Sticky Math

CCSESA
California County Superintendents
Educational Services Association

RIMS Region
Riverside • Inyo • Mono
San Bernardino Counties

Connection &
Structure to
Build Fluency

MATH THAT STICKS

Sticky Math

GSDMC
Greater
San Diego
Mathematics
Council

Can You See How
Connection &
Structure Builds
Fluency?
All Students Can.

MATH THAT STICKS

Sticky Math

David Mattoon

District Secondary Math TOSA for Hemet USD in Hemet, CA

MATH THAT STICKS

Sticky Math

Kenneth McKee

Teacher for Highland Academy Charter School in Beaumont, CA

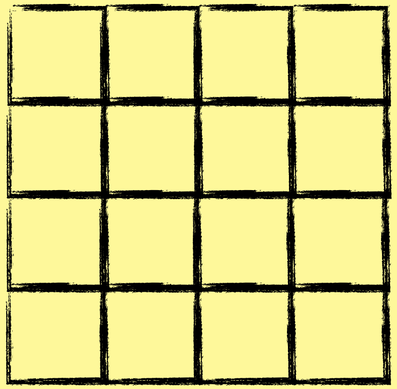
MATH THAT STICKS

Sticky Math

MATH THAT STICKS

Describe every part of the equation on the left sticky using only the image on the right sticky.

$\sqrt{16} = 4$

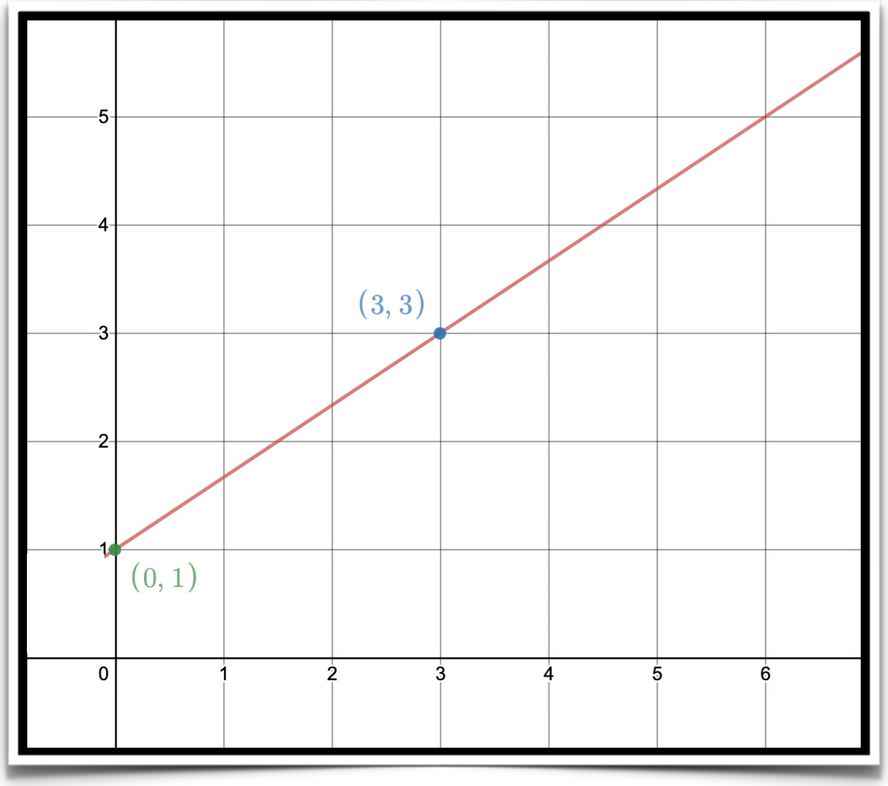


When you finish, create an additional representation.

Find as many connections as you can between the representations; describe the meaning of any symbols.

I found a dollar.

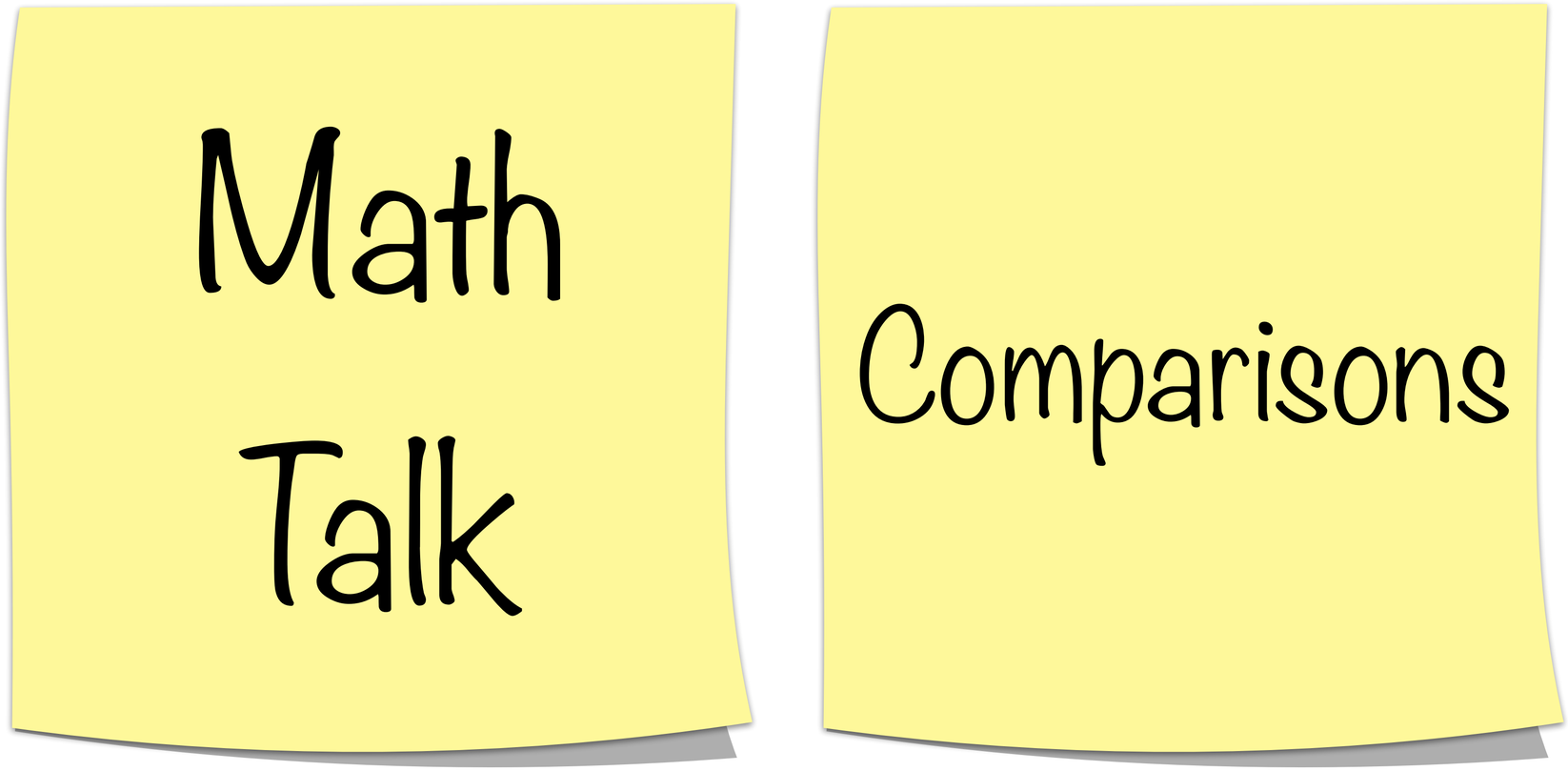
I was given two dollars every three days for lunch money.



$$y = 1 + \frac{2}{3}x$$

When you finish, create an additional representation.

Sticky Math



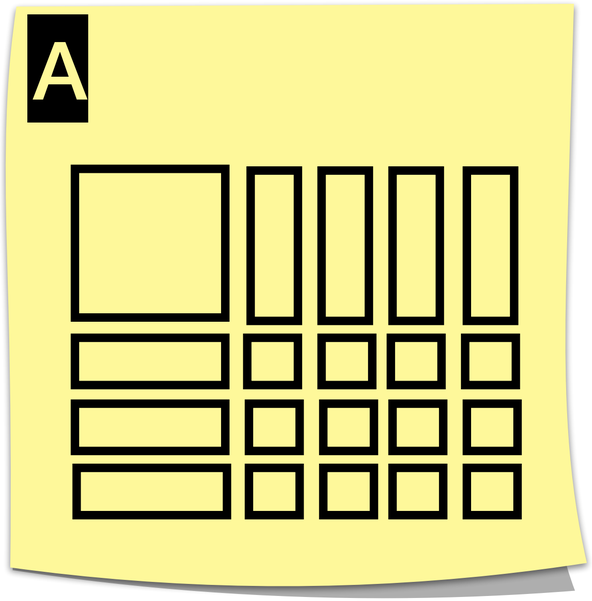
MATH THAT STICKS

Explain the similarities & differences between these two Sticky Math examples.

