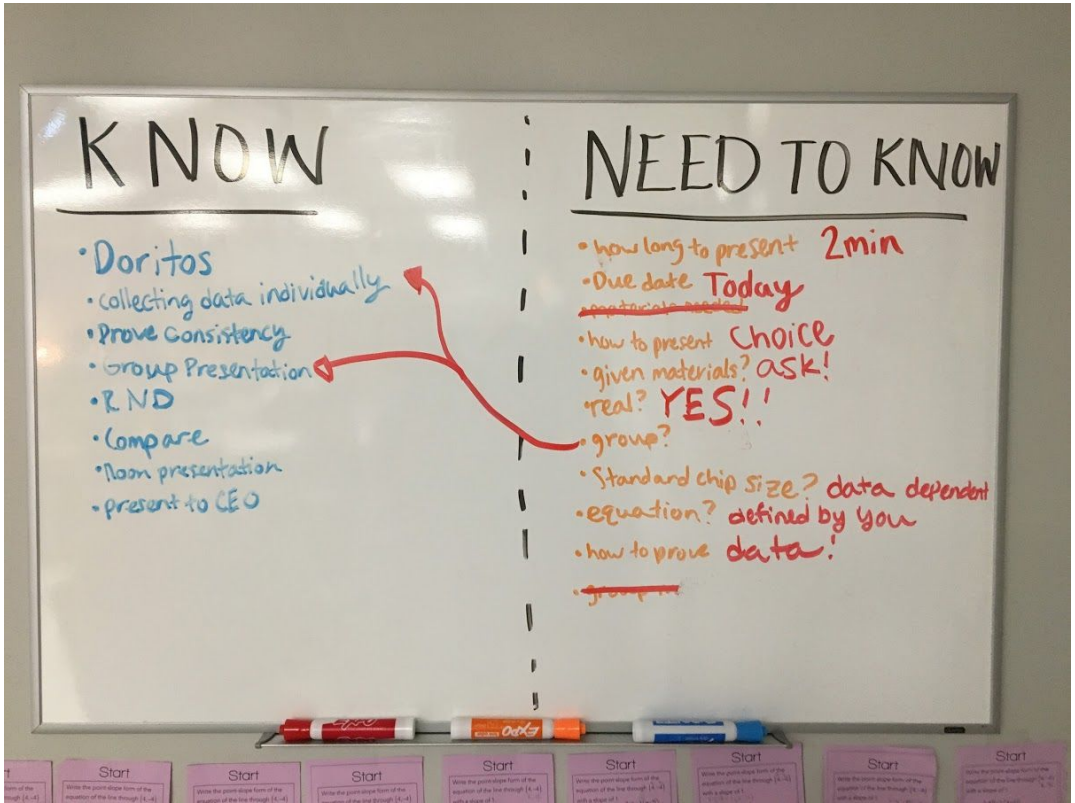


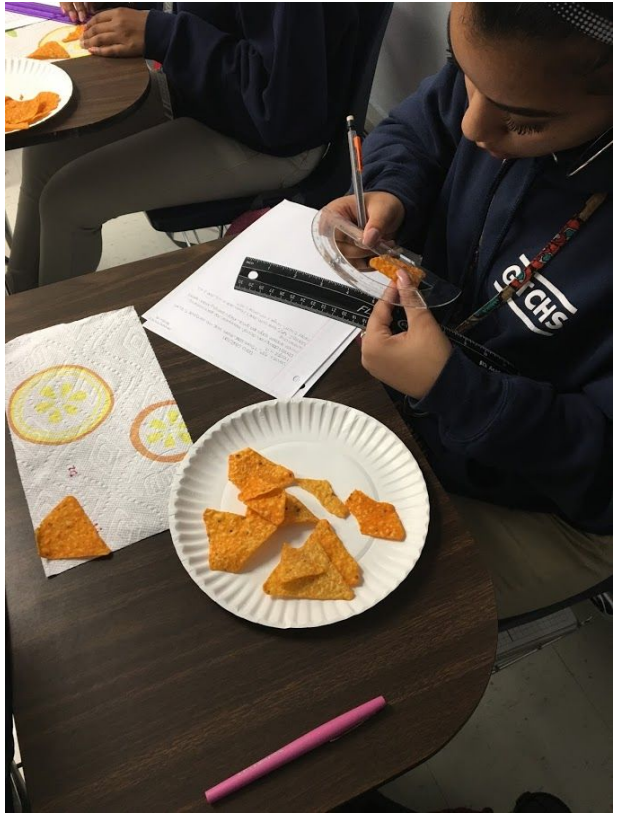
Project # 2

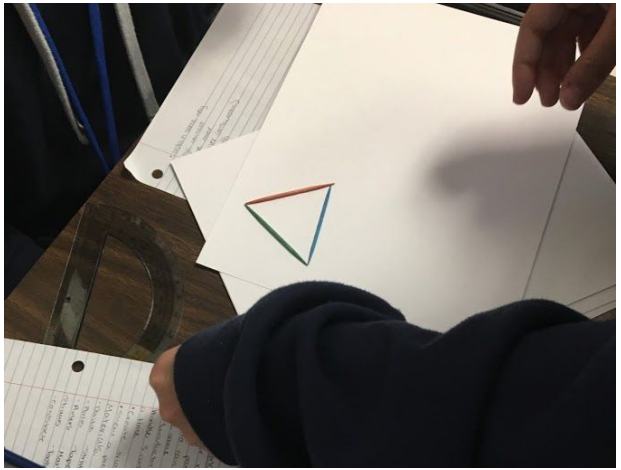
Frito Lay has received several complaints regarding the size of Doritos chips being inconsistent. You are part of the Research and Development team that is working to prove whether or not the chips are consistent.

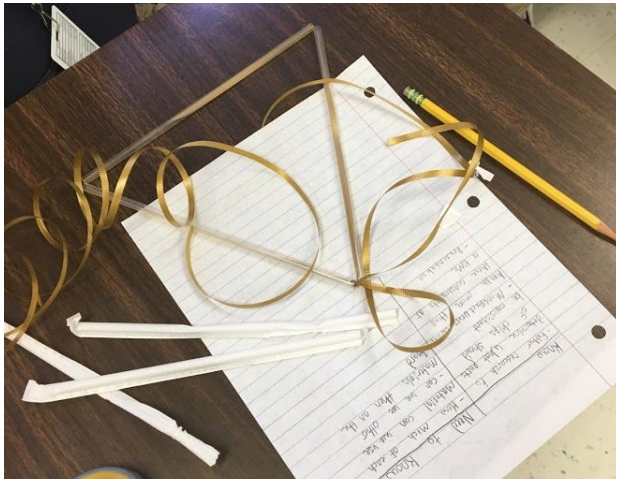
As a researcher on the team, you will need to collect individual data about the Doritos and compare with the members of your team. Then your team will present the results to the CEO at 3pm this afternoon.

