ENGAGING STUDENT WITH BIG IDEAS NCTM - 2023

Presented by:

Cynthia Raff
cynthia@mathandteaching.org

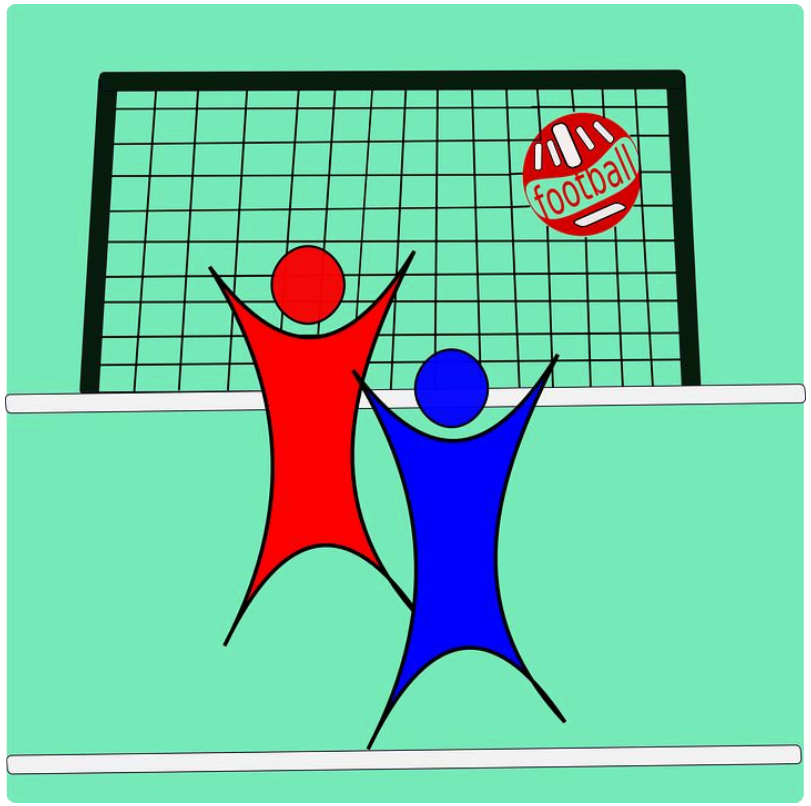
Scan for a copy of lesson plans and the slide deck.

Center For Mathematics And Teaching

MathLinks

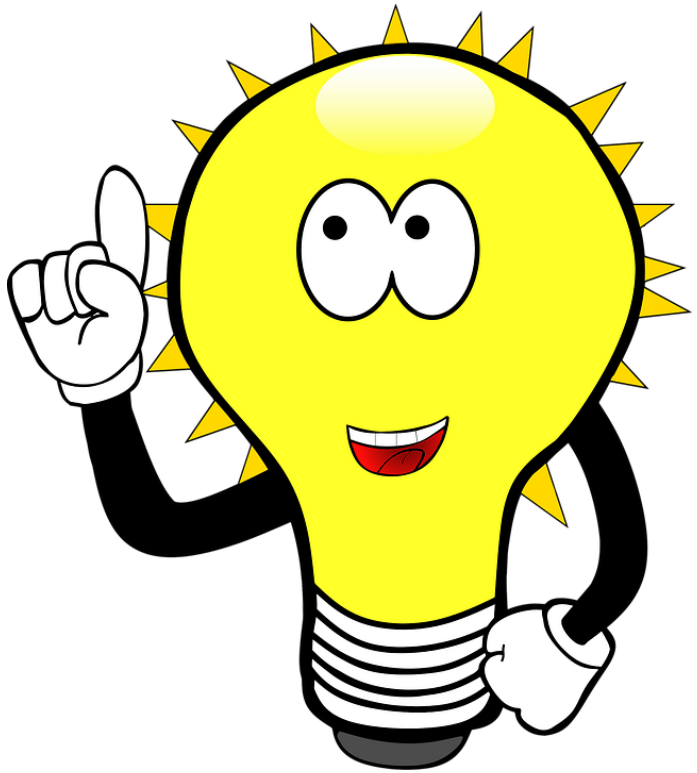
GOALS

- Explore the power of big ideas
- Do some math as examples
- Look for connections



DISCUSS

- What do you think are some big ideas for your grade level?



