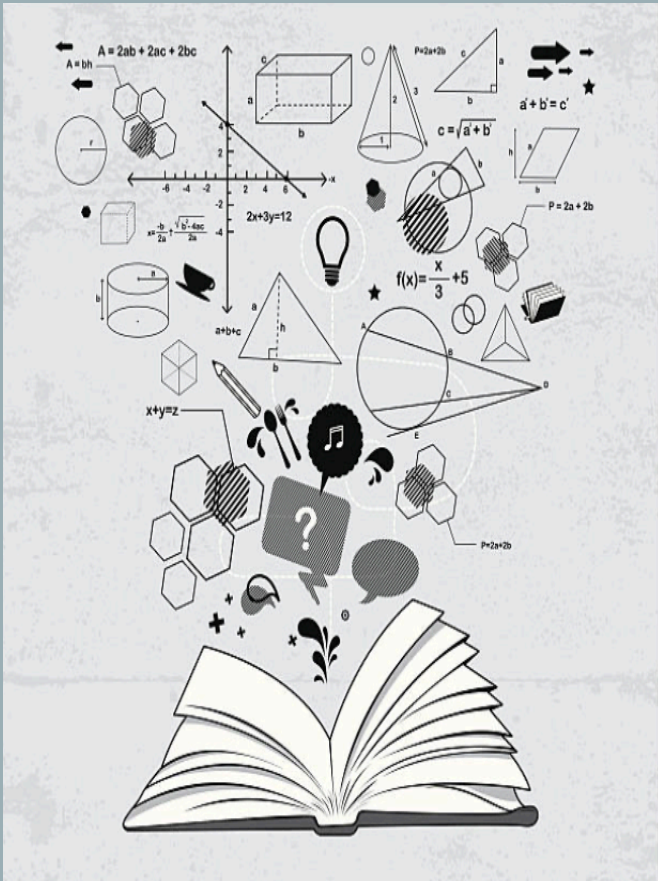# DEVELOPING MATHEMATICAL LITERACY THROUGH YOUNG ADULT LITERATURE

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Paula Greathouse, Ph.D.

Tennessee Tech University

DEFINING YOUNG ADULT LITERATURE

YOUNG ADULT LITERATURE IS DEFINED AS LITERATURE WRITTEN SPECIFICALLY FOR ADOLESCENTS IN GRADES 6-12 (HAZLETT, JOHNSON, & HAYN, 2009).

WHY READ YOUNG ADULT LITERATURE (YAL) TO DEVELOP MATHEMATICAL LITERACY?

YA in general…

- When content is presented in adolescent worlds it becomes more relevant and meaningful, which generates stronger content appeal for secondary students (Schallert & Roser, 2004).

- When adolescent books are read as a complement to content area textbooks, students learn to synthesize concepts across a range of texts (Bean, 2003), while providing focus and coherence to content area instruction (Austin, Thompson, & Beckman, 2005).

## WHY READ YOUNG ADULT LITERATURE (YAL) TO DEVELOP MATHEMATICAL LITERACY?

YA in Mathematics….

- Reading YAL provides access points for students to practice reading like a content area expert – Mathematicians (Greathouse, Kaywell, Eisenbach, 2017).

- In mathematics classrooms, when reading YAL students can be encouraged to draw on imagination as they solve problems presented in the text as a way to consider the possibilities of mathematics in their world and future. Positioning students as readers in this way helps develop critical literacy, as concepts are explored at deeper levels. (Koellner, Wallace & Swackhamer, 2009)

WHAT YOUNG ADULT LITERATURE DO YOU READ IN YOUR CLASSROOM?

BOOK TALKS
&
MATHEMATICS ACTIVITIES

FINDING SOLUTIONS IN *DO THE MATH: SECRETS, LIES, AND ALGEBRA*

Can Tess find the solutions?

