

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 formulas¹ 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
 - 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!!

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

- 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.
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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 Cavalieri'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 formulas² 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.