THE KEYCHAIN FUNDRAISER

The Lincoln Middle School fundraising committee wants to sell keychains to raise money for the big dance. Keychains are packaged and sold in small quantities.

(1a) Copy the pricing information for the Hi-Tops keychains.

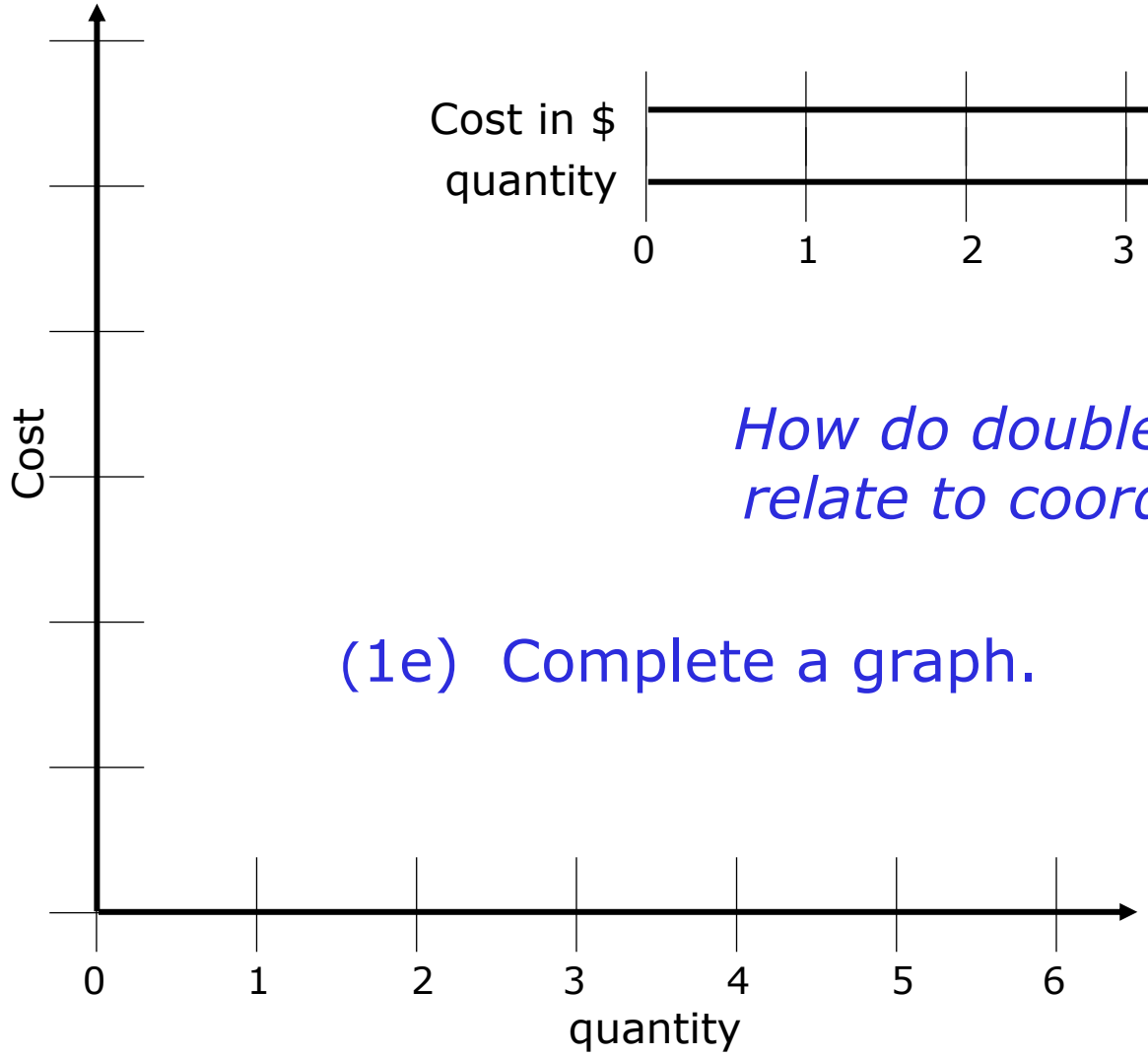
HI-TOPS
2 for $3.00

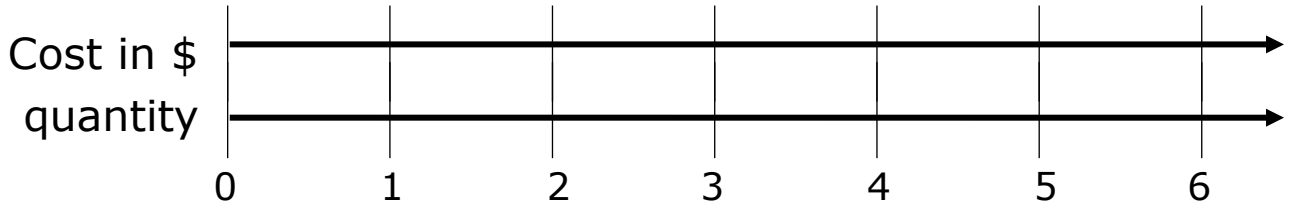
(1b) Complete a table that relates the number of keychains (quantity) and cost.

(1c) Write an input-output rule that relates quantity and cost.

(1d) Complete a double number line.

FROM NUMBER LINES TO GRAPHS





How do double number lines relate to coordinate planes?

(1e) Complete a graph.

ANOTHER OPTION

HI-TOPS
2 for $3.00

(2a-2e)
For the Donuts keychains:

DONUTS
3 for $4.00

- Copy the pricing information.