secrets, Lies, and Algebra

$$(\text{♀} + \text{♂} = \text{♥})$$

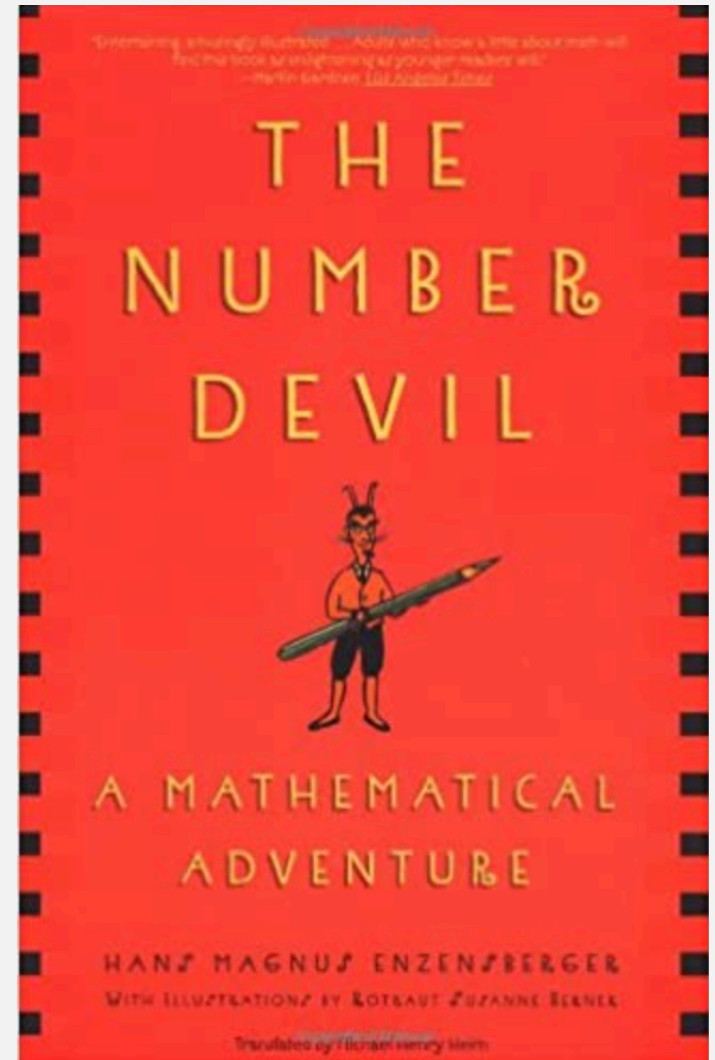Wendy Lichtman
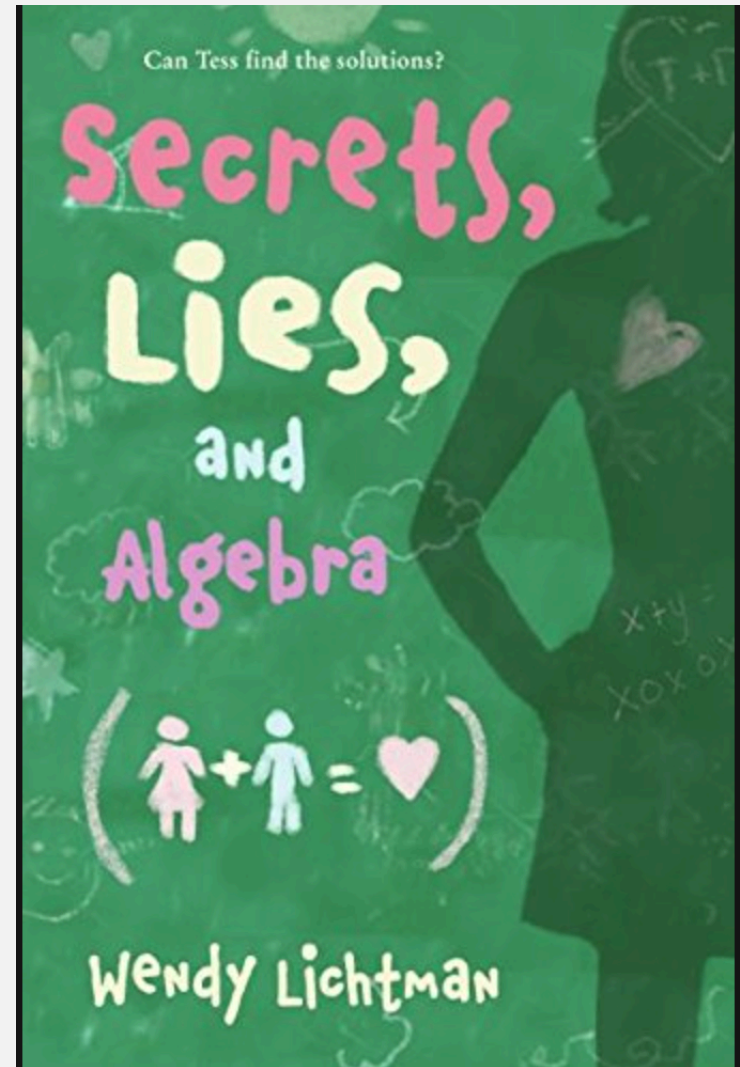
MATH ACTIVITIES

Draw a Mathematician

- Students draw and list characteristics of a mathematician
  - Promotes discussion of stereotypes and impressions

Representing Life in Symbols

- Students:
  - Brainstorm different mathematical symbols or review symbols for their graphic organizers
  - Choose a symbol that best represents themselves and explain the reasoning for their choice
  - Choose a second symbol to represent another individual in their life and explain the reasoning
  - Create a visual representation of the symbols they chose

FROM DISENCHANTED TO INTRIGUED: UNVEILING THE *NUMBER DEVIL*'S TRICKS IN PRECALCULUS AND CALCULUS

"Entertaining, amusingly illustrated... Adults who know a little about math will find the book so enlightening as younger readers will."
—Martin Gardner, *Los Angeles Times*

