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FOR MATHEMATICS

High School Geometry with Technology Tools

Your host

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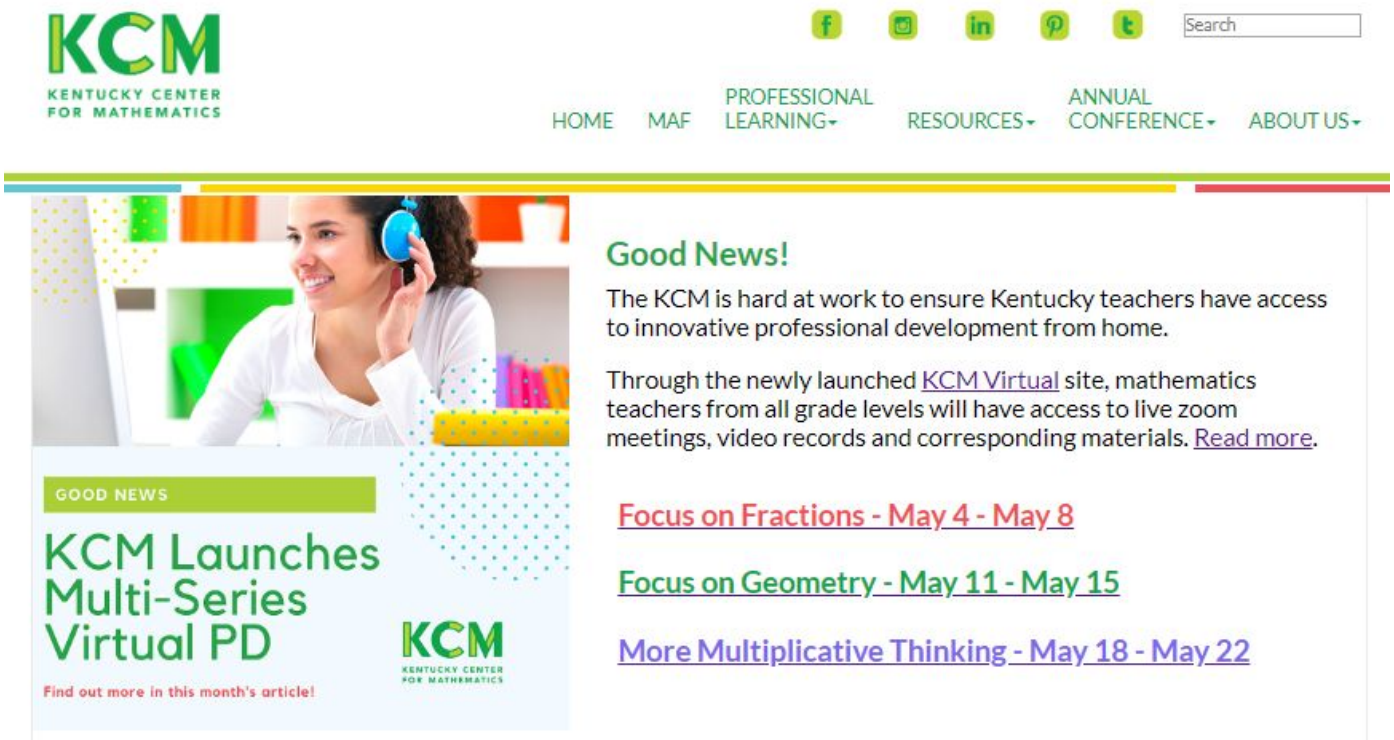

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Today's Session

Research: Van Hiele Model

Standard

Task: Shipping Packages

- ➔ Geogebra
- ➔ Sketchup

Virtual Resources for Geometry

Next Week: More Multiplication Thinking

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Van Hiele Levels of Geometric Thinking

Level 0 (Visualization). The student reasons about basic geometric concepts.

Level 1 (Analysis). The student reasons about geometric concepts by means of an informal analysis of component parts and attributes.

Level 2 (Abstraction). The student logically orders the properties of concepts and forms abstract definitions.

Level 3 (Deduction). The student reasons formally within the context of a mathematical system, complete with undefined terms, axioms, an underlying logical system, definitions, and theorems.

Level 4 (Rigor). The student can compare systems based on different axioms and can study various geometries in the absence of concrete models.

