Math connections to STEM Education
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May 21th, 2019

Missing Class Note

- OLS, Syllabus, & Assignments
- Synergy of NGS & CDSM with emphasis on Numbers & Operations, Measurement, & Statistics
- Authentic Data in the classroom
- "Poll questions #1" Describe the overall pattern, predict 2019. Which increments had the biggest wage change?
    - My answer: There is a big change and increase of wage from 1955 to 1965, as well as a big drop of wage from 1980 to 1990.
- Space math. https://spacemath.gsfc.nasa.gov/
    - Example: Graphing Quadratic functions: Vertical motion under gravity
- Algebra example: How does this compare to 2019?

Algebra Example: How does this compare to 2019?
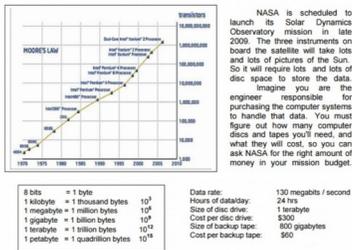
    - It talks about how data changing over time.
    - It helps students to make connection and prediction
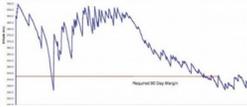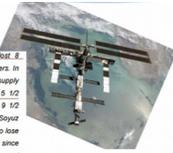- Middle school: equations & proportions with weight

Object	Location	G (m/sec²)	Weight (pounds)
Earth	Planet	9.8	110
Mercury	Planet	3.7	
Mars	Planet	3.7	
Io	Jupiter moon	1.8	
Moon	Earth moon	1.6	
Titan	Saturn moon	1.4	
Europa	Jupiter moon	1.3	
Pluto	Planet	0.58	
Charon	Pluto moon	0.28	
Vesta	Asteroid	0.22	
Enceladus	Saturn moon	0.11	
Miranda	Uranus moon	0.08	
Deimos	Mars moon	0.003	

W=Mg where W is weight in lbs, M is mass in kg
and g is gravity on surface
Find the weights given 1 kg=9 kg or 2.2 lbs

- Elementary Example: Numbers& Operations

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  - o Negative number
 - o Pulling data like this help students learn about decreasing.
  - o "Poll" question #2 what kind of problem could you create with data?
- Progression of fractions
  - o CCSS content standards addressed:
    - GD k-5 numbers & operation in based ten
    - GD3 Develop understanding of tractions as numbers
    - GD4 Extend understanding of fraction equivalence; units fractions, decimals
    - GD608 Understand & use ratios to solve real world problems
    - HS Geometry Ratio of Similitude
  - o NGSS addressed:
    - Motion & Stability: Forces and interactions
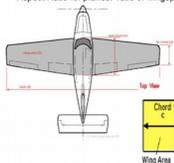   - Energy
- Multiple Representations
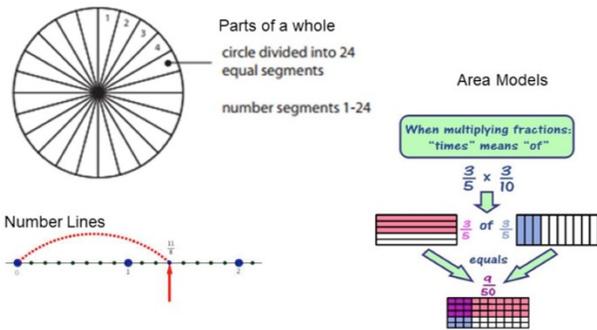
- Illumination (national council of teachers of mathematics)
  - o Fraction model
  - o The model really help them build understanding
- Ratios

- "Poll" questions #3
  - o Could the wright brothers have flown?

- From home plate to first base on a modern baseball field?
- From home plate to an outfield wall of a professional baseball stadium?
- From one goal line to the opposite goal line on an American football field?
- From one wing tip to another of a Boeing 747 jet?