THE NUMBER DEVIL

A MATHEMATICAL ADVENTURE

HANS MAGNUS ENZENSBERGER
WITH ILLUSTRATIONS BY ROTRAUT SUZANNE BERNER

Translated by Michael Henry Heim
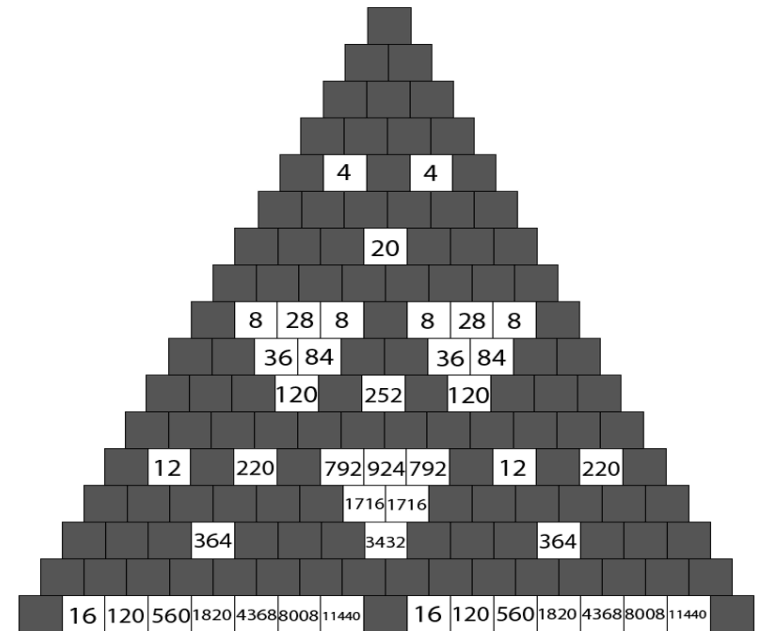
MATH ACTIVITIES

Activities Built into *The Number Devil*

- At the conclusion of *The Third Night*, the Number Devil reveals one last trick about prima-donna numbers and challenges the reader to try to express 27 as the sum of prima-donna numbers (p. 64).

- Toward the end of *The Fifth Night*, the Number Devil asks the reader if they continue to divide up the squares of squares, "What do you get if you add them together?" (p. 103). (Answer: 1 + 3 + 5 + 7 + 9 = 25). This task reinforces the Number Devil's discussion on perfect squares.

- After the Number Devil's discussion on Bonacci numbers at the end of *The Sixth Night*, the Number Devil presents Bonacci numbers in a tree and asks the reader, "How many branches are there by the time you reach the top, line nine?" (p. 121). (Answer: 34).
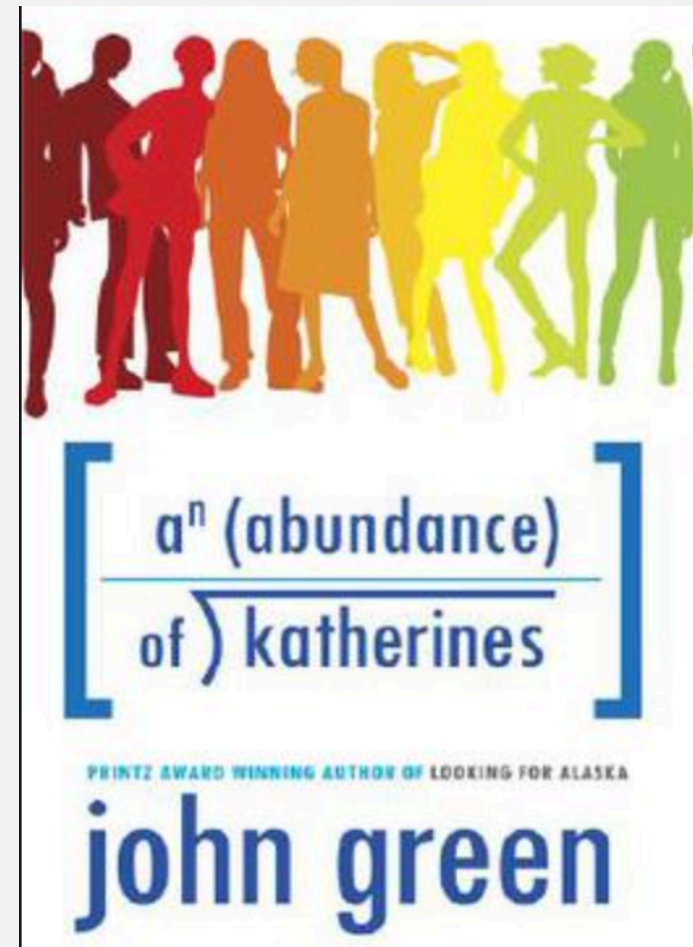
MATH ACTIVITIES

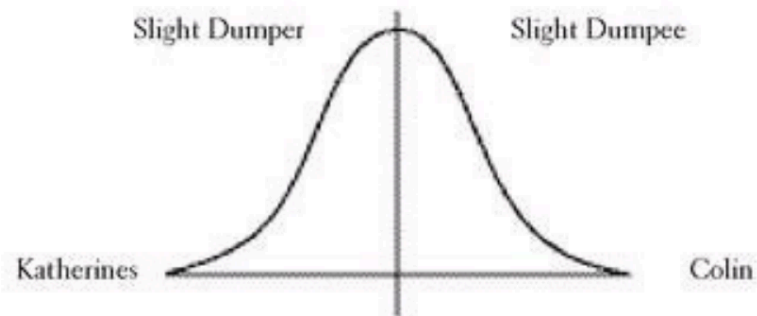## Activities Built into *The Number Devil cont.*

In *The Seventh Night's* discussion of triangle numbers, the Number Devil guides the reader to discover the pattern if all the numbers that can be divided by four are highlighted in the triangle (p. 145).