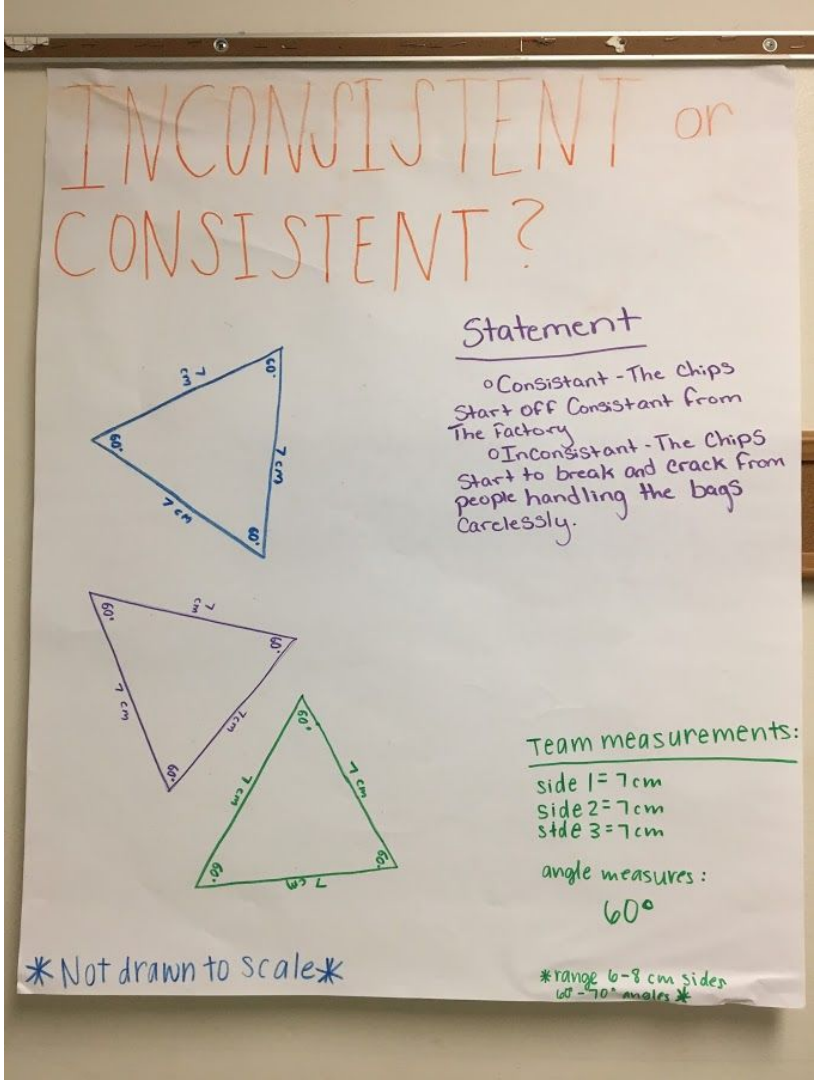
What does it look like?










INCONSISTENT or CONSISTENT?
Statement
oConsistant - The chips start off Consistant from The Factory
oInconsistant - The Chips start to break and crack from people handling the bags Carelessly.
60°
7 cm
Team measurements:
side 1 = 7cm
side 2 = 7cm
side 3 = 7cm
angle measures:
60°
Not drawn to scale
*range 6-8 cm sides
60 - 70° angles*

