

■ **Problem Solving**

Problem Solving

The process of applying a variety of appropriate strategies based on information provided, referenced, recalled, or developed. Students require frequent opportunities to formulate, grapple with, & solve complex problems that involve a significant amount of effort.

"What we have to learn to do, we learn by doing."

Aristotle
384 – 322 BC

Problem Solving Strategies

- Draw a Diagram
- Guess & Check
- Look for a Pattern
- Make a Table
- Solve a Simpler Problem
- Use Logical Reasoning
- Work Backwards

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■ **Reasoning and Proof**

Reasoning & Proof

Making and investigating mathematical conjectures. Developing arguments and proofs. Students who reason and think analytically tend to note patterns, structure, or regularities in both real-world and mathematical situations.

The Kepler conjecture
 First proposed by Johannes Kepler in 1611, it states that the most efficient way to stack cannonballs or equal-sized spheres is in a pyramid. A University of Pittsburgh mathematician has proven the 400-year-old conjecture.



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Types of Proof

- Direct Proofs
- Proof by Exhaustion
- Contrapositive
- Proof by Contradiction
- If and Only If Proofs
- Proof by Construction



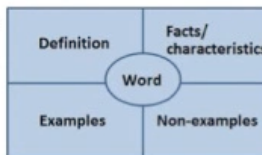
■ Communication

Communications

Organizing mathematical thinking coherently and clearly to peers, teachers and others. Using the language of math to express mathematical ideas precisely.

Communicating Mathematics

- Organize and consolidate your mathematical thinking through communication;
- Communicate your mathematical thinking coherently and clearly to peers, teachers, and others;
- Analyze and evaluate the mathematical thinking and strategies of others;
- Use the language of mathematics to express mathematical ideas precisely

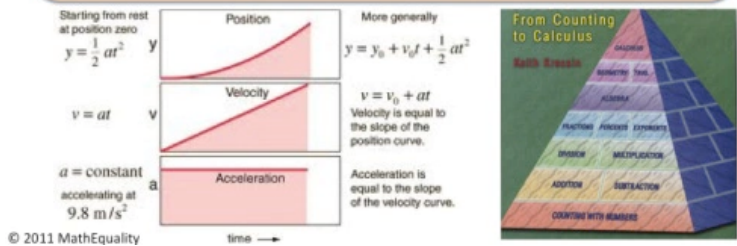


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■ Connections

Connections

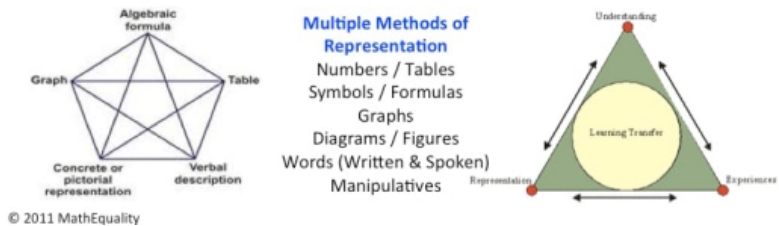
Recognizing and using connections among math ideas as well as with other subjects such as the physical sciences, engineering, social sciences & business. Understanding how mathematical ideas interconnect and build on one another to produce a coherent whole.



■ **Representations**

Representations

Creating and using multiple representations to organize, record, and communicate mathematical ideas. Using models and interpreting mathematical phenomena to significantly expand the capacity to model and interpret physical, social, and mathematical phenomena.



NCTM Process Standards Task

Instructions for my students for this task follow.

- **NCTM Process Standards** (250-500 words)
 - In your own words, explain each of the NCTM’s process standards for mathematics.
 - How familiar are you with each of the process standards?
 - Which of the process standards have you applied / used in prior math classes?
 - Which of these did you find easiest to use? Why?
 - Which of these did you find hardest to use? Why?