CRITICAL LITERACY OF GRAPHS: A MATHEMATICAL EXPLORATION OF *AN ABUNDANCE OF KATHERINES*
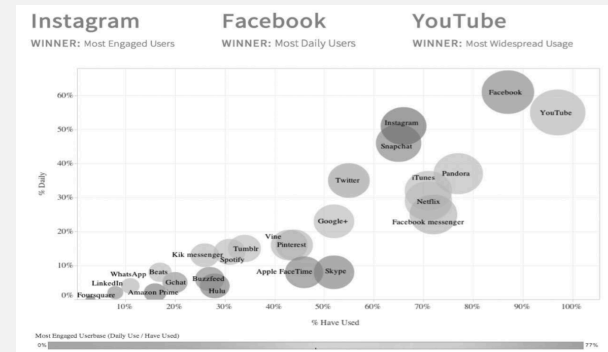
MATH ACTIVITIES

Initial Algebraic Model

- Students read Chapter 3 of the text and examine and consider multiple interpretations of the graph Colin develops to encapsulate his ideas about the "rise and fall of relationships" (p. 16).

- Questions such as these may be posed:
  - Why does the graph look like a bell curve?
  - What other qualities of people might be distributed similarly?
  - Do all people in relationships fall within this continuum? Why or Why not?
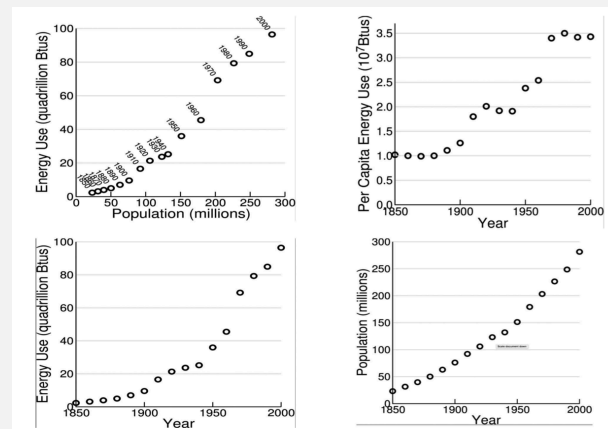 - What other qualities of relationships might Colin consider in analyzing the longevity of his relationships?

MATH ACTIVITIES

Building Schema

- Examples of how graphs can represent issues of relevance to adolescents.


- Graphs of quantities that covary

MATH ACTIVITIES

Colin's Final Model

- Students explore the effects of the new parameters on the resulting graphs, using *An Abundance of Katherines: Colin's Relationship Function*—a Desmos application with sliders that vary the values of each parameter.

- Students generate their own new "relationship graphs" through different combinations of parameter values.

- Students engage in a mathematical analysis of the resulting graphs using the following questions:

  - Who does the breaking up in this relationship? When does a breakup occur? Does this result correlate with the values of each parameter you chose? Why or why not?
  - What is the significance of the "turn-around" point(s)?
  - How might you describe the intensity of this relationship in comparison to other relationships you explore using this model?
  - When is the function increasing? Decreasing? What does this mean with respect to the relationship?
  - What might be limitations of this model? In what ways does each change in parameter value affect each graph?

