MassMate General Outline: May 25th at Bridgewater

Introduce ourselves and emphasize that we are giving a TEACHER perspective, we are not experts

COOPER: Present the Kendall PP for an overview of Common Core

FORGER: Go into how to read the document

FORGER: Present Alg 1

COOPER: Present Geo

FORGER: Present Alg 2

COOPER: Present Stat standards

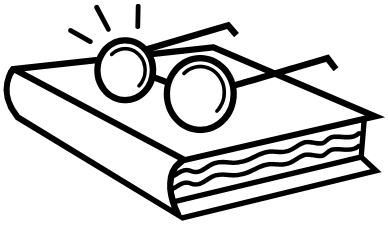
If we have time:

Have them highlight in their copies what they see as different from what they currently do (just as we did)

Present how we have created our alg 1, geo, and alg 2 courses to adhere to CC(from what Coop typed up on the last PD day)

How to read the new Common Core:

- There are 6 conceptual categories that span the grades
    - Numbers and Quantity
    - Algebra
    - Functions
    - Geometry
    - Statistics and Probability
    - Modeling
- There are 3 model courses offered as a traditional pathway, Algebra 1, Algebra 2, and Geometry with Statistics and Probability integrated in each course
- There is also an integrated approach included, Math I, Math II, Math III which has Algebra 1, Algebra 2, Geometry, and Statistics and Probability in each course
- Each model course has specific critical areas that are explained to focus what the students will be able to do at the end of that course
- The new common core standards are more advanced and rigorous than the previous standards
- There are no grade levels, it is based on conceptual categories
- They do not list a sequence of courses, but rather what students should be able to do at the end of each concept (Algebra 1, Algebra 2 and Geometry)
- At the end of these concepts, students will be ready for advanced courses, such as pre-calculus
- The standards are written with a focus of "college readiness"
- There is then a shortened version of the course overview, with standards for practice
- After the overview, the conceptual categories are listed with the standards that relate to them for each course
- The standards are listed and categorized by this format: (following page 100)
    - Concept (Algebra)
        - Domain (Seeing Structure in Expressions)
            - Cluster (Write expressions in equivalent forms to solve problems)
                - Standard (Choose and produce an equivalent form of an expression…)
- Basically, the concepts are organized according to Big Ideas down to Details
- Each Conceptual Category and Domain are coded
    - A.SSE represents Algebra: Seeing Structure in Expressions
- There are additional standards that MA has included, noted with "MA"
- A "+" indicates an advanced level topic
- A (*) indicates a modeling standard (which is a new conceptual category from the former MA standards)



Algebra 1 Clusters: As standards for 9-12 and not as a single course

Introduce properties of exponents to rational exponents

Use properties of rational and irrational numbers

Reason quantitatively and use units to solve problems

Interpret structure of expressions- terms, factors, etc

Write expressions in equivalent forms to solve problems

Perform arithmetic operations on polynomials

Create equations that describe numbers or relationships

Understand solving equations as a process of reasoning and explain

Solve equations and inequalities in one variable

Solve systems of equations

Represent and solve equations and inequalities graphically

Understand concept of function and use notation

Interpret functions that arise in applications in context

Analyze functions using different representations

Build a function that models a relationship, using series and sequences

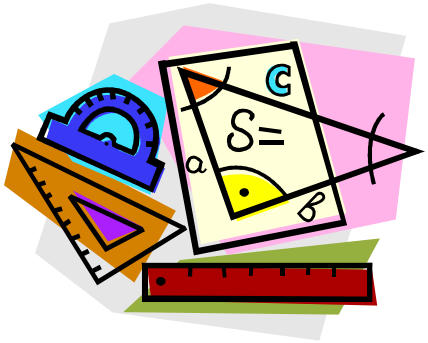
Build new functions from existing functions

Construct and compare linear, quadratic, and exponential models and solve problems

Summarize and interpret data in one variable- plots, central tendency, shape, center, spread as well as normal approximations

Summarize and interpret data in two variables- tables, scatterplots, trends

Interpret linear models



Comparisons in geometry!

GEOMETRY – a first look

Finding perimeter, area, surface area, and volume in the Common Core

- MA Standards under measurement in 8th and 10th grade standards

Common Core: **Geometric Measurement and Dimension** code: **G.GMD**

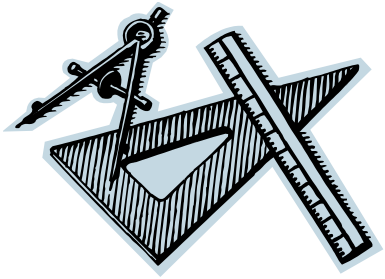
- EXPLAIN the volume formulas
- 3. Use volume formulas[1] for cylinders, pyramids, cones, and spheres to solve problems.★
- Much more application or analysis of how these formulas come about and understanding of why we use them.