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Research

Level 3

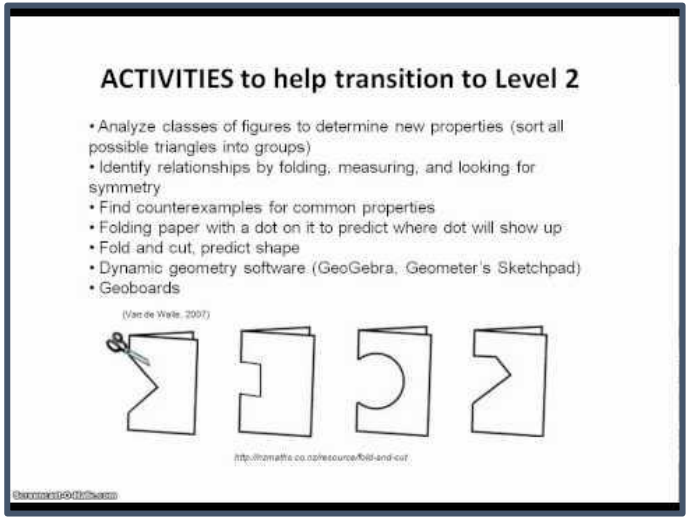
1. Clarification of ambiguous questions and rephrasing of problem tasks into precise language.

2. Frequent conjecturing and attempts to verify conjectures deductively.

3. Reliance on proof as the *final* authority in deciding the truth of a mathematical proposition.

4. Understanding of the roles of the components in a mathematical discourse, such as axioms, definitions, theorems, proof.

5. Implicit acceptance of the postulates of Euclidean geometry.



Burger, W. F., & Shaughnessy, J. M. (1986). Characterizing the van Hiele levels of development in geometry. Journal for research in mathematics education, 31-48.

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Standards

Geometry-Modeling with Geometry	
Standards for Mathematical Practice	
MP.1. Make sense of problems and persevere in solving them. MP.2. Reason abstractly and quantitatively. MP.3. Construct viable arguments and critique the reasoning of others. MP.4. Model with mathematics.	MP.5. Use appropriate tools strategically. MP.6. Attend to precision. MP.7. Look for and make use of structure. MP.8. Look for and express regularity in repeated reasoning.
Cluster: Apply geometric concepts in modeling situations.	
Standards	**Clarification/Illustration**
KY.HS.G.29 Use geometric shapes, their measures and their properties to describe objects in real world settings. **MP.1, MP.4**	Students use geometric shapes to model objects, for example, modeling a tree trunk or a human torso as a cylinder).★
KY.HS.G.30 Apply concepts of density based on area and volume in modeling situations, using appropriate units of measurement. **MP.4, MP.6**	Students explore scenarios where they find the area of regions and the volume of solid figures. In the process, they appropriately use units of measurement, for example, persons per square mile, BTUs per cubic foot
KY.HS.G.31 Apply geometric methods to solve design problems. ★ **MP.1, MP.4**	Students practice modeling techniques in this standard using a variety of strategies and practices, for example, designing an object or structure to satisfy physical constraints or minimize cost, working with typographic grid systems based on ratios
Attending to the Standards for Mathematical Practice	
Students recognize various situations for which geometric knowledge would apply and do so to solve real-world problems (**MP.4**). As students use geometric methods to solve design problems, they continually reflect on whether their method and process makes sense for the problem and revise, as needed, until a viable solution has been found (**MP.1**). Students also select appropriate theorems and formulas and report units with appropriate accuracy (**MP.6**).	

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Task: Shipping Packages

What would students need to know about rectangular prisms to respond to this tasks?

You design boxes for the "Peculiar Package Company." This company prides itself on creating boxes in unique shapes. However, it also makes standard rectangular prism-shaped boxes.

The postal service has recently adopted a policy of only shipping packages that meet certain size requirements. The new regulations state, "The maximum combined length and girth is not to exceed 100 inches."

Your new assignment is to design a package in the shape of a rectangular prism with a square base and the largest possible volume. It must also meet the postal service requirement.

What are the dimensions of the package? Give your answer in its exact form - no decimal approximations, please.