Project #2, Part 2

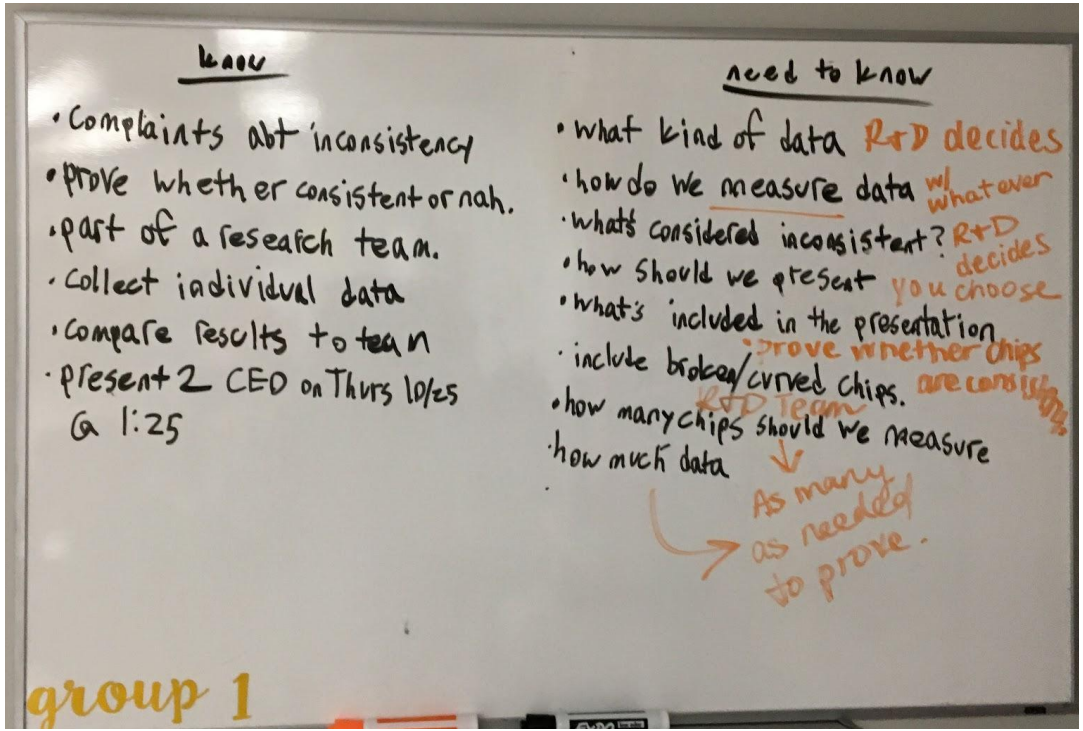
Dear Research and Development Team,

Thank you for your presentation regarding the consistent sizes of our Doritos. At this time I would like you to further your research to determine what parts of the Doritos we can keep the same to make sure that the chips consistent. Our manufacturers cannot handle more than three constraints at a time. Create triangle examples using the materials you have to test constraint options. Be prepared to present all of the results.

Sincerely,

Vivek Sankaran
Frito Lay, CEO

How we begin...


know
• Complaints abt inconsistency
• prove whether consistent or nah.
• part of a research team.
• Collect individual data
• Compare results to team
• present 2 CEO on Thurs 10/25 @ 1:25
need to know
• what kind of data R+D decides
• how do we measure data w/ whatever
• whats considered inconsistent? R+D decides
• how should we present you choose
• what's included in the presentation
• include broken/curved chips. prove whether chips are consistent R+D team
• how many chips should we measure
• how much data
As many as needed to prove.
group 1

What does it look like?

Samples of Student Work

- Digital
- Tangible

Inquiry– Exponent Laws

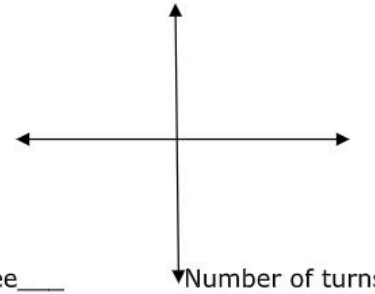
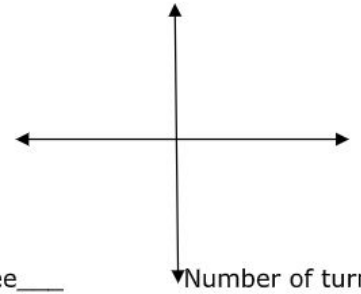
Exponent Properties: The Product Rule		
What is the difference between $3x$ and x^3? Explain in complete sentences and with examples		
Product	Repeated multiplication	Power of the form a^b
$2^2 \cdot 2^3$	$2 \cdot 2 \cdot 2 \cdot 2 \cdot 2$	2^5
$3^4 \cdot 3^5$		
$11^6 \cdot 11^8$		
$5^1 \cdot 5^4 \cdot 5^3$		
$x^9 \cdot x^7$		
Now, determine a general rule for what happens when we have two exponential expressions multiplying each other with the same base. You may want to write the rule in words, or you can use an example or expression to communicate the rule.		
Why do you think this rule is called "the product rule"?		
Please write the algebraic rule we came up with as a class:		

Inquiry- Polynomials

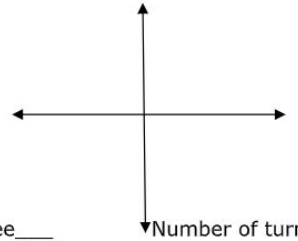
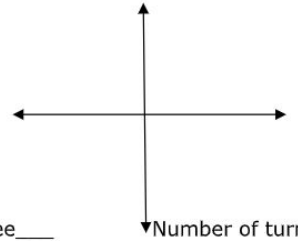
Polynomial Functions

Recall: The degree of a polynomial in one variable corresponds to the largest exponent on the variable.