Specific Differences that we don't cover in our at level College geometry students:

- Number sense (N.Q.3.MA3a) – significant figures.
- Geometry Congruence
    - Coordinate plane transformation (specifically comparing translations verses horizontal stretches)
    - Coordinate plane translations, reflections, and rotations of polygons
    - Constructions of these movements with pen and paper and/or software.
    - Actually writing proofs for lines and angles (vertical angles, parallel lines and angles, perpendicular bisectors, angle bisectors)
    - Actually constructing proofs for triangles (angle sum, congruence, midsegment)
    - Actually constructing proofs for parallelograms and special parallelograms
    - Formal geometric constructions with compass and ruler and/or geometric software
    - Similarity, Right triangle, and Trigonometry
        - Properties of dilation given by a center and a scale factor
        - Constructing proofs for two figures being similar.
        - Prove theorems about triangle and the sides being cut by parallel lines.
        - In advanced courses using and proving the law of sine's and law of cosine's
        - Using trigonometry to find area of triangles that aren't right triangles (doesn't specify with or without Hero's formula)
- Circles
    - Describing the relationship between radii, chords, angles, right angles inside the circle

[1] Note: MA 2011 grade 8 requires that students know volume formulas for cylinders, cones and spheres.

    - Properties of inscribed quadrilaterals.
    - Construct tangent lines to circles.
    - Use radians to find arc length and sector area.
- Expressing Geometric properties and Equations
    - Translating between the geometric description and equation of CONIC SECTIONS!!
        - Derive the equation for graphing a circle with Pythagorean Theorem
        - Derive Equation of parabolas using Focus and Directrix!
    - Coordinate plane Geometry
        - Using properties that apply to the coordinate plane, prove points on the plane are special triangles, parallelograms, specific polygons, by using algebra and geometry properties
    - Measurement and Dimension
        - Using Cavalieri's and informal limit arguments for circumference, area of circles, volume of cylinders, pyramids, cones, and spheres.
        - Identify two dimensional cross sections of three dimensional figures and creating of three dimensional objects by two dimensional rotations.

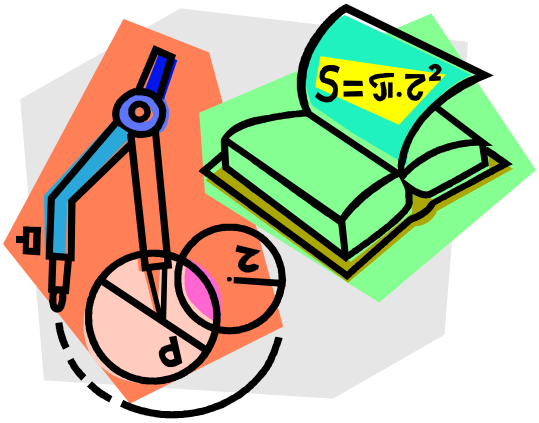


IN OUR ADVANCED LEVEL the list decreases dramatically

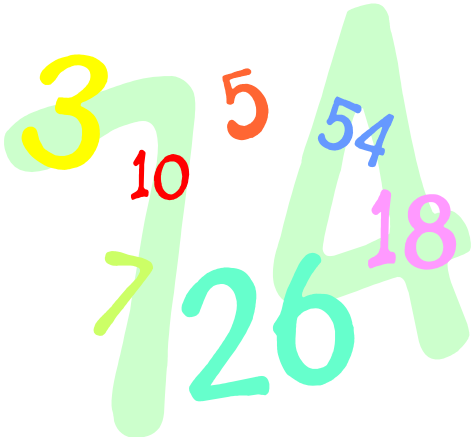
- Geometric Congruence
    - Formal geometric constructions with compass and ruler and/or geometric software
    - (mostly because we run out of time)
- Similarity, Right Triangle, Trigonometry
    - Properties of dilation given by a center and a scale factor; specifically this one
    - 1. Verify experimentally the properties of dilations given by a center and a scale factor:
        - a. A dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged.
        - b. The dilation of a line segment is longer or shorter in the ratio given by the scale factor.
    - The Trigonometry stuff in the geometry standards is currently in our algebra 2 and pre-calculus curriculum
        - 7. Explain and use the relationship between the sine and cosine of complementary angles.
        - 8. Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.
        - **Apply trigonometry to general triangles.**

- 9. (+) Derive the formula $A = (1/2)ab\sin(C)$ for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side.
- 10. (+) Prove the Laws of Sines and Cosines and use them to solve problems.
- 11. (+) Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces).