TAKE IT TO *THE LIMIT*: DEVELOPING MATHEMATICAL LITERACY
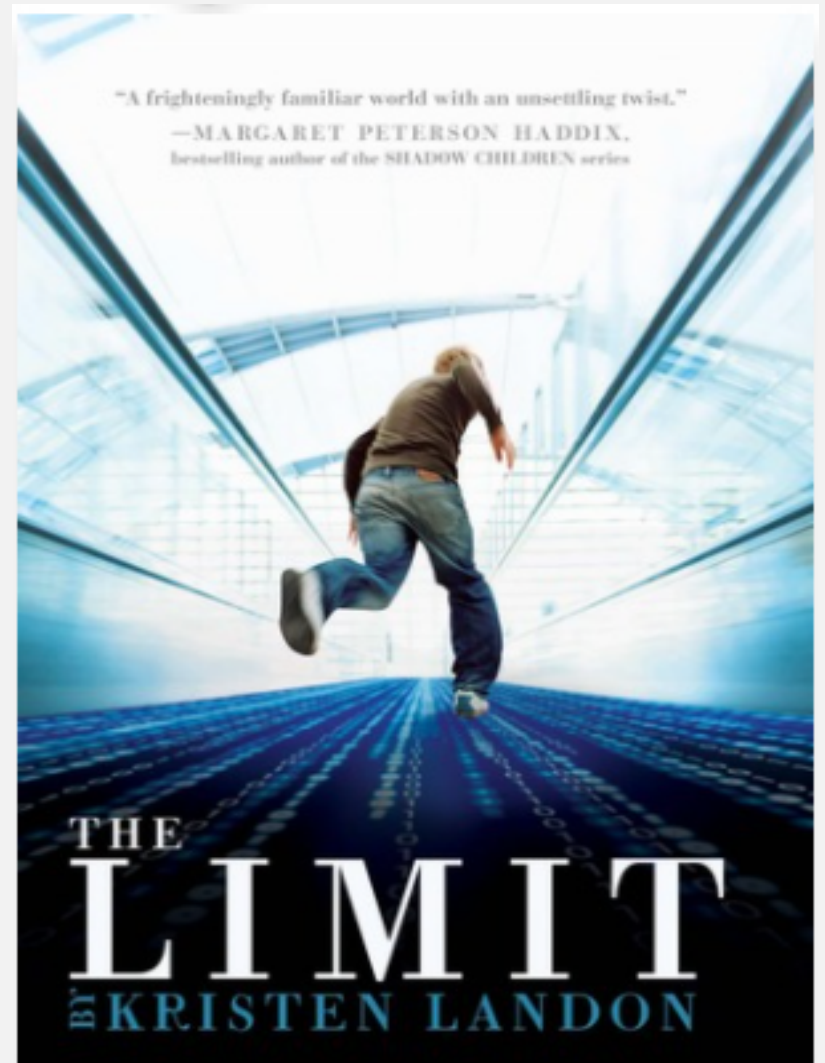
MATH ACTIVITIES

Introducing Limits and Budgets

- Students should be provided opportunities to encounter the specialized mathematical language associated with limits and budgets

- Poll students to see how many have created/managed a budget before (or a checking/savings account)

- Ask students to share stories of managing a budget

- Encourage students to think of scenarios in which sticking to a budget is essential

- Ask students to share stories about exceeding their limit and the consequences of doing so

- Make a list of any specialized vocabulary words that occur naturally in the conversation

- Ask students to list these words in their math journals/notebooks and write their own definitions as inferred from contextual clues

MATH ACTIVITIES

Basketball Task

MATH ACTIVITIES

d=rt

In Chapter 6, Matt devises an escape plan through the lobby of the workhouse (p. 56–57). Have students calculate their own "escape" from a location within their school.

- Post-it notes can be posted on the floor of the gym/hallway
- Students must locate their designated post-it note and estimate the distance from their location to the escape door
- They will measure the actual distance and record it on their note
- Students will calculate their running rate (feet per second) by timing each other as they run a known distance
- Using $d = rt$, students will calculate how long it would take their team to escape
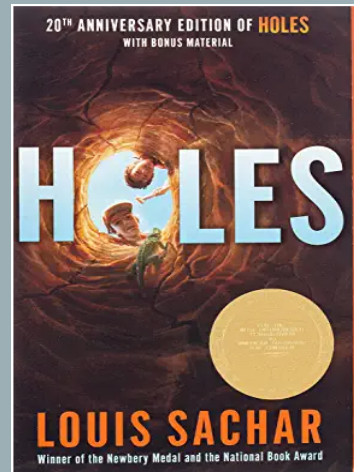- Debrief with whole-class discussion
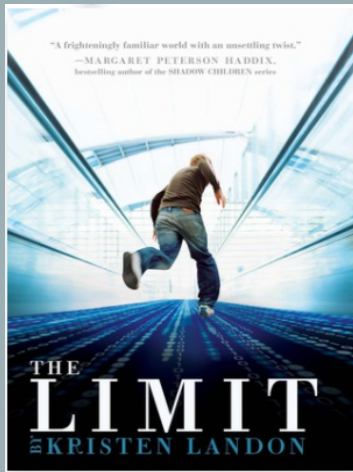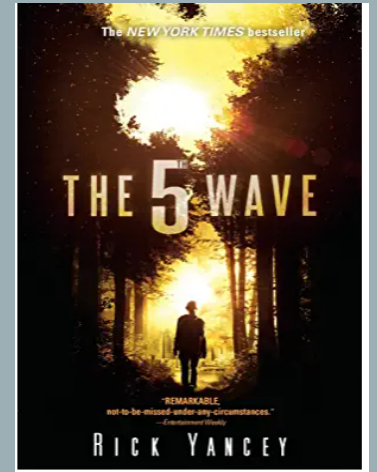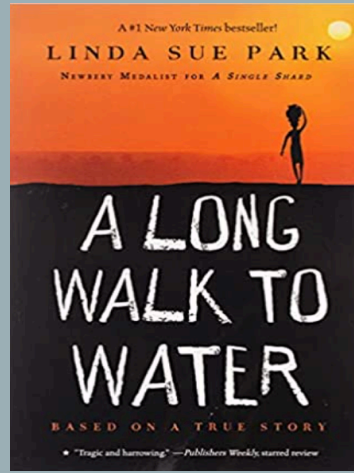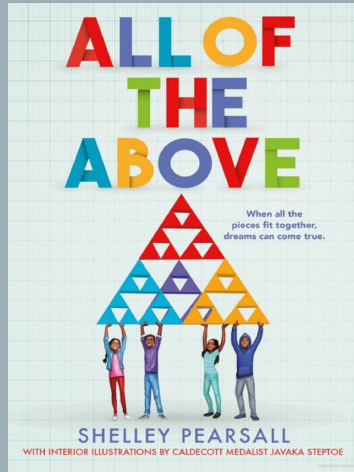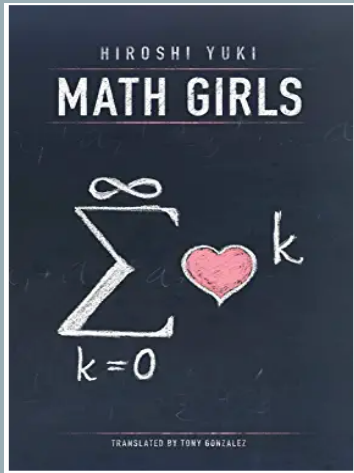
MATH ACTIVITIES