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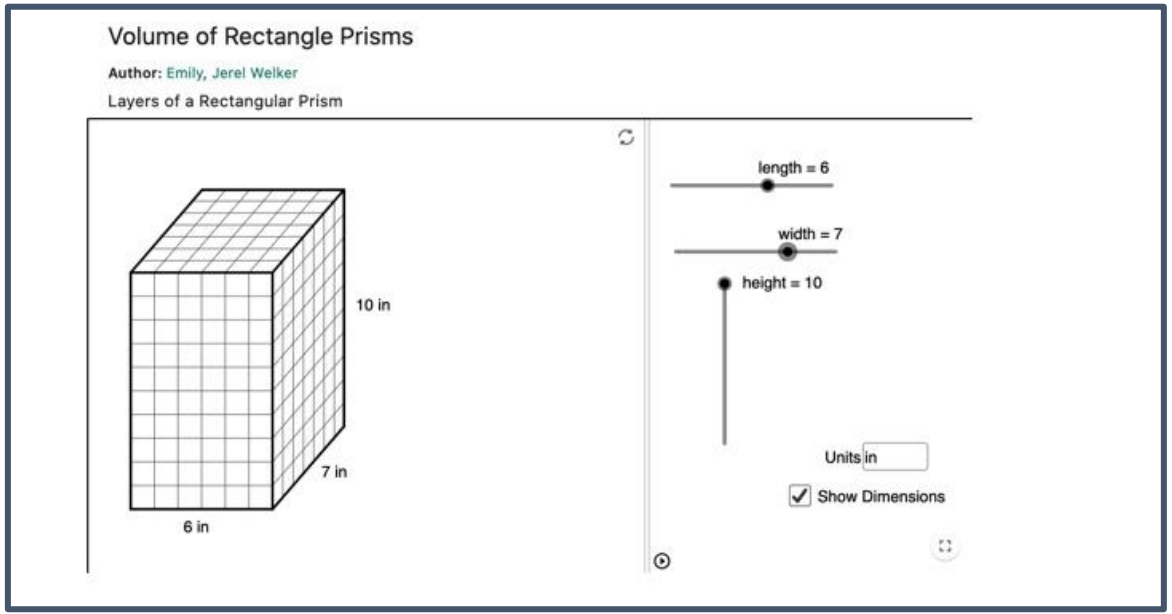
Explorations with Rectangular Prisms

GeoGebra



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Guess and Check

	Height *h*	Width *w*	Girth *2h+2w*	Length of Box *L*	Volume *h*w*L*
Package A	15	15	60	20	4500
Package B	16	16	64	30	7680
Package C	17	17	68	32	9248
Package D	18	18	72	28	9072