Example A

A

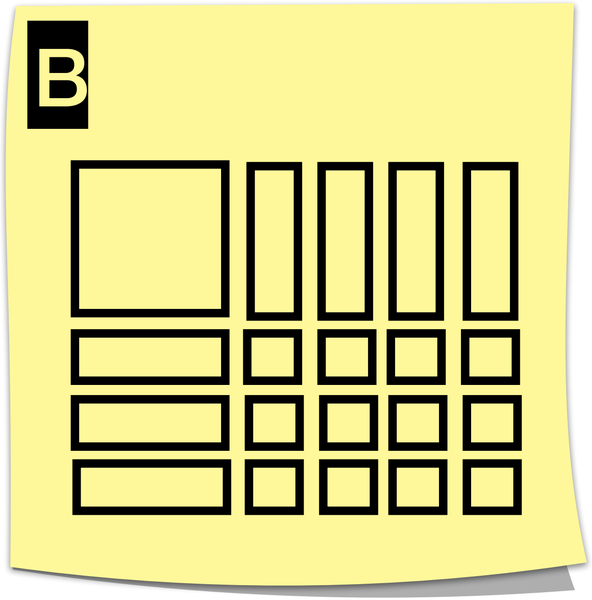
$(10 + 4)(10 + 3)$



Example B

B

$(x + 4)(x + 3)$



Use two other stickies to record the product of each expression.

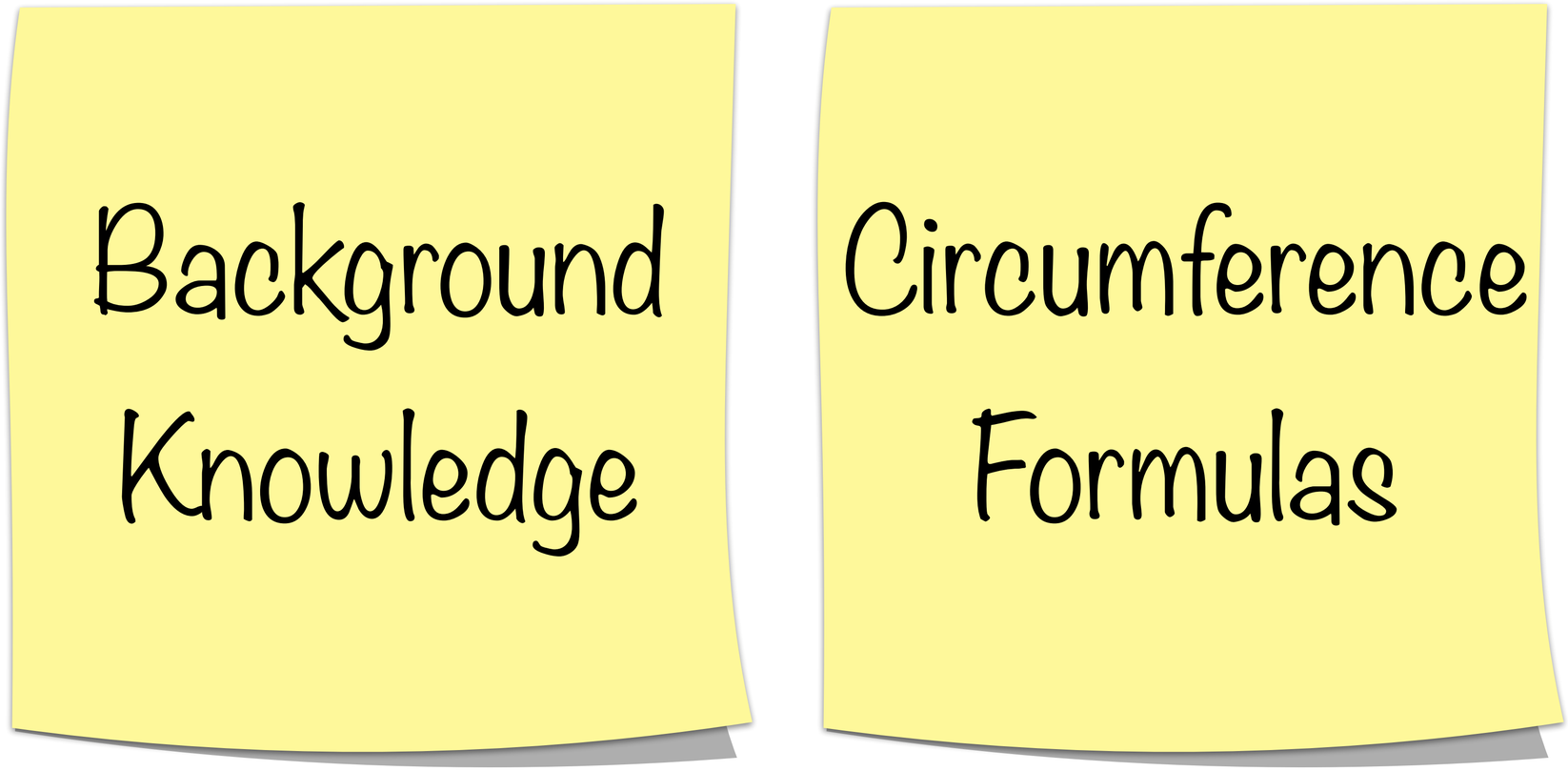
Sticky Math

Full Lesson

How does the area of a circle relate to the area of a rectangle?

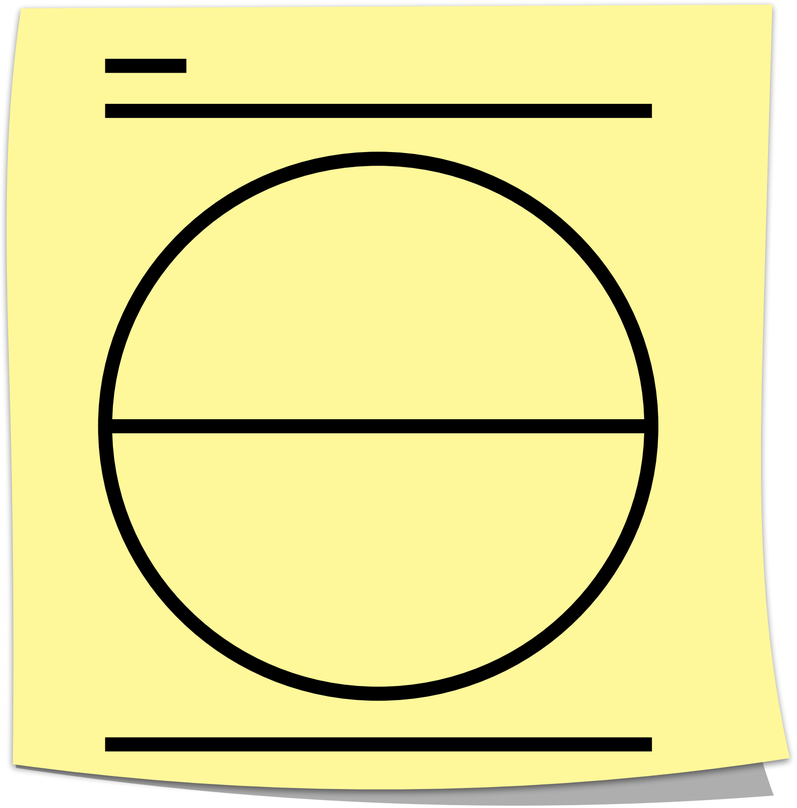
MATH THAT STICKS

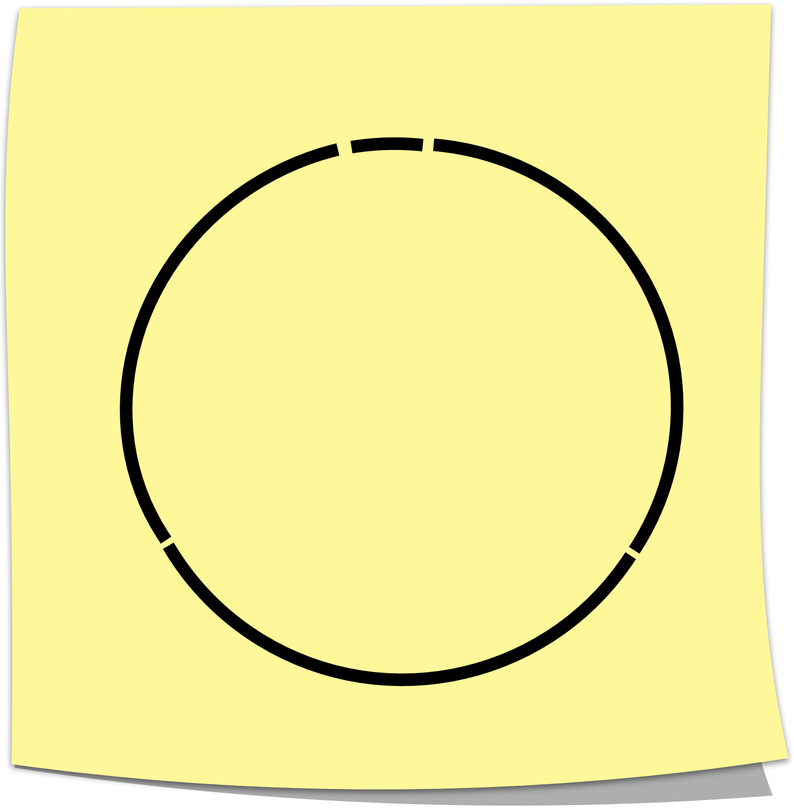
Sticky Math



MATH THAT STICKS

Find as many connections as you can between the two representations; describe the meaning of any symbols.

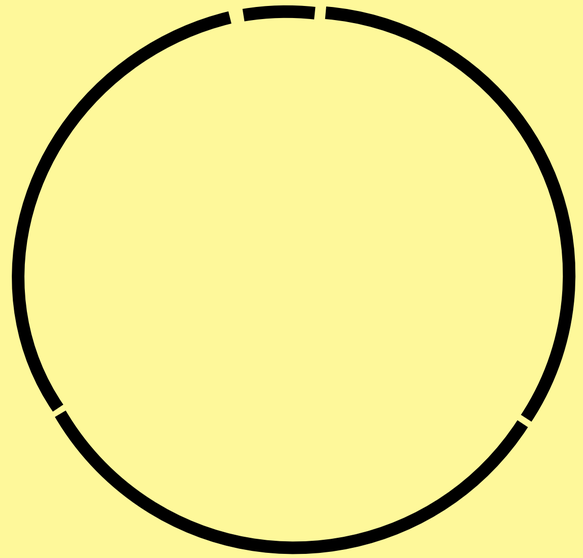




Describe what you notice on a third sticky.

Find as many connections as you can between the two representations; describe the meaning of any symbols.

$$C_o = \pi d$$



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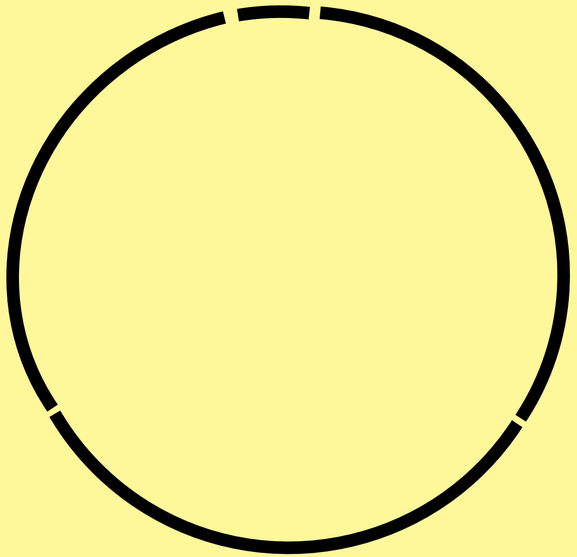
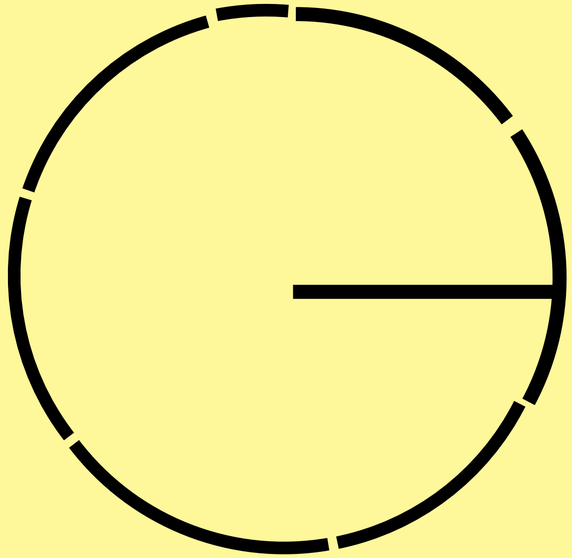


$$C_o = \pi d$$

$$C_o = \pi(2r)$$

$$C_o = 2\pi r$$



Describe what you notice on a fourth sticky.

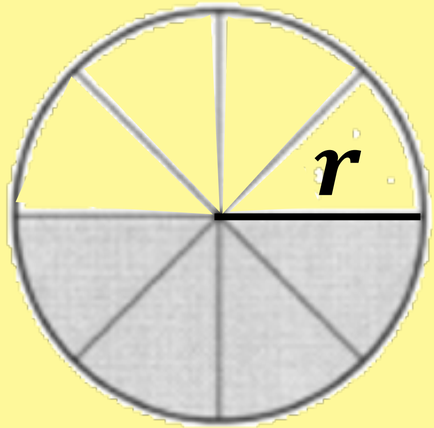
Sticky Math

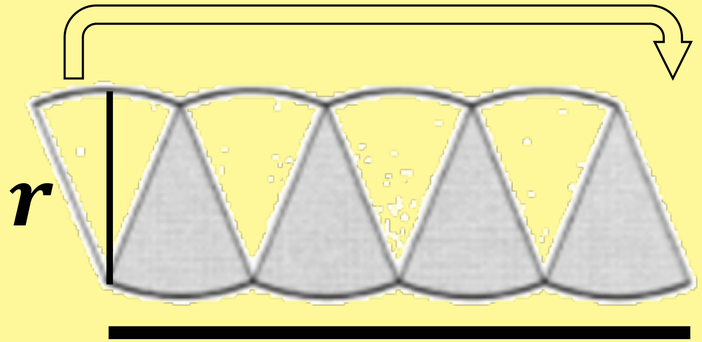
How is the area of a rectangle...

related to the area of a circle?

MATH THAT STICKS

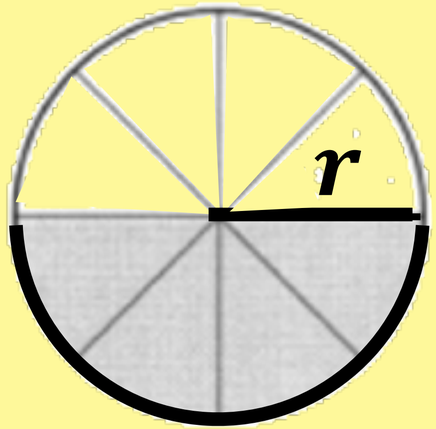
Find as many connections as you can between the two representations; describe the meaning of any symbols.

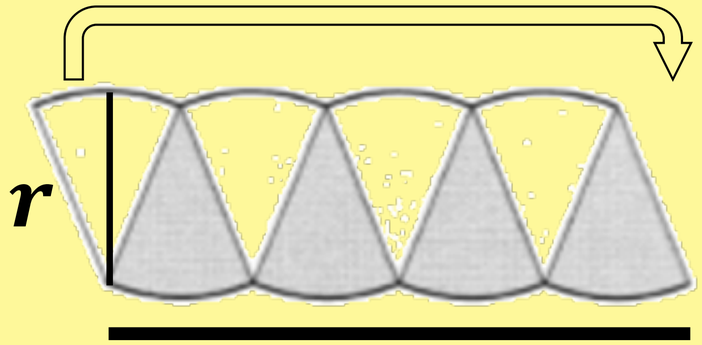




Describe what you notice on a third sticky.

Find as many connections as you can between the two representations; describe the meaning of any symbols.



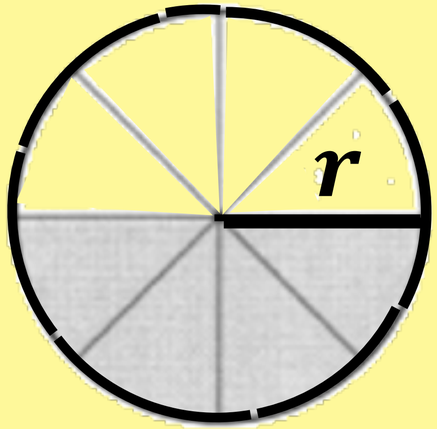


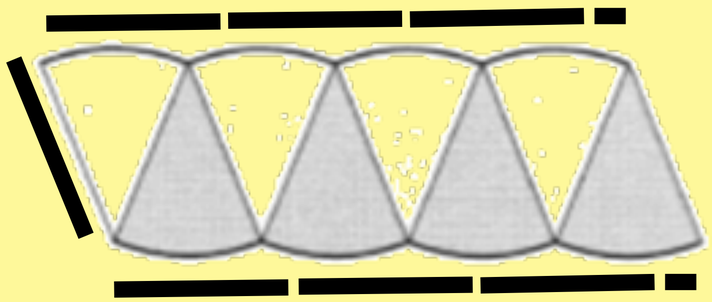
$$A_{\blacksquare} = (l)(w)$$

$$A_{\bullet} = (r)(\frac{1}{2}C)$$

Describe what you notice on a fourth sticky.

Find as many connections as you can between the two representations; describe the meaning of any symbols.





$$A = (r)(\frac{1}{2}C)$$

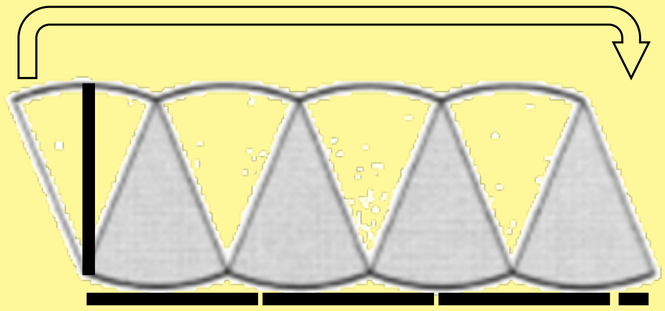
$$A = (r)[\frac{1}{2}(2\pi r)]$$

Describe what you notice on a fourth sticky.

Find as many connections as you can between the two representations; describe the meaning of any symbols.

$$A_{\bullet} = (r)[\frac{1}{2}(2\pi r)]$$

$$A_{\bullet} = (r)(\pi r)$$

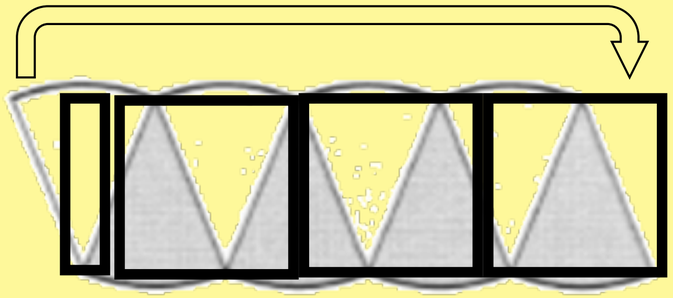


Describe what you notice on a third sticky.

Find as many connections as you can between the two representations; describe the meaning of any symbols.

$$A_{\bullet} = (r)(\pi r)$$

$$A_{\bullet} = \pi r^2$$



Describe what you notice on a third sticky.

Sticky Math

MATH THAT STICKS

Which one represents

"six times a number plus eight"?

Which one & why?

$2(3x + 4)$

$2x + 3 + 4x + 5$

If $x = 10$, then what is the value of both expressions?

Which one represents

"twenty-one times a number plus twenty-eight"?

Which one & why?

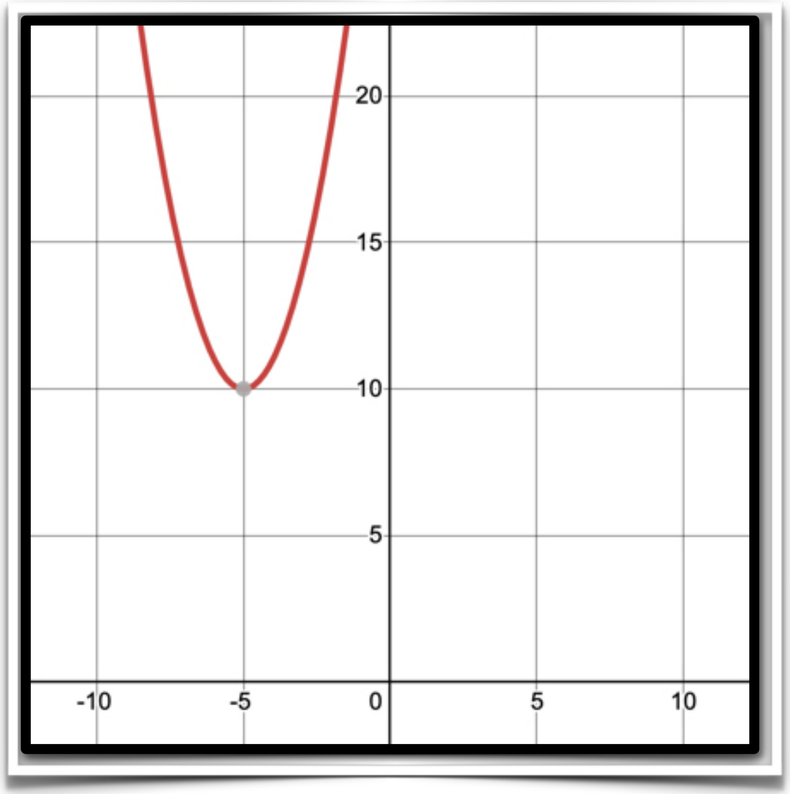
$5 + 2(3x + 4)$

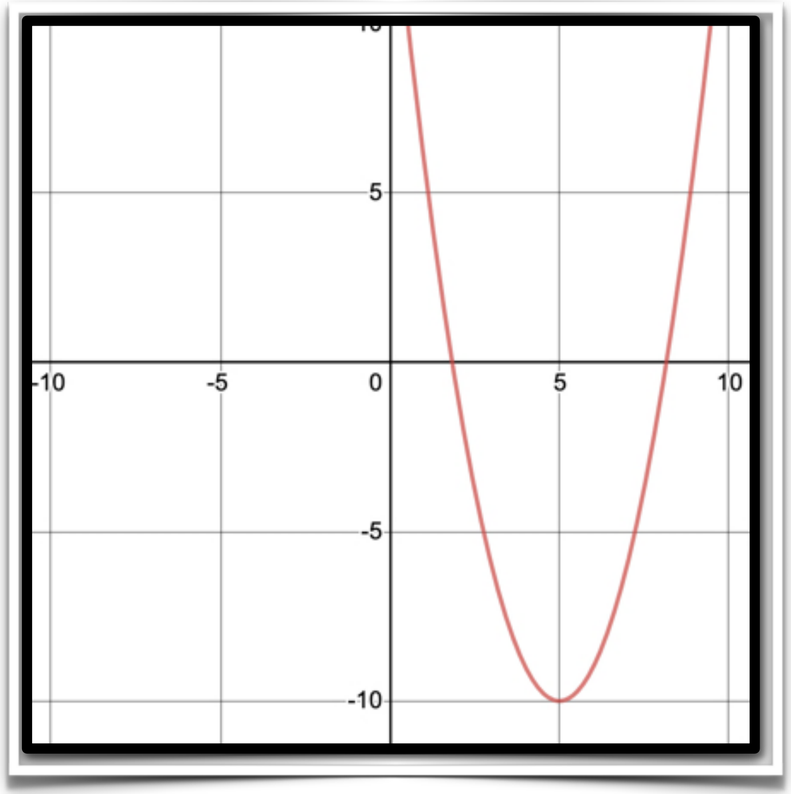
$7(3x + 4)$

What is the simplified version of the other expression?

Which one has two solutions?

Which one & why?

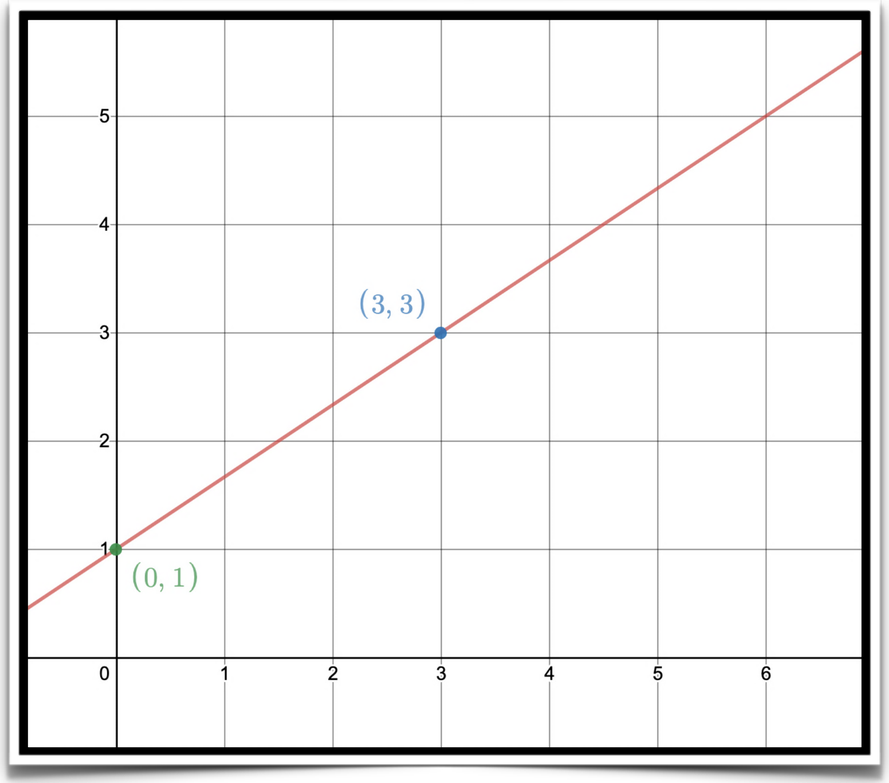




Sketch a graph of a quadratic function with one solution.

Which represents the equation of the line in the graph?

How do you know?

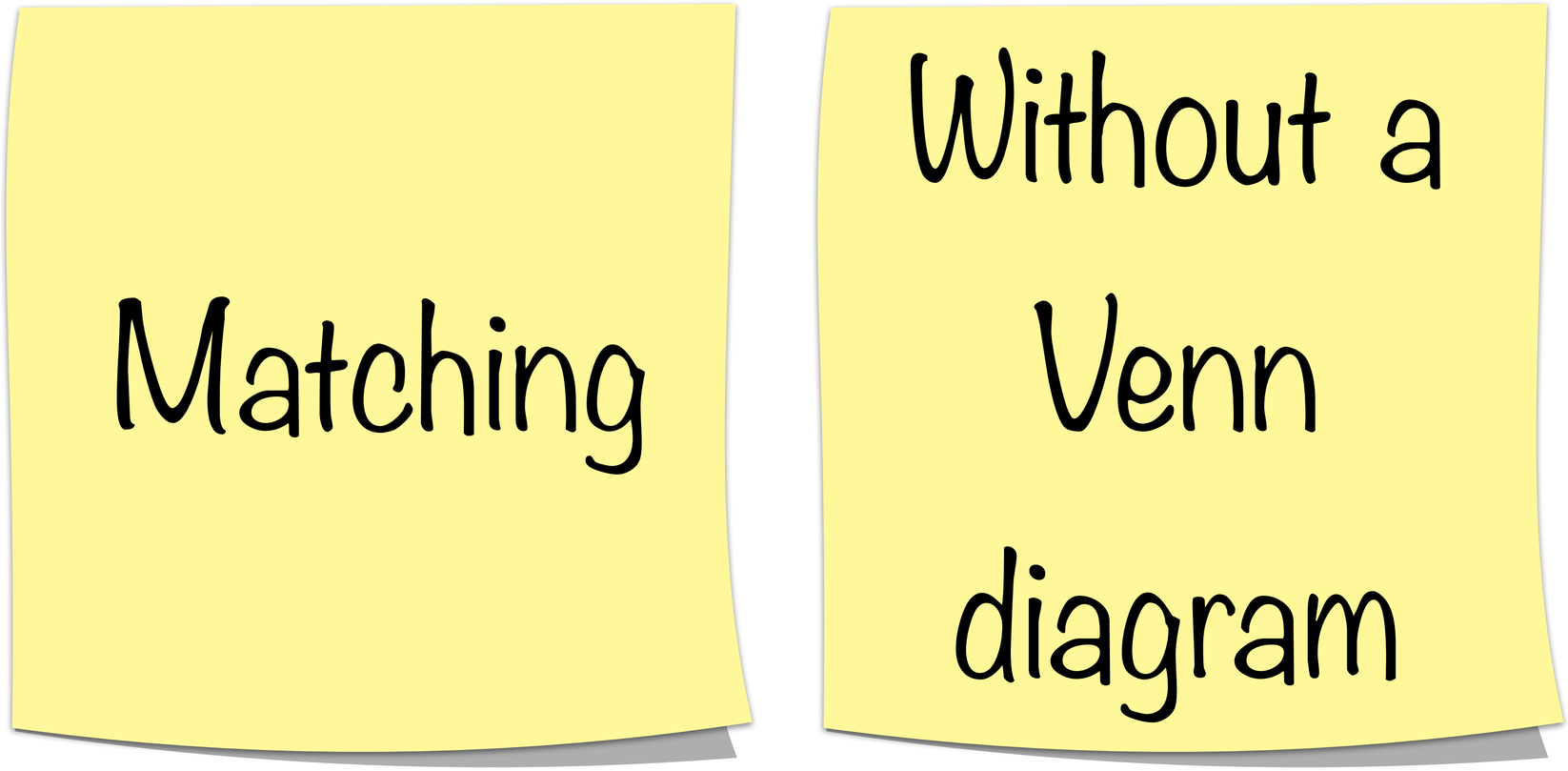


$$y = -\frac{2}{3}x + 1$$

$$y = \frac{-2}{-3}x + 1$$

Sketch the graph of the other equation.

Sticky Math

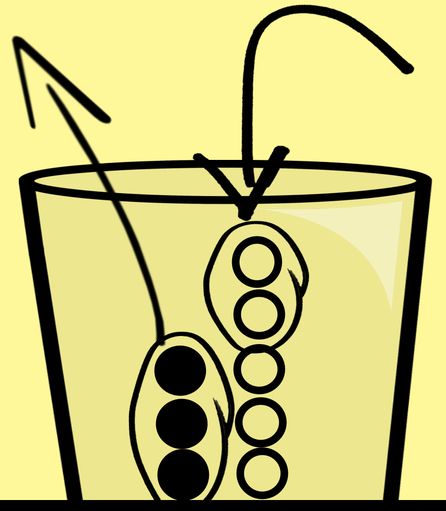


MATH THAT STICKS

Sticky Math Matching!

Add two hot rocks and remove three cold rocks

+2-(-3)

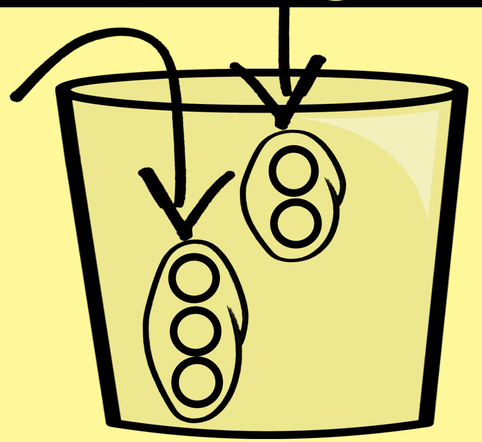


5

There is nothing to match; they all match. Create a competing set.

Add two hot rocks and add three hot rocks

+2+(+3)



Positive two and the opposite of negative three

Sticky Math Matching!

In order to create & maintain productive struggle:

- Use similar digits in each set. For another set related to this set, I might use -2, 3, -3 & -5.
- Mix operations between sets to highlight the conceptual differences between operations. For another set related to this set, I might use multiplication of integers with the addends becoming factors.

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MATH THAT STICKS

Sticky Math Matching!

- Give students the stickies, but do not tell them how many stickies in a set. Discuss the similarities and differences between the ways teams of students grouped them.
- Have each student in a team contribute to a set, then have two teams swap their sets. Each team sorts the new set; when they are finished the other team checks their work.
- Any errors or lack of errors in set creation or sorting act as a formative assessment.

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MATH THAT STICKS

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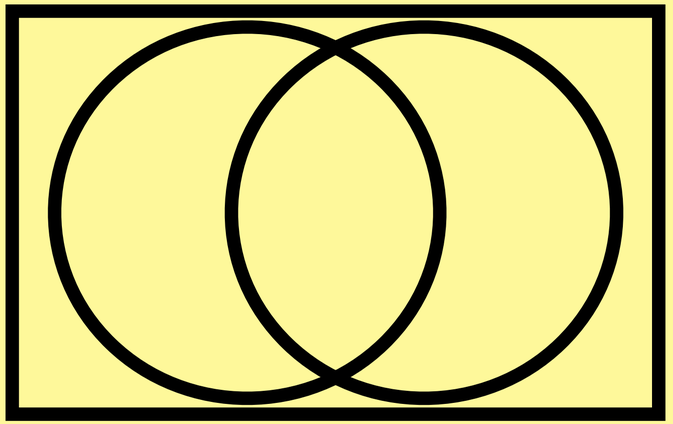
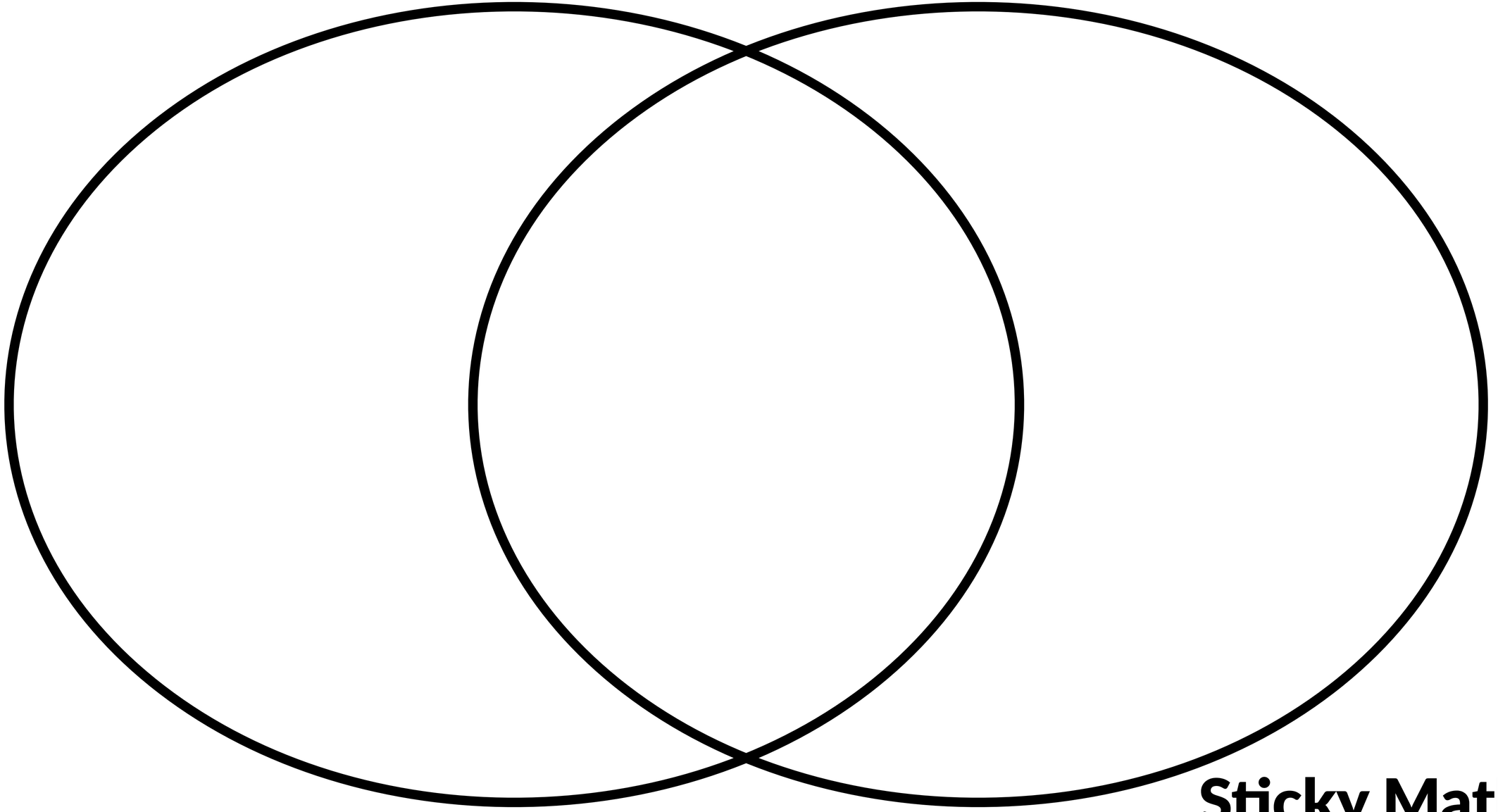
Matching with a Venn diagram



MATH THAT STICKS

Title: _____ Name/Group: _____



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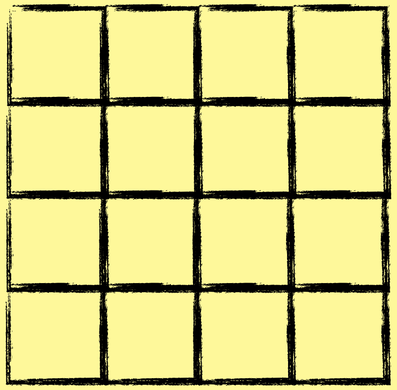
MATH THAT STICKS

Sticky Math Matching! (Use Venn Diagram)

Four squared is sixteen.

$(4)(4) = 16$



$x^2 = 16$

A number multiplied by itself is sixteen.

$(-4)(-4) = 16$

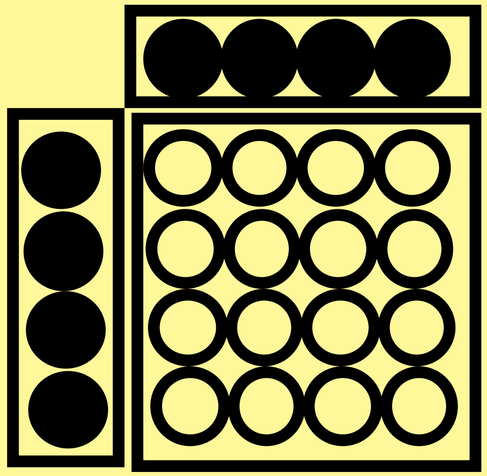
$4^2 = 16$

Four in two dimensions.

Matching continued (Use Venn Diagram)

Negative four squared is sixteen.

$\sqrt{(4 \bullet 4)} = 4$

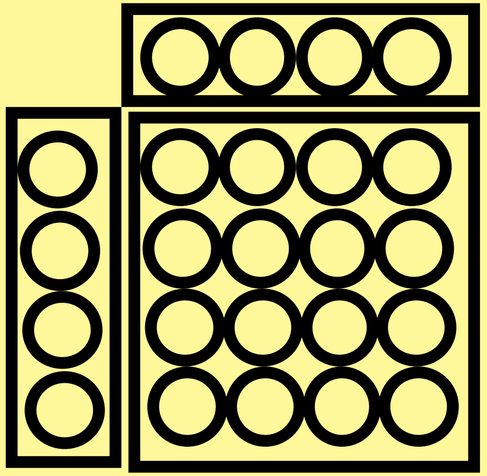


$\sqrt{(4^2)} = 4$

Sixteen is negative four times negative four.

$\sqrt{(16)} = 4$

$(-4)^2 = 16$



Use Blank Stickies to Label Venn Diagram

Negative four squared is sixteen.

$\pm\sqrt{16} = \pm 4$

Sixteen is negative four times negative four.

$-\sqrt{(16)} = -4$

Sticky Math Matching!

- Have groups decide how to group their stickies using the Venn diagram & label each part of the Venn diagram using the blank stickies.
- Groups sort the set, they then take turns justifying their reasoning to another group. The other group has an opportunity to critique their reasoning. Then they switch roles.

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MATH THAT STICKS

Sticky Math Matching!

- Do not tell students how many stickies in a set or how to sort them.
- Discuss the similarities and differences between the ways groups of students sorted them; explore whether any differences can be justified or whether they are misconceptions
- Any errors or lack of errors or lack of errors in sorting act as a formative assessment.

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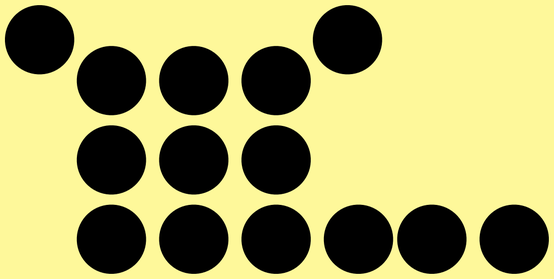
MATH THAT STICKS

Sticky Math

Dots

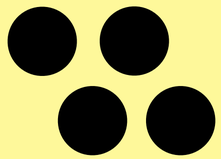


MATH THAT STICKS

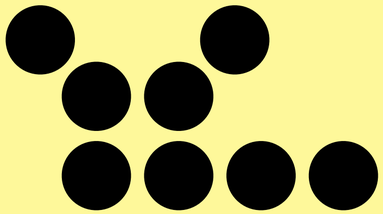
Show the function in some other way

(use a different representation).

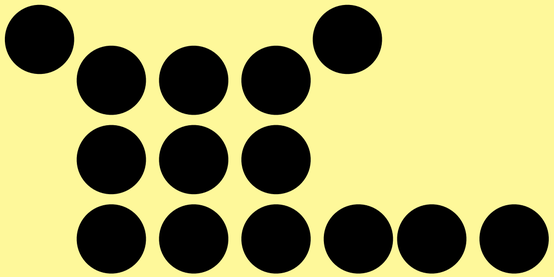
Case 1



Case 2



Case 3



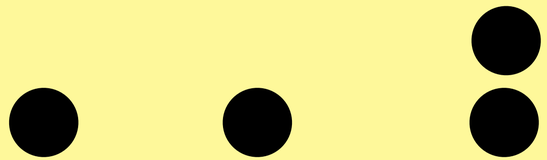
What would an equation be for d, the number of dots,

dependent on n, any case number?

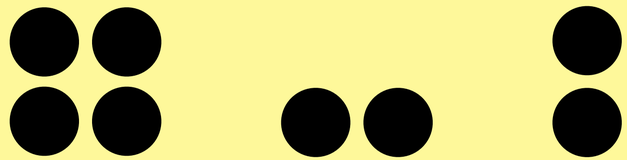
Show the function in some other way

(use a different representation).

Case 1



Case 2



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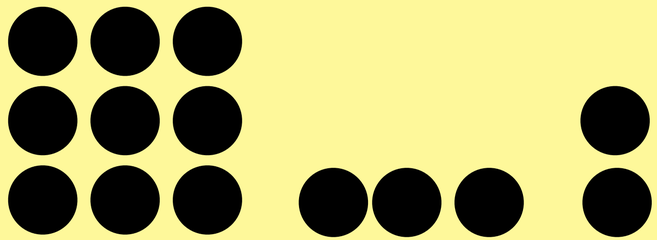


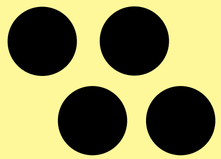
What would an equation be for d, the number of dots,

dependent on n, any case number?

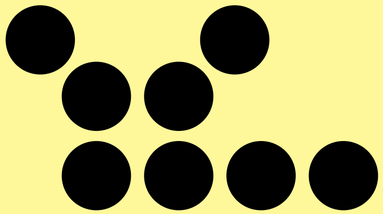
Show the function in some other way

(use a different representation).

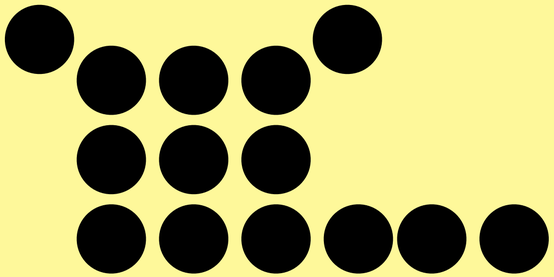
Case 1



Case 2



Case 3

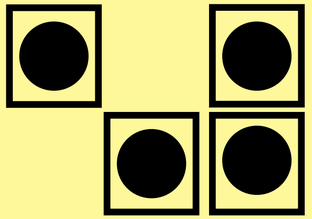


What would an equation be for d, the number of dots,

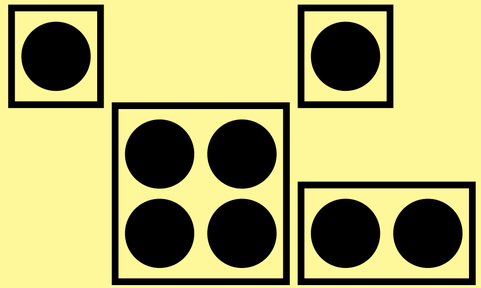
dependent on n, any case number?

Use the rectangles to create a quadratic trinomial expression.

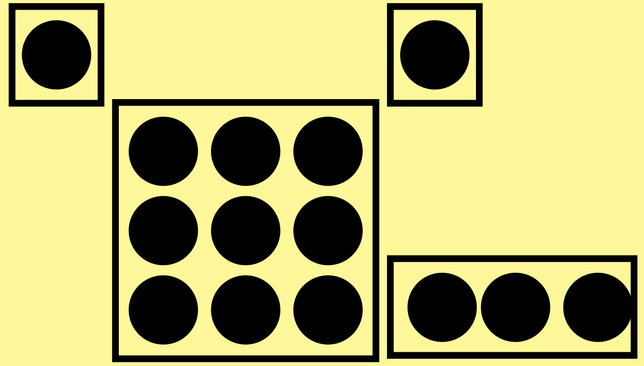
Case 1



Case 2

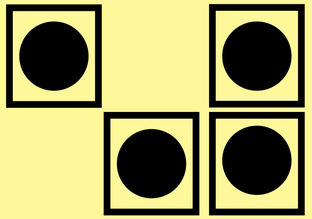


Case 3

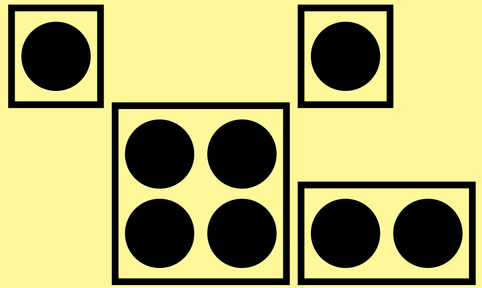


Explain how the rectangles relate to the quadratic trinomial below.

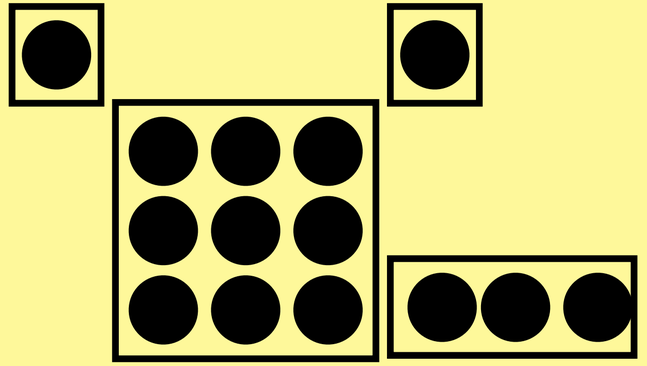
Case 1



Case 2



Case 3

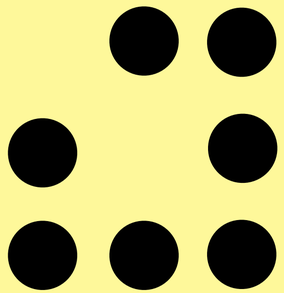


$$c^2 + c + 2$$

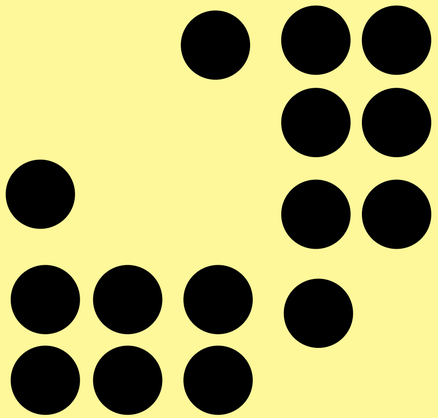
Show the function in some other way

(use a different representation).

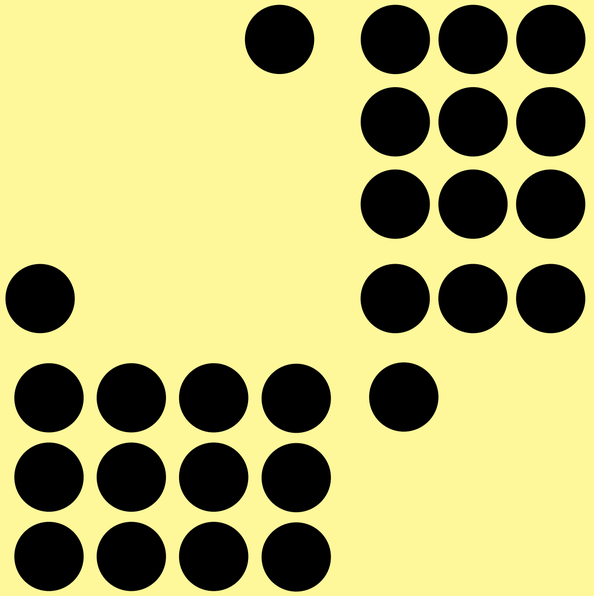
Case 1



Case 2



Case 3



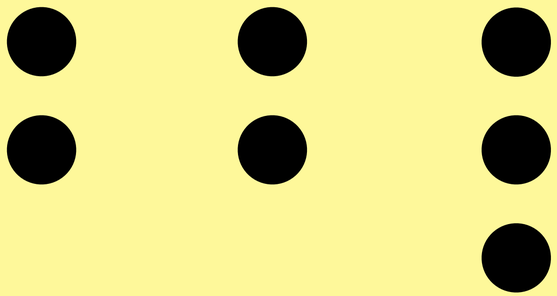
What would an equation be for d, the number of dots,

dependent on n, any case number?

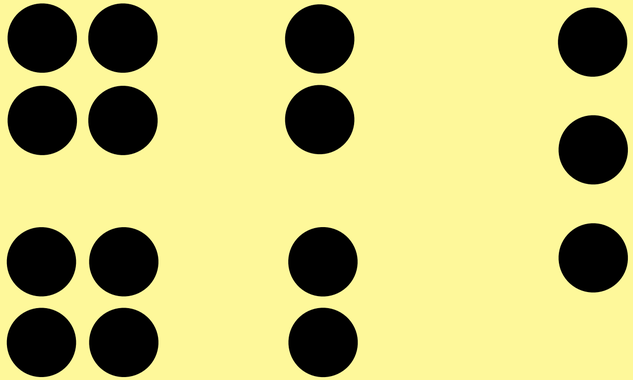
Show the function in some other way

(use a different representation).

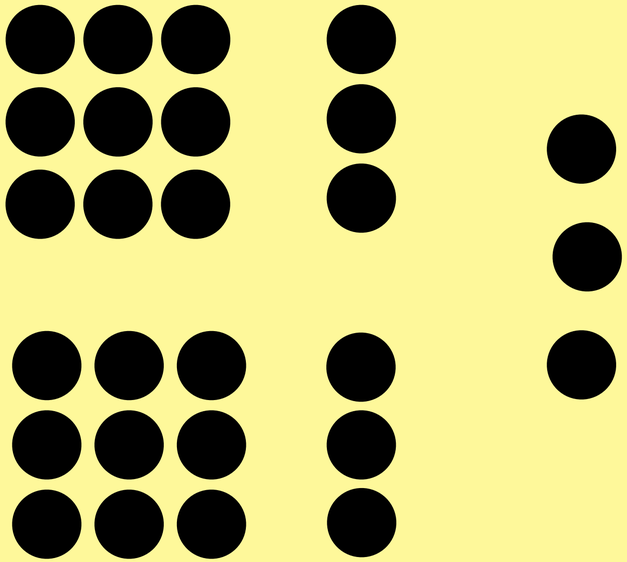
Case 1



Case 2



Case 3



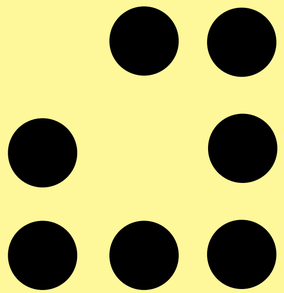
What would an equation be for d, the number of dots,

dependent on n, any case number?

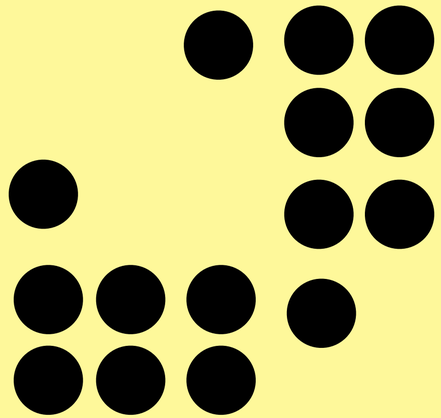
Show the function in some other way

(use a different representation).