- Complete a table, equation, double number line, and graph (round as needed).

COMPARING REPRESENTATIONS

THE KEYCHAIN FUNDRAISER

[SMP1, 2, 7]

Follow your teacher's directions for (1) and (2).

(1a) – (1e) and (2a) – (2e) Copy pricing information, and complete the various representations.

(1a)

HI-TOPS
2 for $3

(1b) Table

HI-TOPS	
# of keychains (x) (quantity)	Cost in $ (y)
2	3
4	6
6	9
1	1.50
3	4.50

(1c) Rule: $y = 1.50x$

(2a)

DONUTS
3 for $4

(2b) Table

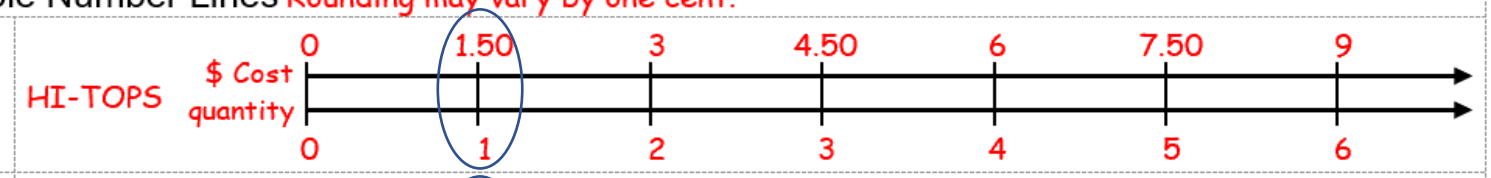
DONUTS	
# of keychains (x) (quantity)	Cost in $ (y)
3	4
6	8
9	12
1	1.33
2	2.66 or 2.67

(2c) Rule: $y = 1.33x$

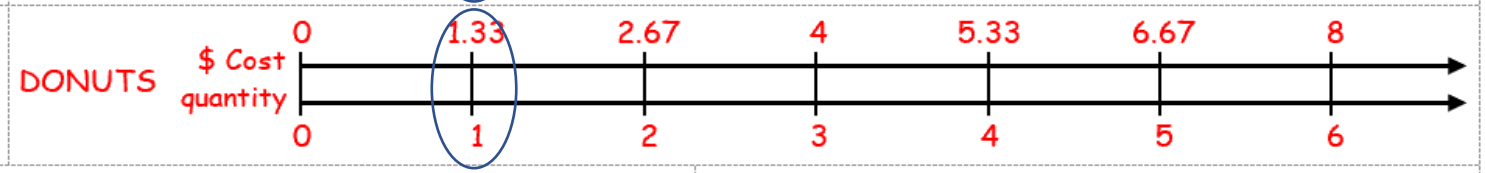
COMPARING REPRESENTATIONS

Double Number Lines Rounding may vary by one cent.