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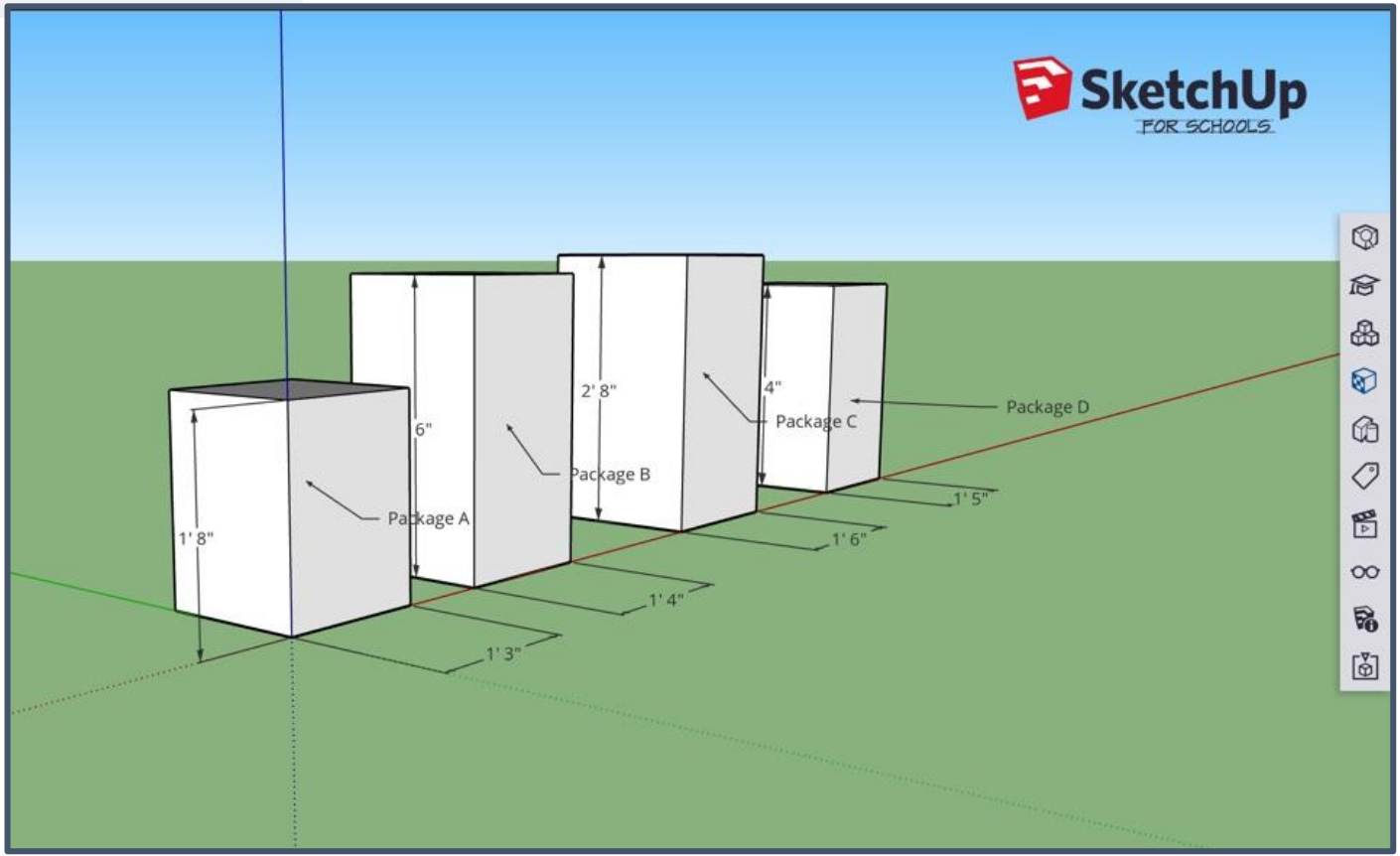
https://edu.sketchup.com/app



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Shipping Packages

Did you know that girth meant the length all the way around the package, a.k.a. the perimeter of a cross section?

Did you remember that the combined length and girth can't exceed 100?

Did you draw a picture?

Did you remember that the base of the box has to be square?

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Virtual Resources for Geometry

Geogebra

Phet Interactive Simulations

Desmos

Didax Math Virtual Manipulatives

SketchUp for Schools

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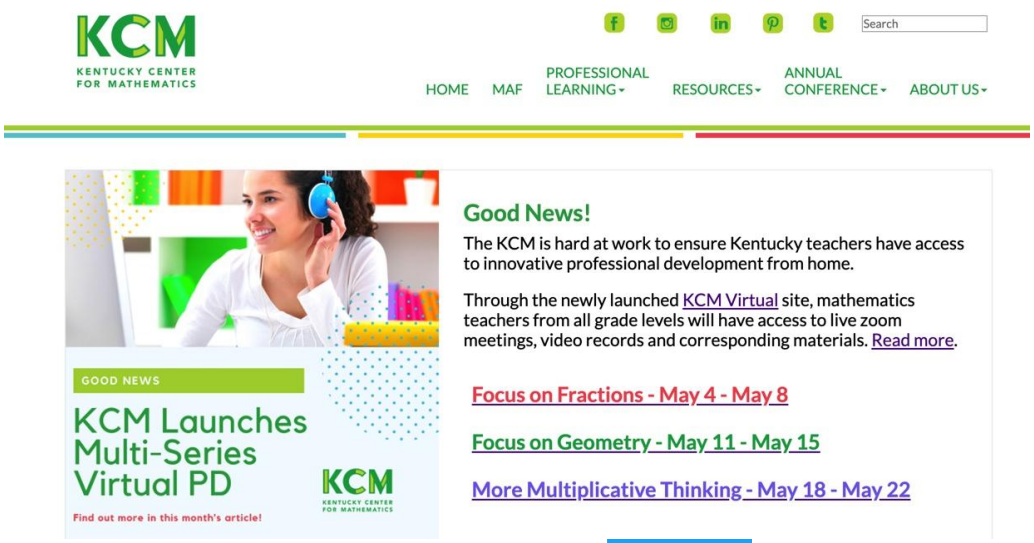

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KCM Support for Educators

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