

# A Winning Formula for Math Literacy

*What really matters?*

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# What are the Core Principles of Math Literacy?

1. **Students are actively engaged in reading and writing to construct knowledge.**

Learning is not a passive experience. The meaning of a text is not contained in the words, symbols or diagrams on a page. The reader constructs it, often by writing. Our goal is to have students draw on their prior knowledge, connect what they know to new ideas and concepts, meaningfully synthesize information, and develop key understandings that are central to learning and applying mathematical concepts.

# Active Reading

- ▶ Before/During/After
- ▶ Marking and Annotating
- ▶ Collaborating
- ▶ Summarizing, Questioning, and Reflecting
- ▶ Notemaking

# Writing to Learn

- ▶ Collins Type One
- ▶ Collins Type Two
- ▶ Collins Type Three

# What are the Core Principles of Math Literacy?

## 2 . Content teachers use varied resources.

Teachers can enhance content learning by using a wide variety of materials in addition to textbooks. For example, they can introduce journals, newspapers, primary sources, and graphics. Teachers and students should always be looking for authentic connections and applications of content and concepts. Access to the Internet in schools has opened the door to finding information in text, video, graphics, and audio formats.

# Authentic and Accessible

- ▶ Why?
- ▶ Relevance
- ▶ Purposeful

# What are the Core Principles of Math Literacy?

## 3. Literacy is a social experience.

Reading and writing are not isolated acts, but rather social ones. Reading as a meaning-making process relies on students working together. Teachers can facilitate discussions in which students collaborate to form joint interpretations of what they read. This shared reading helps them gain a deeper understanding of the processes and strategies involved in comprehension. Writing benefits from collaborative brainstorming, sharing of drafts, and discussions of text where the author receives feedback.

# Collaboration is Key

- Pairs
- Quads
- Short bursts
- Visible & Accountable
- Avoid extremes
- Familiarity
- Teacher proximity
- Individual accountability

# What are the Core Principles of Math Literacy?

4. Teachers should guide students to read, write and talk "as if they are in the field."

The core principle here is that students should read math materials as if they are mathematicians. They should talk like mathematicians. They should write like mathematicians. The importance of learning the language and vocabulary of math is inherent in understanding concepts. The “foreign language” that math represents requires applying language acquisition strategies regularly – immersion is critical and the theories of available, visible, and visual vocabulary is the foundation.

# Language Immersion

- Word Walls
- Speaking and Writing
- Families and connections
- Building to applications

# Teaching Math Literacy for the Real World

- How many problems in the real world (worth solving) are easy? Why?

# Typical Example

- **A parabolic arch has a span of 120 feet and a maximum height of 25 feet. Find the equation of the parabola.**

# Typical Solution

- The equation of the parabola with vertex  $(h,k)$  is  $y = a(x-h)^2 + k$

- So the equation of the parabola with vertex  $(60,25)$  is

$$y = a(x-60)^2 + 25$$

- Since it goes through  $(0,0)$  we substitute that in:

$$0 = a(0-60)^2 + 25$$

- Solve for  $a$

$$0 = a(-60)^2 + 25$$

$$0 = a(3600) + 25$$

$$0 = 3600a + 25$$

$$-3600a = 25$$

$$a = \frac{25}{-3600}$$

$$a = -\frac{1}{144}$$

- So the equation of the parabola is  $y = \left(-\frac{1}{144}\right)(x-60)^2 + 25$

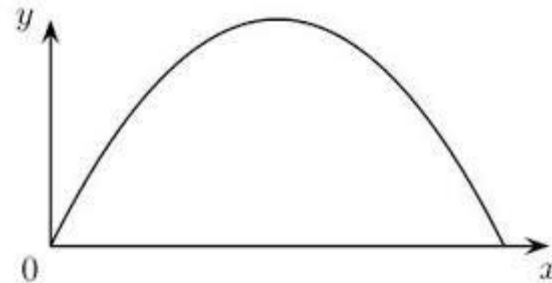
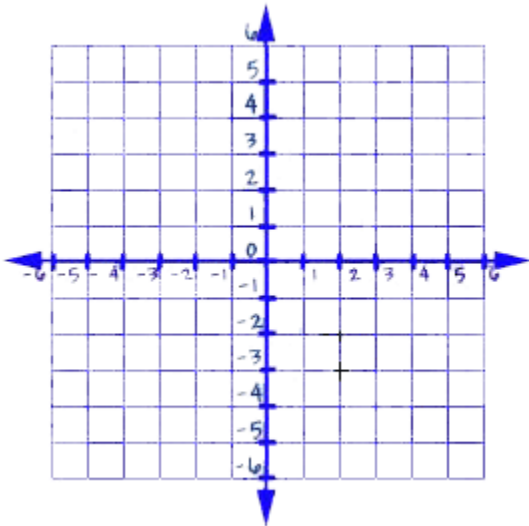
# Formulation *is* the Real World

- Start teaching the Formulation
- Type one writing:
- Examples:
  - Write three questions you would ask if you were in charge of building this structure?
  - What do you think you need to know in order to build this? Write 5 lines.
  - What do you notice about this figure? How would you describe this shape to another person? Write 3 lines.