Using a graphing calculator sketch the graph, state the degree of the polynomial function and state the number of turns in each graph.

f(x) = 2x - 1	f(x) = 3x + 4
	
Degree___ Number of turns___	Degree___ Number of turns___

Inquiry- Polynomials

$f(x) = x^5 - 5x^3 + 4x$	$f(x) = x^5 - 6x^3 + 5x$
	
Degree___ Number of turns___	Degree___ Number of turns___

What is the relationship between the degree of the polynomial and the number of turns in the graph?

_____
_____
_____

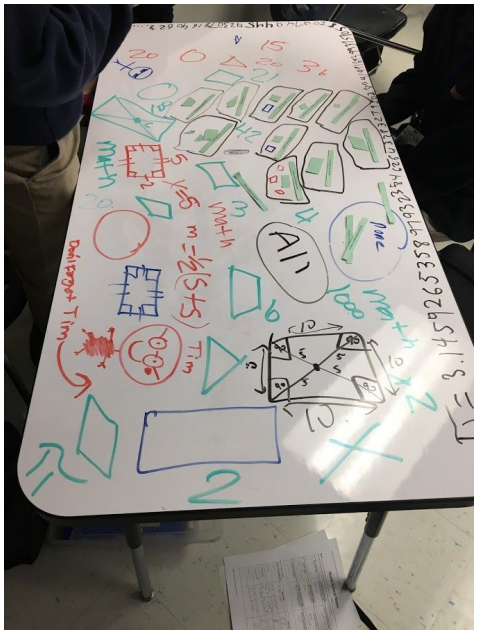
What similarities do the even degree functions share?

_____
_____
_____

What similarities do the odd degree functions share?

_____
_____
_____

Inquiry- Quadrilaterals



Step 1 Using the lines on a piece of graph paper as a guide, draw a pair of parallel lines that are at least 10 cm long and at least 6 cm apart. Using the parallel edges of your straightedge, make a parallelogram. Label your parallelogram *MATH*.

Step 2 Look at the opposite angles. Measure the angles of parallelogram *MATH*. Compare a pair of opposite angles using your protractor.

The opposite angles of a parallelogram are ??? .

Step 3 Two angles that share a common side in a polygon are consecutive angles. In parallelogram *MATH*, $\angle MAT$ and $\angle HTA$ are a pair of consecutive angles. The consecutive angles of a parallelogram are also related.

Inquiry- Parallel Lines and Proportional Parts

Parallel Proportional Inquiry Activity

You will be using the parallel lines on the floor to create parallel lines and proportional parts of triangles.

1. Using two pieces of floor tape, create the two sides of your triangle. (red)
2. Using two different colors of floor tape, go over any parallel lines inside of your triangle. (purple)
3. Collect AS MUCH data as possible from this diagram.
4. Using computer paper, recreate your diagram and look for any patterns in the triangles. Your goal is to identify any proportional characteristics (corresponding, congruent angles, proportional sides).

Inquiry- Parallel Lines and Proportional Parts

Inquiry- Volume and Surface Area

Portfolios

Digital

Non- Digital

Interactive Notebook Supplement

Portfolios

You will be graded on:

- **Organization (20pts.)** *Is the portfolio organized? Are the papers stapled together, paper clipped, placed in a folder or in a binder? Is this rubric included?*
- **Mandatory Included Materials (50pts.)** *There are certain materials that must be included in your portfolio. They are marked with an asterisk in your list of assignments. There should also be a minimum amount of assignments included.*
- **Completion of Included Materials (30pts.)** *Did you successfully complete all of the included activities and/or worksheets? Did you record all of your observations when asked to do so?*

The following activities may be included in your portfolio:

- Similar Right Triangles, Geometric Mean
- Pythagorean Theorem*
- Converse of the Pythagorean Theorem
- Discovering Trigonometry*
- Trigonometry Ratios (Chart)
- Trig Pile Up
- Inverse Trigonometry Exit Ticket
- Special Right Triangles
- Sparky and the Dude*
- Law of Sines (Completed #1-6)*
- Law of Cosines
- Dancing Vectors*

You must have **at least eight activities** in your portfolio. The assignments with an asterisk beside them are **required** for your portfolio.