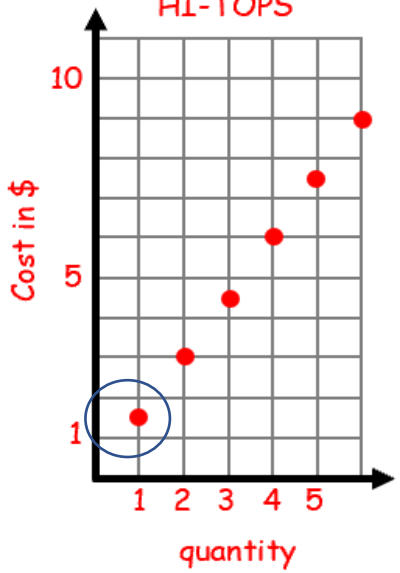
(1d)



(2d)

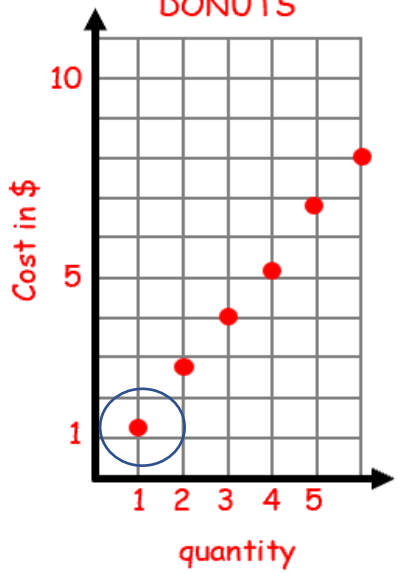


(1e) Graph



trend lines may be drawn to stress the linear relationships

(2e) Graph



3. Record the meanings of unit rate and unit price in **My Word Bank**.

AN EXTENSION

A COMMITTEE DECISION

(Using the *MathLinks* Rubric) See Activity Routines in the Teacher Portal for instructions. [SMP4, 5, 7]

Help the Lincoln Middle School fundraising committee decide which keychains to sell for the fundraiser. The six different keychains analyzed on the previous pages are listed below. In addition, a small survey was taken, the results of which are in the table below.

1. Complete the table. Percent rounded to the nearest whole percent.

Keychain	Price	Unit price (price per keychain)	Students polled who preferred this keychain: Number	Percent
Hi-Tops	2 for $3	$1.50	18	30%
Donuts	3 for $4	$1.33	10	17%
Googlies	5 for $6	$1.20	20	33%
Emojis	6 for $5	$0.83	6	10%
Locks	3 for $6	$2.00	1	2%
Cubes	2 for $5	$2.50	5	8%
			Total: 60	Total: 100%

Consider unit prices from the table.