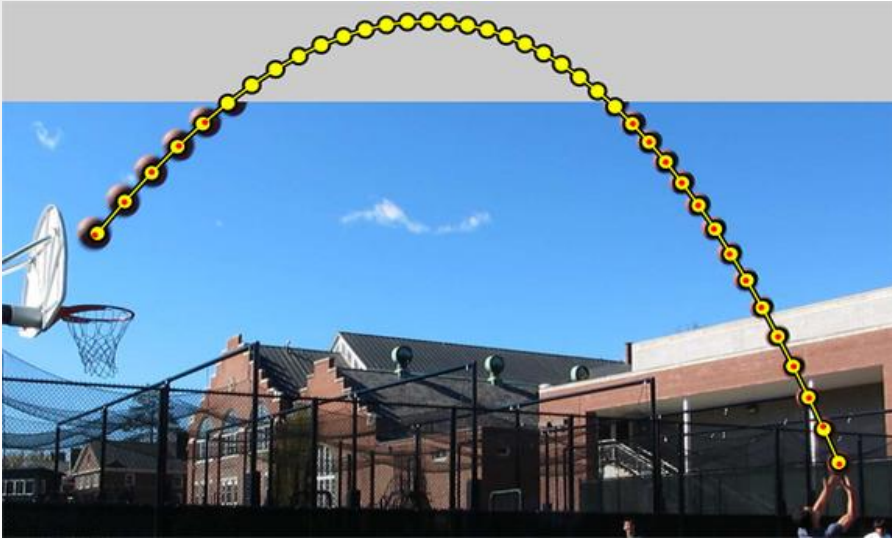


# Investigate Other Arches

- Overlay the coordinate system
- Use the Textbook
- Do we have the same questions and connections?



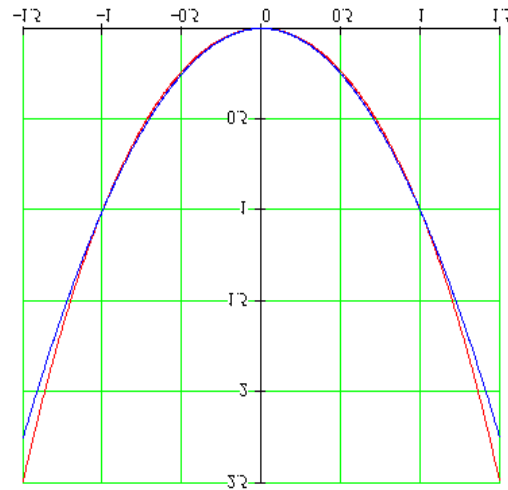
# Continue the Formulation



- Make cross-content connections

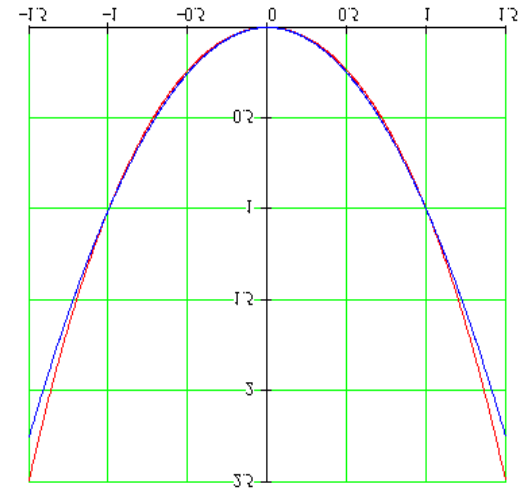


# Extend the Experience with Investigation



- Type 2 writing:
- Is the Gateway Arch a parabolic arch? Why or Why not? Cite 3 pieces of evidence to support your claim.

# Investigation and Research



- If I am not sure, who should I ask?
- Where should I look?
- What is a credible source?
- It is not a parabolic arch.
- It does not fit perfectly within the equation.
- Connect the new (**catenary**) to the known (**parabolic arch**)
  - The Gateway Arch in St. Louis, Missouri is an inverted **catenary**. A *catenary* is the curve of a hanging chain. The catenary shape minimizes the potential energy throughout the chain. When shifted, a hanging chain will naturally return to this position. At each point in a hanging chain or arch, the opposing forces (chain: tension forces, arch: compression forces) are balanced. This creates stability.
- Extend with Informational text *Mathematics of the Gateway Arch* by Robert Osserman

# Consider Vocabulary

- Frayer Model

Definition	Real World Connections
Examples	Non-Examples

# Basic Word Problems

Formulation and Investigation: How much water would it take to fill this tank? Write 3 lines what you think you would need to know.



- Typical: A cylindrical fish tank is 1 foot tall. The radius of the fish tank is 24 inches. How much water does it take to fill the tank? (Be careful – look at the units you are given)

# Where did you see the Core Principles of Math Literacy?

1. Students are actively engaged in reading and writing to construct knowledge.
2. Content teachers use varied resources.
3. Literacy is a social experience.
4. Teachers should guide students to read, write and talk "as if they are in the field."

# What stands out for you?

- 3 things you found interesting:
- 2 things you will try:
- 1 thing you'd like to know more about: