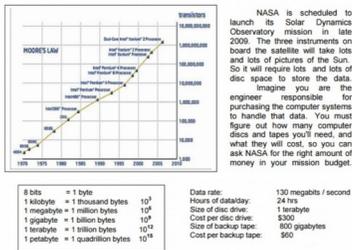


Missing Class Note

- 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

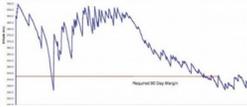
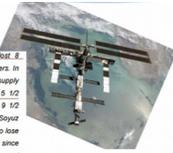
| Object | Location | G (m/sec ²) | Weight (pounds) |
|-----------|--------------|-------------------------|-----------------|
| Earth | Planet | 9.8 | 110 |
| Mercury | Planet | 3.7 | |
| Mars | Planet | 3.7 | |
| Io | Jupiter moon | 1.8 | |
| Moon | Earth moon | 1.6 | |
| Titan | Saturn moon | 1.4 | |
| 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

**Elementary Example:
Numbers & Operations**

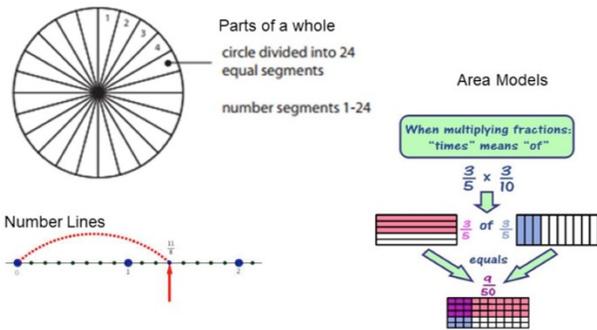
"In January, the altitude was 340 kilometers. By March it had lost 8 kilometers before the Progress-59 supply ship raised its altitude by 5 kilometers. In May, the ISS lost 4.12 kilometers and was re-boosted by the Progress-60 supply ship by 5 1/2 kilometers. Again the ISS continued to lose altitude by 5 1/2 kilometers by July when the Progress-61 supply ship raised its orbit by 9 1/2 kilometers. The ISS altitude then fell by 3 kilometers by October when the Soyuz TMA-11 mission re-boosted the station by 5 kilometers. The ISS continued to lose altitude until late December, 2007 when it had lost a total of 8 1/2 kilometers since its last re-boost by Soyuz. Since December 2007, the total of all the declines and re-boosts added up to a net change of + 11 1/2 kilometers by April 2009."



"POLL" QUESTION #2
What kind of problem could you create with this data?

- - Negative number
 - Pulling data like this help students learn about decreasing.
 - "Poll" question #2 what kind of problem could you create with data?
- Progression of fractions
 - CCSS content standards addressed:
 - GD k-5 numbers & operation in based ten
 - GD3 Develop understanding of fractions 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
 - NGSS addressed:
 - Motion & Stability: Forces and interactions
 - Energy
- Multiple Representations

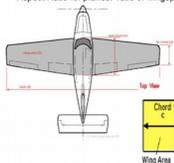
Multiple Representations.....



- Illumination (national council of teachers of mathematics)
 - Fraction model
 - The model really help them build understanding
- Ratios

Ratios

Aspect Ratio for planes: ratio of wingspan to its wing chord or width



$$\text{Aspect Ratio} = \frac{\text{Span}}{\text{Chord}} = \frac{a^2}{bc} = \frac{a}{c}$$

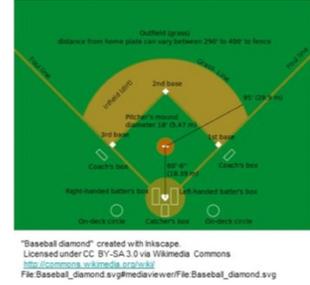


Rates

Your car can easily go 60 mph on a highway & jet airliner can cruise at 600mph. What is the rate of travel for the Wright Brother's first flight if they flew 120 ft in 12 sec?
Run 120 feet & clock your time. Find the average for the group or class. What is your unit rate? How does this compare to the Wright Brother's flight?

- "Poll" questions #3
 - 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?



- 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.com/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, sea level rise, populations, economy, temperature

• Ms/Hs example

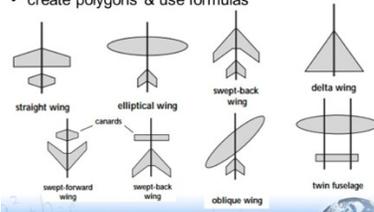
MS/ HS Example

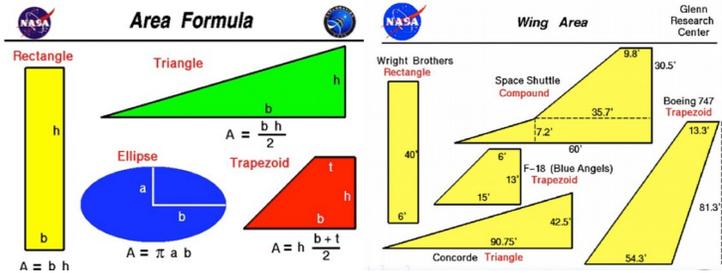
- **CCSS Math Standards Addressed**
Measurement & Data-
Measure lengths in standard units
Understand concepts of area & relate to multiplication
- Geometry-
Reason with shapes and their attributes.
Solve problems involving angle measure, area, & volume.
Apply geometric methods to solve design problems.
- **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





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

Progression of Statistics

CCSS Content Standards Addressed:

K-5 Numbers & Operations
Measurement & Data

GD6 Develop understanding of statistical variability.
* Understand data can be described by its center, spread, and overall shape.
* Display data in plots on a number line, dot plots, histograms, and box plots.

GD7 Use random sampling to draw inferences about a population.
Use measures of center and variability for two data sets,
Design & use simulations to make predictions

GD8 Construct & interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities.
Use equations for linear models to interpret data

NGSS Addressed:

Science as Inquiry
Life Science
Personal Health



Engage

- How strong are you?
- Do you think this is inherited?
Can we change your strength aptitude?
- Does this differ for girls & boys? How does this differ in space?

Elementary/MS Example



Stress on Your Body

- **ENGAGE** class discussion
Good stress vs. bad
- NASA Twins research- Kelly brothers
check out NASA ScienceCasts: Separated at Launch
- Discuss how physical stress
can have an effect on muscles & bone over time



- Explore
 - Predict how many times you can click a clothespin in 1 minute
 - 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.
 - Now for some conditioning! Repeat his activity above every other day for two weeks.

Analyzing your Data

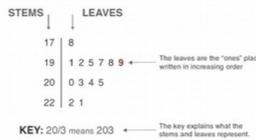
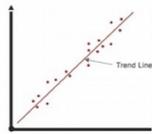
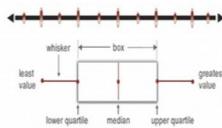
| | Trial 1 | 2 | 3 |
|--------------|---------|----|----|
| Initial Test | 82 | 80 | 70 |
| Wk 1 | M | 83 | 75 |
| | W | 85 | 75 |
| | F | 85 | 77 |
| Wk 2 | M | 86 | 78 |
| | W | 89 | 78 |
| | F | 90 | 80 |

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

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.