Averages

In Chapter 5, Matt "calculat[es] the average number of windows for the buildings [he] pass[es]" (p. 47). Task students with an interesting mathematical exercise:

- Count all of the buildings/homes they pass on the way to school from home each day
- Then count the number of windows on all of those buildings/homes
- Finally, calculate an average number of windows from the buildings they pass each day
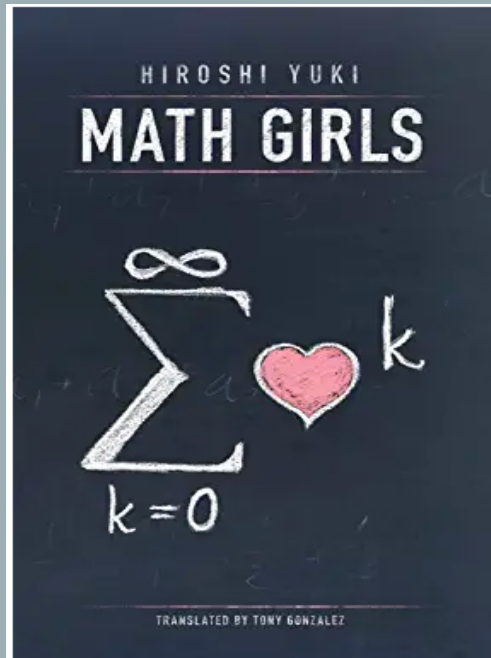
Integer Rules Investigation

In Chapter 18, Matt ruminates, "the chances of my entire family ever living at home together again were about as good as the product of two positive numbers coming out negative" (p. 184).

OTHER YOUNG ADULT LITERATURE SUGGESTIONS

HIROSHI YUKI

MATH GIRLS

$$\sum_{k=0}^{\infty} \heartsuit\, k$$

TRANSLATED BY TONY GONZALEZ

ALL OF THE ABOVE

When all the pieces fit together, dreams can come true.

SHELLEY PEARSALL

WITH INTERIOR ILLUSTRATIONS BY CALDECOTT MEDALIST JAVAKA STEPTOE

A #1 New York Times bestseller!

LINDA SUE PARK

NEWBERY MEDALIST FOR *A Single Shard*

A LONG WALK TO WATER

BASED ON A TRUE STORY

★ "Tragic and harrowing." —*Publishers Weekly*, starred review

THE MAGIC FISH

TRUNG LE NGUYEN

The *NEW YORK TIMES* bestseller

THE 5ᵀᴴ WAVE

"REMARKABLE, not-to-be-missed-under-any-circumstances."
—*Entertainment Weekly*

RICK YANCEY

"A frighteningly familiar world with an unsettling twist."
—MARGARET PETERSON HADDIX, bestselling author of the SHADOW CHILDREN series

THE LIMIT

BY KRISTEN LANDON

"Weaves mystery, math, and quirky kids in a unique adventure." —L.A. Times

ISLAND OF THE UNKNOWNS

A Mystery by BENEDICT CAREY

20TH ANNIVERSARY EDITION OF HOLES
WITH BONUS MATERIAL

HOLES

LOUIS SACHAR

Winner of the Newbery Medal and the National Book Award

nandini bajpai

SWIPE RIGHT ON LOVE.

A MATCH MADE IN MEHENDI

Math Girls
Hiroshi Yuki

HIROSHI YUKI

MATH GIRLS

$$\sum_{k=0}^{\infty} \heartsuit k$$

TRANSLATED BY TONY GONZALEZ

Combining mathematical rigor with light romance, *Math Girls* is a unique introduction to advanced mathematics, delivered through the eyes of three students as they learn to deal with problems seldom found in textbooks.

Mathematics in this Novel
- Sequences
- Series
- Recursive Formulas
- Explicit Formulas
- Complex Numbers
- Fundamental Theorem of Algebra
- Polynomial Generating Functions
- Proof of the Binomial Theorem
- Sine Function
- Continuity
- Limit
- Derivative
- Taylor Series

All of the Above
Shelley Pearsall
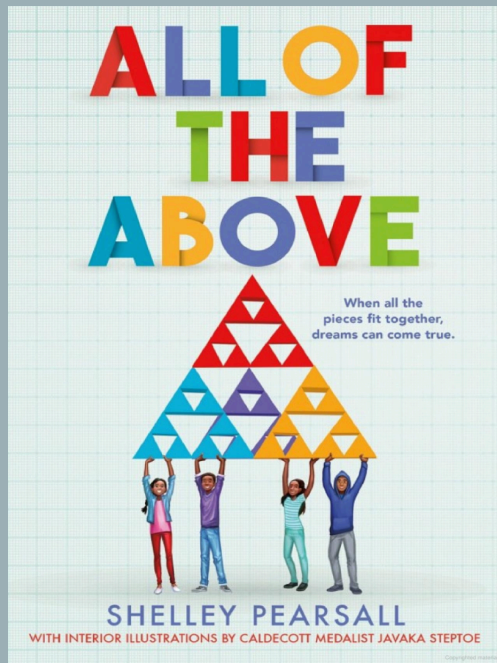
Based on a true story, *All of the Above* is the delightful and suspenseful story of four inner city students and their quest to build the world's largest tetrahedron.

