Objective 4.5 – Objects in the real world can be modeled using geometric concepts

Essential Question 1 – How are mathematical objects different from the physical objects they model?

Tier 1 – Focus

Describe the differences between 2-d and 3-d objects (drawings versus models / sculptures)

* Objects built in 2-d space cannot have depth whereas objects built in 3-d space *have to*.

* Can students recognize the difficulty in representing a 2-d object in 3-d space?

Given a mathematical object determine the greatest possible error of the object if it were a physical object

Given a physical object with a specific margin of error determine the greatest possible area and least possible area. How does this differ from a mathematical object's area of the same dimensions?

Tier 2 – Coherence

How does a concept like greatest possible error help to illustrate the differences between physical objects and mathematical objects?

How do the differences between a mathematical object and a physical object mirror the differences between a theoretical yield and experimental yield in a chemical reaction?

How do the differences between a mathematical object and a physical object mirror the differences between an event and a written recording of the event?

Tier 3 – Rigor

Why are concepts like margin of error and greatest possible error integral to construction and planning?

What margins of error would be acceptable for a mathematical drawing

* When going from a blue print to a finished product what margin of error is acceptable for an object of given dimensions?

Show students the flatlander excerpt from Carl Sagan's Cosmos (http://www.youtube.com/watch?v=UnURElCzGc0) which explains the difference between the 3rd and 4th dimensions by illustrating the known difference between the 2nd and 3rd dimensions. Ask students to envision what it would be like to be a flatlander and how that would alter their perceptions.

* This asks students to envision the differences between 2- and 3-dimensional objects. More advanced students can be asked to envision what it be like to encounter a 4th dimension of space.

Essential Question 2 – What makes a good geometric model of a physical object or situation?

Tier 1 – Focus

Given a geometric object and the desired final dimensions determine how to alter the geometric object such that it meets the criteria.

Given a physical object determine how to use geometric objects to recreate the physical object

Determine criteria for determining whether a geometric model would be a good fit for a physical object.

Tier 2 – Coherence

What other disciplines rely on modeling in order to represent physical objects? How do they go about representing them?

* disciplines such as chemistry rely on modeling to determine what should happen in a chemical reaction.

What other math disciplines can use models to represent physical objects?

* parabolas can be used to approximate the suspension cable on a suspension bridge

How would margin or error and greatest possible error be used when creating a physical object from a geometric model?

Tier 3 - Rigor

What qualities should a geometric object have when modeling a physical object?

How would an architect rely on the relationship between geometric and physical objects when creating a blue print?

Why do we represent physical objects as geometric models during design?

Essential Question 3 – Taken from 4.2

Assessment tier 1: (Focus)

What are the properties of triangles and how can similarity principle be used to find unknown parts of triangles.

- Draw and label parts of triangles.
- Use Pythogorean Theorem to find missing angles and sides of right triangles.
- Use scale factors and similarity concepts to find unknown parts of triangles.
- Use models and scale factors to determine the actual size of figures.
- Describe the difference between similarity and congruence.

Assessment tier 2: (Coherence)

Discuss the similarities and difference on given similar triangles.

- Why do health experts use a triangle to show the number of servings needed in one day?
- How many chemical bond models form triangles?
- Why is the triangle used to modeling many cooperative concepts?
- How does the concept of the triangle apply to athletics, such as football, basketall, wrestling, etc.

Assessment tier 3: (Rigor)

Use similar triangles to solve ratio problems in the real world.

- Look at the design of different bridges and describe how and why similar triangles have been used?

- Describe how triangulation is used in navigation?
- Describe how triangulation is used in counseling family members?
- Analyze how triangles have been used in different art design.

Essential Question 4 – How do you apply geometric principles and objects to real-world design and construction?

Tier 1 – Focus

There is no tier 1 as this question specifically asks for tier 3 (applying conceptual understanding and applying to real-world events)

Tier 2 - Coherence

There is no tier 2 as this question specifically asks for tier 3 (applying conceptual understanding and applying to real-world events)

Tier 3 – Rigor

How can 2-dimensional objects be used in 3-dimensional drafting and construction?
What does an architect have to keep in mind when utilizing geometric objects during drafting?
What objects or design methods can create aesthetically pleasing finished products?
Have students analyze art focused on buildings. What aspects of the buildings are emphasized in the art and how are those aspects able to be represented using geometric objects or principles?

Essential Question 5 – How does understanding the properties of geometric objects aid construction and design?

Tier 1 – Focus

There is no tier 1 as this question specifically asks for tier 3 (applying conceptual understanding and applying to real-world events)

Tier 2 – Coherence

There is no tier 2 as this question specifically asks for tier 3 (applying conceptual understanding and applying to real-world events)

Tier 3 – Rigor

How do the principles of volume and surface area interact when designing buildings or packaging? How does this interaction effect the design process?

* How can an architect use properties of geometric objects to minimize the cost of materials when designing a building?

How can the properties of geometric objects help an architect when designing an irregular skyscraper?

* Much of design revolves around not only creating something that is structurally sound but also aesthetically pleasing. A simple prism is capable but not interesting.

Historically, how has the idea “form follows function” effected construction methods and how can this concept be applied to the construction of buildings that depend upon irregular shapes?

Previous architectural styles such as the undulating lines and whiplash motif in Art Nouveau sought to put a more elaborate touch on facades and designs. How can this be represented with geometric objects?