- This is something that is in our current Honors Pre-Calculus Course 4th quarter
  - **Translate between the geometric description and the equation for a conic section.**
  - 1. Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.
  - 2. Derive the equation of a parabola given a focus and a directrix.
- Again, the Cavelieri's properties
  - **Explain volume formulas and use them to solve problems.**
  - 1. Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. *Use dissection arguments, Cavalieri's principle, and informal limit arguments.*
  - 2. (+) Give an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures.
  - 3. Use volume formulas[2] for cylinders, pyramids, cones, and spheres to solve problems.★
  - **Visualize relationships between two-dimensional and three-dimensional objects.**
  - 4. Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.



[2] Note: MA 2011 grade 8 requires that students know volume formulas for cylinders, cones and spheres.



Algebra 2 Clusters: As standards for 9-12 and not as a single course

Master properties of exponents and rational exponents

Perform arithmetic operations with complex numbers

Use complex numbers in poly identities and equations

Represent and model with vectors

Perform operations on matrices and use in applications

Review: Interpret structure of expressions

Review: Write expressions in equivalent forms to solve problems- derive formula for series and explain mortgages

Review: Perform arithmetic operations on polynomials

Understand relationship between zeros and factors of polynomials

Use polynomial identities to solve problems

Rewrite rational expressions

Review: Create equations that describe numbers or relationships

Review: Understand solving equations as a process of reasoning and explain AND solve rational and radical equations in one variable with extraneous solutions

Review: Represent and solve equations and inequalities graphically

Review: Interpret functions that arise in applications in context

Review: Analyze functions using different representations

Review: Build a function that models a relationship, no series and sequences

Review: Build new functions from existing functions

Some review: Construct and compare exponential models and solve problems- different than algebra 1 because no linear or quadratic

Extend domain of trig functions using unit circle

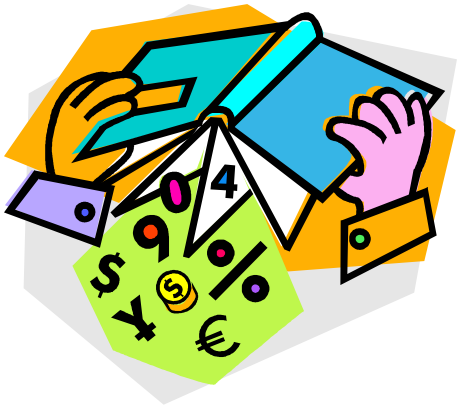
Model periodic phenomena with trig functions

Prove and apply trig identities

Review: Normal distribution- calculate and interpret using calculators and spreadsheets

Understand random processes with experiments

Make inferences and justify conclusions from samples and experiments



NOTE:

VERY important to read the footnotes: If the topic is in Algebra 1 and 2, there is either overlap or Algebra 2 is picking up where Algebra 1 left off.

This means that they may need total review… hence why putting Algebra 1 and Algebra 2 years after each other is helpful- less review.

Also, it seems that Algebra 1 actually covers more material than Algebra 2 does.

Algebra 2 covers matrices, complex numbers, trig, and goes deeper with stats.

Maybe lower levels actually do Algebra 1 and Algebra 2 in 3 years. Big question: Do the students have to cover each math subject in one year? Doesn't sound like it.

The Statistics covered in Algebra 1 and Algebra 2 topics are extensive- basically a half year statistics course… will be difficult to cover in the algebra courses

Not as much emphasis on technology as old MA standards had

Shows us how to incorporate teaching principles with learning standards- instead of being separate in MA standards, they are together in CC

More topics covered… algebra 1 and algebra 2 instead of algebra 1, algebra 2, and pre calculus

Probability and Statistics - similarities and differences between MASSACHUSSETES and CC

Current Standards in Massachusetts for Probability and Statistics

- 7th graders start looking at probability
- Graphical analysis and constructions of displays is between 8th and 10th grades integrated with algebra and geometry.
- Algebra 1 standards include analysis of shape, center, and spread of a distribution.

Grade 11 and 12 Massachusetts Standards

- Counting techniques
- Modeling a scatter plot with a least squares regression line.

Transition to the Common Core: Statistics and Probability: S.ID

- Algebra 1: creating, analyzing, and interpreting scatter plots using slope, and analyzing correlation as well as association.
- "Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve." S.ID.4
- Algebra 2: includes conditional probability formulas and compound events
- Make inferences and justify conclusions from sample surveys, experiments and observational studies. S.IC 1-6