Mathematics in this Novel

- Building the world's largest tetrahedron
- Representing and finding the surface area of three-dimensional figures using two-dimensional nets
- Proportional Reasoning

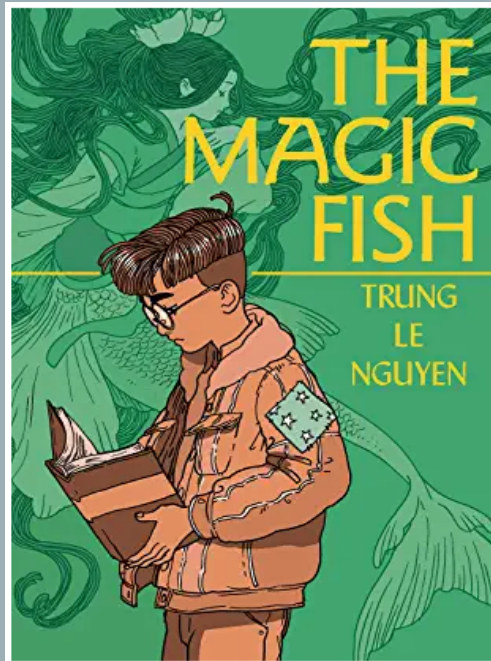## A Long Walk to Water
Linda Sue Park
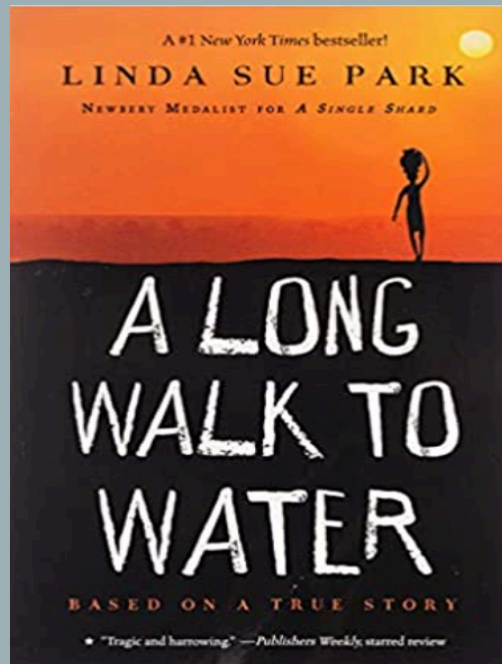
Based on factual events, *A Long Walk to Water* begins as two stories which go on to intersect in a moving way. The stories, told in alternating sections, revolve around a girl, Nya, in Sudan in 2008 and a boy, Salva, in Sudan in 1985.

Mathematics in this Novel
- Scale
- Theoretical walking speed

# The Magic Fish
Trung Le Nguyen

The Magic Fish, a graphic novel, follows the story of Tiến, who loves his family and his friends, but has been keeping a secret from them that might change everything – he's gay.

Mathematics in this Novel
- Rational Numbers
- Density Principle
- Identifying and Reasoning about Fractions
- Multiple Solution Ideas and Strategies
- Conceptual Understanding about Rational Numbers

The 5th Wave
Rick Yancey
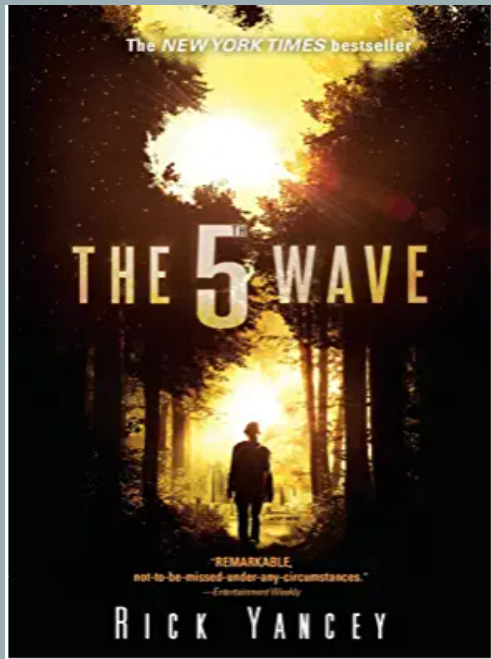
After the 1st wave, only darkness remains. After the 2nd, only the lucky escape. And after the 3rd, only the *un*lucky survive. After the 4th wave, only one rule applies: trust no one. Now, it's the dawn of the 5th wave, and on a lonely stretch of highway, Cassie runs from the beings who only look human, who roam the countryside killing anyone they see.

Mathematics in this Novel
- Creating Equations
- Reasoning with Equations and Inequalities
- Interpreting Functions
- Building Functions