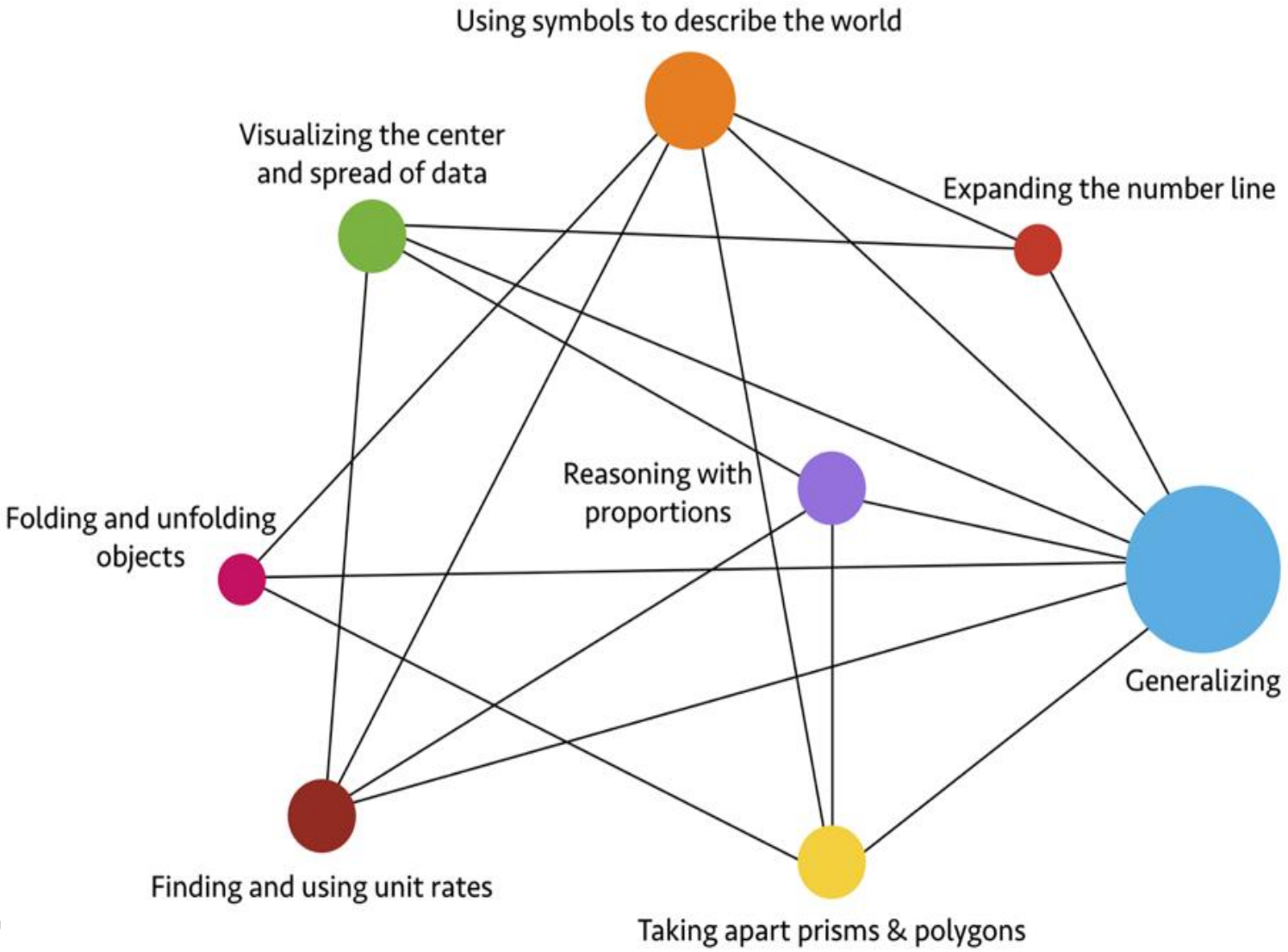
2. What is the range of prices?	3. What is the median price?	4. What is the mean price?
$2.50 - $0.83 = $1.67	$1.42	$1.56

Write one statistical question based on each. Answers will vary. Examples:

5. Unit prices	6. Students polled
What is the typical unit price of a keychain?	What keychains do students like best?

7. Recommend one or more keychains to the committee based on data from the table.
   Answers will vary. Some possibilities:
   - Recommend emoji's because they are the cheapest
   - Recommend googlies because they are the most popular and 2nd cheapest

BIG IDEAS EXAMPLE 1 - GRADE 6



Center For Mathematics And Teaching

MathLinks

BIG IDEAS EXAMPLE 2 - GRADE 6

Investigate concepts and solve problems involving length, area, and volume.

Extend the number system to include negatives.

Use statistical measures and displays to describe center and spread.

Explore relationships between inputs and outputs.

Gain computational fluency with positive rational numbers.

Rewrite and evaluate expressions and solve equations.

Explore and apply ratio and rate reasoning and representations.