"Baseball diamond" created with Inkscape.
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http://commons.wikimedia.org/wiki/
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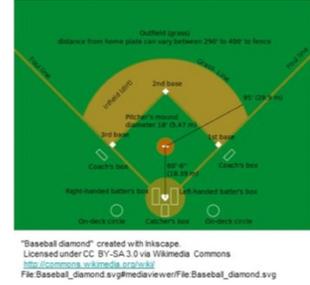
- Authentic DATA
  - How can you find it using technology? What resources are reputable? Share on our class wiki.
  - How can you collect your own?
- Recourse
  - My NASA data
    - The need for data literacy
  - Data www.gapminder/data
    - Bubbles
- Real world scale models to collect DATA
  - Gliders, planes, kites
  - Cars, trains, Legos, K'Nex
  - Rockets- air, water
- Considerations when using real data
  - The importance of preparation exercises
    - Use of technology, ability to analyze & read visuals
  - Anticipating challenges to students success
    - Scaffold experiences, class practice, pair/share, std demonstrations
  - Making time for the societal component
    - Climate change, see ice, see levels, populations, economy, temperature
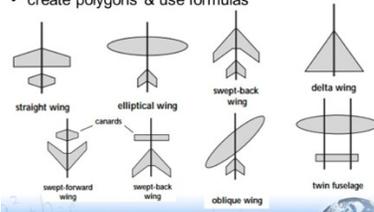- Ms/Hs example

MS/ HS Example

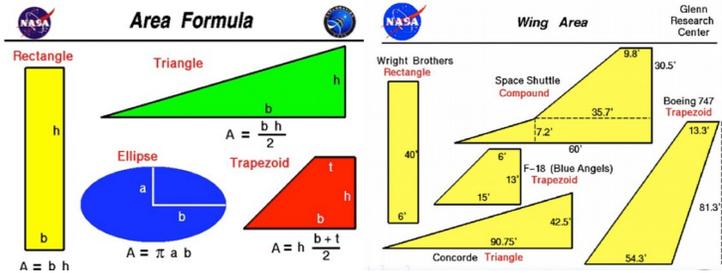- **CCSS Math Standards Addressed**
  Measurement & Data-
    Measure lengths in standard units
    Understand concepts of area & relate to multiplication

  Geometry-
    Reason with shapes and their attributes.
    Solve problems involving angle measure, area, & volume.
    Apply geometric methods to solve design problems.

- **NGS Standards Addressed**
  Science as Inquiry-
    Abilities necessary to do & understand about scientific inquiry

  Physical Science-
    Properties & changes in matter.

  Science and Technology–
    Abilities and understanding of science and technological design.

Calculate Wing Areas
- estimate irregular shapes with Pick's Theorem
- create polygons & use formulas

straight wing
elliptical wing
swept-back wing
delta wing
swept-forward wing
swept-back wing
canards
oblique wing
twin fuselage

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- Design challenge connected to DATA
  - o Time flights & measure distances traveled
  - o Average data per plane
    - Graph to find connection – does wing size matter?
  - o Create a better wing-
    - What other improvements would you make to your glider?
- Elementary/MS example

- Explore
  - o Predict how many times you can click a clothespin in 1 minute
  - o Test your initial hand strength, using your non-dominant hand for 1 min. Rest for 1 min & reset for 1 min & repeat for a total of three trials. Collect your data.
  - o Now for some conditioning! Repeat his activity above every other day for two weeks.

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Analyzing your Data

	Trial 1	2	3
Initial Test	82	80	70
Wk 1 M	83	83	75
W	85	84	75
F	85	84	77
Wk 2 M	86	85	78
W	89	86	78
F	90	88	80

Have the students write to EXPLAIN
what happened to their hand strength.
Why do you suppose it turned out this way?

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Explain & Evaluate

How did the muscle strength in your hand change over the conditioning period?
What type of graph is the most appropriate to visually demonstrate this?

How did the muscle stamina in your hand change over the conditioning period?
What type of graph is the most appropriate to visually demonstrate this?
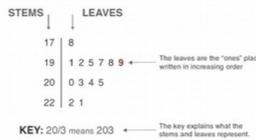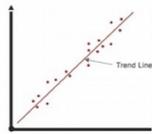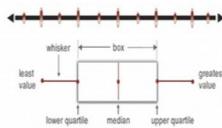
- Illuminations

  - Mean and median
  - Line of best fit
- Extend
  - Collect the last day's trail 1 data from all the students on one chart. Arrange the chart to have 1 column for girls and 1 column for boys
  - Based on the class data, which group had greater muscle strength? Verify your answer graphically.
  - What does that mean for our astronauts in space? What texts would you suggest for the Kelly twins?
- Application of DATA?
  - Given the ideas and examples that have been presented, and your own teaching goals and experiences how can you apply authentic data?
  - After reflecting for a moment, please use the chat to share something about where you are in your teaching, how you would move forward, and why this is a strong move. You can also enter questions for discussion.
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