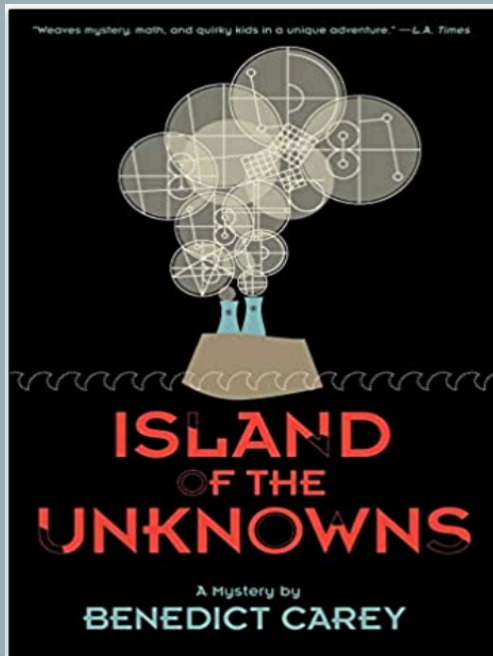## The Limit
Kristen Landon
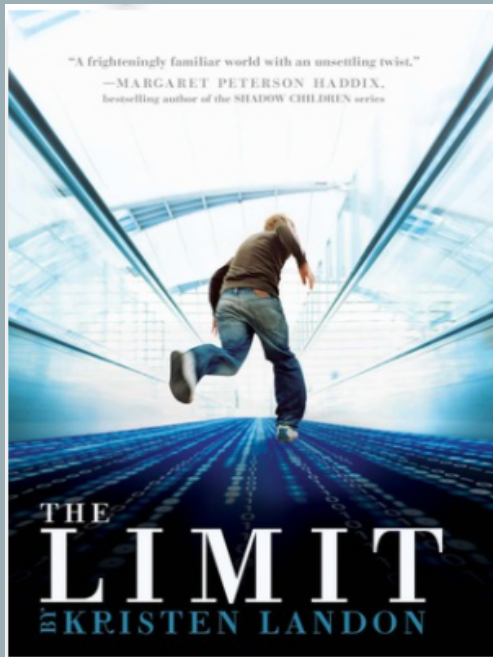
In a world not too far removed from our own, kids are being taken away to special workhouses if their families exceed the monthly debt limit imposed by the government.

Mathematics in this Novel
- Mental Mathematics
- Integers
- Averages
- Budgets
- Compounded Debt

Island of the Unknowns
Benedict Carey

In a trailer park called Adjacent, next to the Folsom Energy Plant, people have started to vanish, and no one seems to care. At first Lady Di and her best friend, Tom Jones, barely notice the disappearances—until their beloved math tutor, Mrs. Clarke, is abducted too. Mrs. Clarke has left them clues, in the form of math equations.

Mathematics in this Novel
- The Cartesian Coordinate Plane
- Pythagorean Theorem
- Probability
- Principles of Euclid, Pythagoras, and Descartes

Holes
Louis Sachar
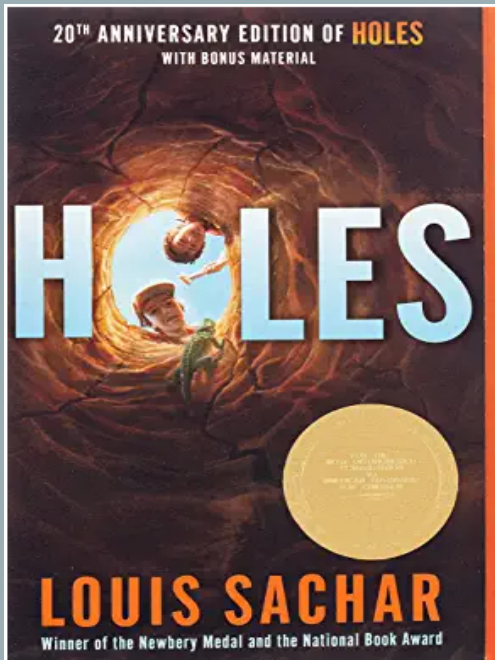
Stanley has been unjustly sent to a boys' detention center, Camp Green Lake, where the boys build character by spending all day, every day digging holes exactly five feet wide and five feet deep. There is no lake at Camp Green Lake. But there are an awful lot of holes. It doesn't take long for Stanley to realize there's more than character improvement going on at Camp Green Lake. The boys are digging holes because the warden is looking for something. But what could be buried under a dried-up lake?

Mathematics in this Novel
- Probability
- Statistics
- Proportional Reasoning
- Measurement

A Match Made in Mehendi
Nandini Bajpai

Fifteen-year-old Simran "Simi" Sangha comes from a long line of Indian matchmakers with a rich history for helping parents find good matches for their grown children. But Simi is an *artist*, and she doesn't want to have anything to do with relationships, helicopter parents, and family drama. That is, until she realizes this might be just the thing to improve her and her best friend Noah's social status. Armed with her family's ancient guide to finding love, Simi starts a matchmaking service, via an app, of course.

Mathematics in this Novel
- Algorithms
- Probability
- Variables

QUESTIONS

DEVELOPING
MATHEMATICAL
LITERACY THROUGH
ADOLESCENT
LITERATURE
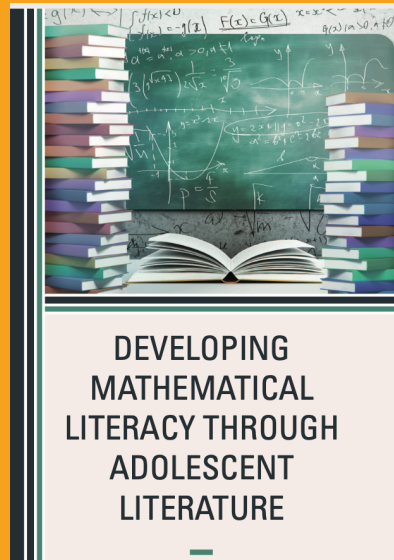
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