*What were some **Big Ideas** and connections that you saw in the Keychain Problem?*

Center For Mathematics And Teaching

MathLinks

STANDARDS FOR MATHEMATICAL PRACTICE

SMP1	**Make sense of problems and persevere in solving them.** • Understand a problem and look for entry points • Consider simpler or analogous problems • Monitor progress and alter solution course as needed • Make connections between multiple representations • Check answers with a different method
SMP2	**Reason abstractly and quantitatively.** • Use numbers and quantities flexibly in computations • Attend to the meaning of quantities • Decontextualize a problem using symbols, manipulate them, and then interpret based on the context
SMP3	**Construct viable arguments and critique the reasoning of others.** • Use assumptions, definitions, established results, examples, and counter examples to analyze an argument and discuss its merits or flaws • Make and test conjectures based on evidence • Analyze situations by breaking them into cases • Understand and analyze the approaches of others
SMP4	**Model with mathematics.** • Attach meaningful mathematics to everyday problems and questions of interest • Make reasonable assumptions and approximations to simplify a situation • Identify quantities, use mathematical tools (such as multiple representations, formulas, equations) to analyze relationships • Interpret results and draw conclusions in the context of the situation

STANDARDS FOR MATHEMATICAL PRACTICE

SMP5	**Use appropriate tools strategically.** • Select and use tools strategically (and flexibly) to visualize, explore, and compare information • Use technological tools and resources to solve problems and deepen understanding
SMP6	**Attend to precision.** • Calculate accurately and efficiently • Explain thinking using mathematical vocabulary • Use symbols appropriately • Specify units of measure
SMP7	**Look for and make use of structure.** • Recognize the structure of a symbolic representation and generalize it • See complicated objects as composed of chunks of simpler object
SMP8	**Look for and make use of repeated reasoning.** • Identify repeated calculations and patterns • Generalize procedures based on repeated patterns or calculations • Find shortcuts based on repeated patterns or calculations

What **SMP's** were applied in the Keychain Problem?

FELIX THE SHEEP

Felix the Sheep has been getting into things lately, so Farmer Frank tied him up at the corner of the barn with a rope.

What is the area of the grass where Felix can graze?

What do we know?

What do you wonder?

What tools might be helpful to solve this problem?

SOME DETAILS

- The base of the barn is a rectangle.
- The rectangle is 40 ft by 20 ft.
- The rope is 30 ft long.

(1) Summarize the facts and the main question in the problem.

(2) Try to solve the problem. Include a labeled diagram and show all calculations clearly.

BIG IDEAS - GRADE 7

Find the likelihood of events with probability.

Sample to understand populations with statistics.

Apply proportional reasoning to ratios, rates, percent, and scale.

Solve problems involving measurements of geometric figures.

Operate with rational numbers.

Develop spatial reasoning in two- and three-dimensions.

Use algebra as a problem-solving tool.

Big Ideas – Connections - Grade 7

These ideas build on past work and prepare students for the future. Some of these include:

Prior Work	What's Ahead
• Measure with a ruler and protractor (Gr 2, 4) • Find areas by decomposing figures into non-overlapping shapes or counting squares (Gr 2, 3) • Identify and use properties of polygons (Gr 2-5) • Develop formulas and find areas of triangles and special quadrilaterals (Gr 6)	• Model more complex problems using geometric formulas (Gr 8+) • Study geometry as a system of definitions, postulates, and theorems (Gr 9+) • Study and use analytic geometry (Gr 9+)

DISCUSS

*What were some **Big Ideas, Prior Work,** and **SMP** connections that you saw in the Felix The Sheep problem?*

In Conclusion

GOALS:

- Do some math

The Keychain Fundraiser
Felix the Sheep

- Big Ideas?

Studied a more simplistic version

- Make Connections

Connected Big Ideas to problems
Viewed connections to past and prior grade levels
Found where Standards for Mathematical Practice were applied

Center For Mathematics And Teaching

MathLinks

THANK YOU FOR ATTENDING!

- Use the QR code to get a more complete handout and slide deck.
- Stop by booth 636 and continue the conversation.

Cynthia Raff
cynthia@mathandteaching.org

www.mathandteaching.org

All activities from *MathLinks*: Core 2nd edition

Center For Mathematics And Teaching

MathLinks