This assignment is to be turned in before your Trigonometry Test Pt.2 on March 12, 2014.

Portfolios

Digital

Non- Digital

Interactive Notebook Supplement

“

If you’re going to fill your classroom with inquiry, problems, and projects, you have to change your assessments!

The 5 Standards of Authentic Instruction

- Higher-Order Thinking
- Depth of Knowledge
- Connectedness to the World
- Substantive Conversation
- Social Support for Student Achievement

- Newman & Wehlage

“

Why do major assessments eliminate the option for substantive conversation?

Test Day in my Classroom

How do I make this work?

Sample Rubric

Rubric:

Criteria	Points Received	Available Points
The dance has a minimum of four dance vectors.		20
Define Vector 1: Magnitude & Direction		5
Define Vector 2: Magnitude & Direction		5
Define Vector 3: Magnitude & Direction		5
Define Vector 4: Magnitude and Direction		5
Define Negative Vectors		8
The dance routine has a minimum of 15 vectors.		15
Creativity Points		10
Total		73

Sample Assessment Activity

The Tree and the Pendulum

1. Now that you have been introduced to the definitions of the trigonometric functions, it's time to look again at the situation described in *The Return of the Tree*.

   Here are the key facts again.

   - Woody was 12 feet from the tree.
   - Woody's line of sight to the top of the tree was at an angle of 70° up from horizontal.
   - Woody's eye was 5 feet off the ground.

   Describe how Woody could find the height of the tree using trigonometry and these measurements.

Interactive Mathematics Program

Sample Assessment Activity

SA, LA and Volume Application

Find an object in the room that represents this shape. Measure its lateral area, surface area and volume. Write the name of the object you measured below its polygon type.

Object	Lateral Area	Surface Area	Volume
Prism			
Sphere			
Cone			
Pyramid			
Cylinder			

Extended Writing Task

Max used the following equations to find x in $\triangle PQR$. Is Max correct? Explain.

$x = \sqrt{8 \cdot 2}$

$x = \sqrt{16}$

$x = 4$

To solve for x in a triangle, when would you use sin and when would you use sin^{-1}? Give an example for each type of situation.

Draw an obtuse triangle and label the vertices, the measures of two angles, and the length of one side. Explain how to solve the triangle.

Why?

Assessment[15]	Assessment Plans: • are consistently aligned with state content standards. • have clear appropriate measurement criteria. • measure student performance in more than three ways (e.g., in the form of a project, experiment, presentation, essay, short answer, or multiple choice test. • require extended written tasks. • are portfolio-based with clear illustrations of student progress toward state content standards. • include descriptions of how assessment results will be used to inform future instruction.	Assessment Plans: • are aligned with state content standards. • have clear measurement criteria. • measure student performance in more than two ways (e.g., in the form of a project, experiment, presentation, essay, short answer, or multiple choice test). • require written tasks. • include performance checks throughout the school year.	Assessment Plans: • are sometimes aligned with state content standards. • have measurement criteria. • measure student performance in more than one way (e.g., in the form of a project, experiment, presentation, essay, short answer, or multiple choice test). • require limited written tasks. • include performance checks but may not be monitored consistently.	Assessment Plans: • are rarely aligned with state content standards. • have ambiguous measurement criteria. • measure student performance in less than two ways (e.g., in the form of a project, experiment, presentation, essay, short answer, or multiple choice test). • include performance checks, although the purpose of these checks is not clear.

Debunking Excuses

- I'm afraid…
- I don't have time…
- Students will misbehave…
- Too much work…
- I'm not in control…
- I'm too type A…

Thanks!

Any questions?

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