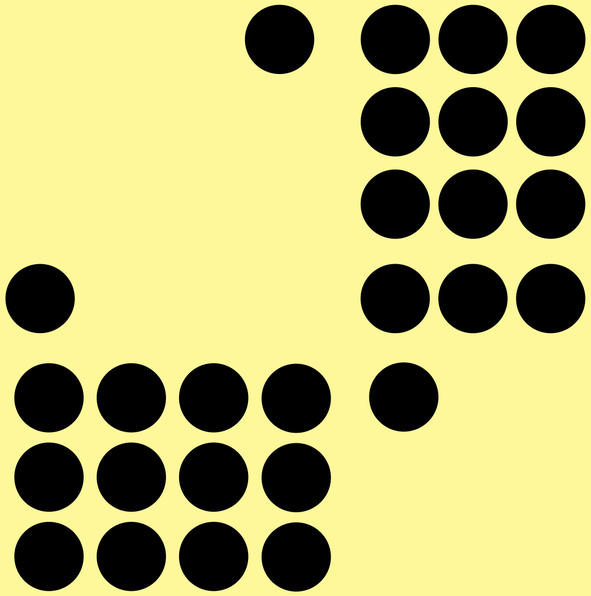
Case 1



Case 2



Case 3

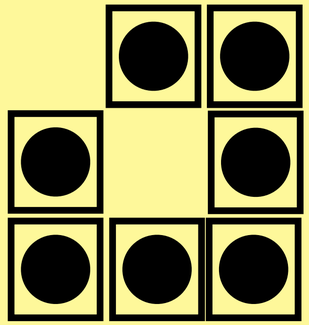


What would an equation be for d, the number of dots,

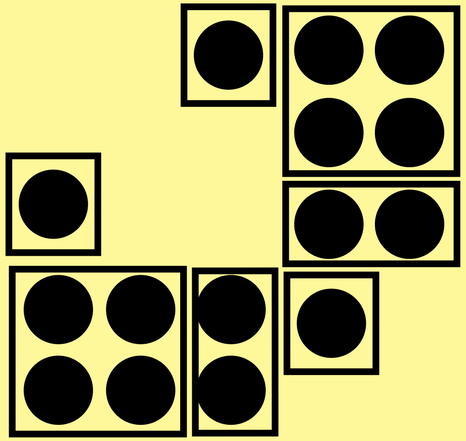
dependent on n, any case number?

Use the rectangles to create a quadratic trinomial expression.

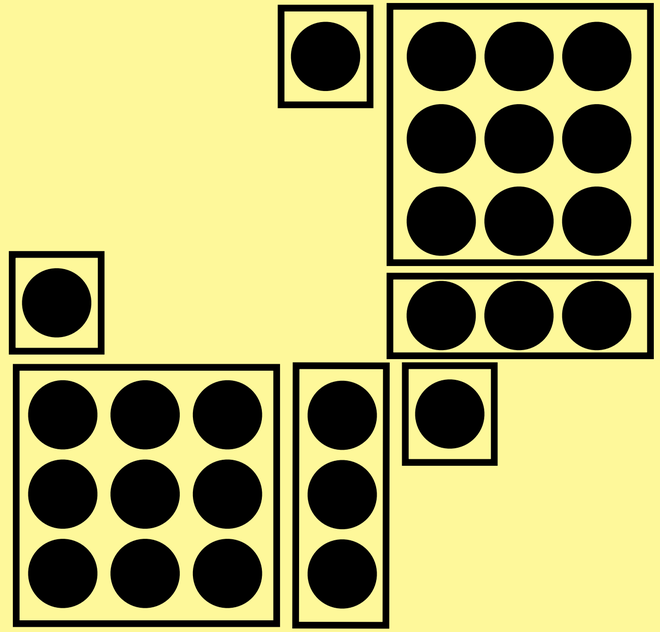
Case 1



Case 2

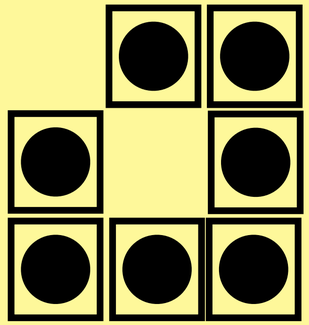


Case 3

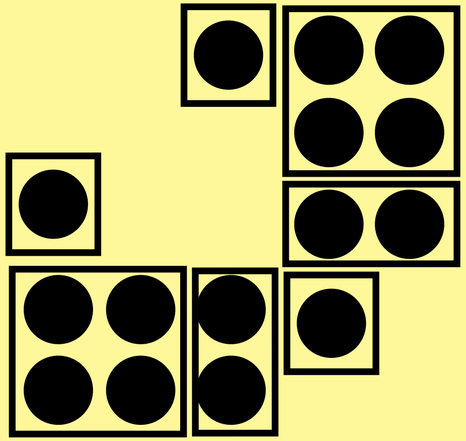


Explain how the rectangles relate to the quadratic trinomial below.

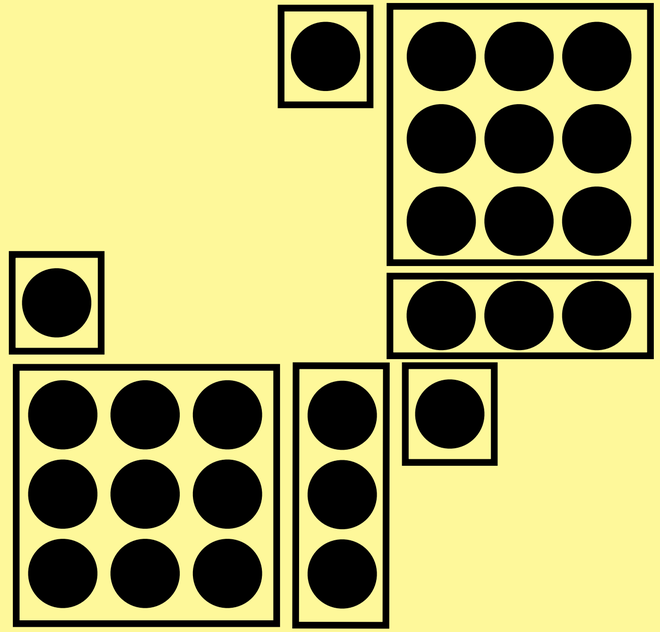
Case 1



Case 2



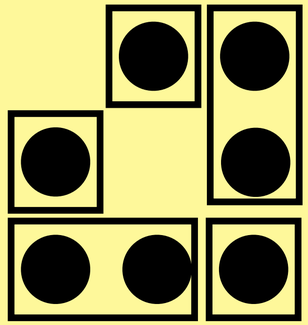
Case 3



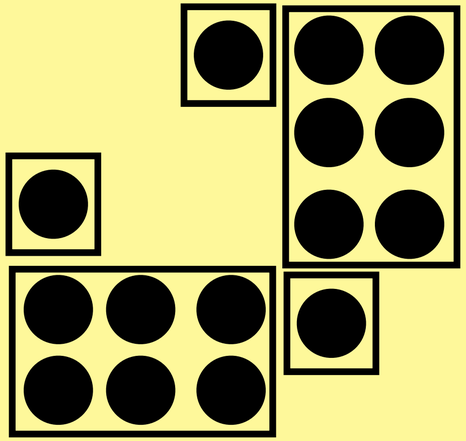
$$2c^2 + 2c + 3$$

Write an expression that describes how the rectangles have been drawn below.

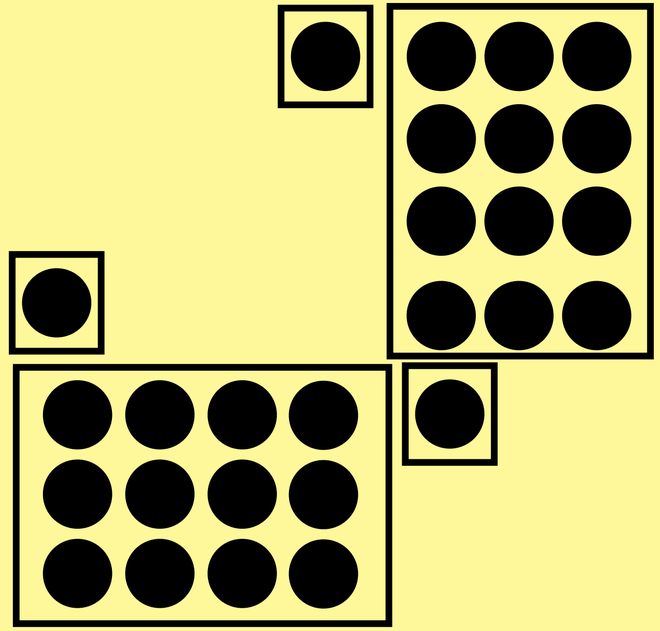
Case 1



Case 2

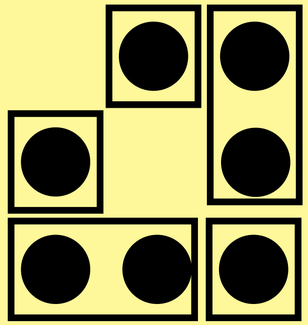


Case 3

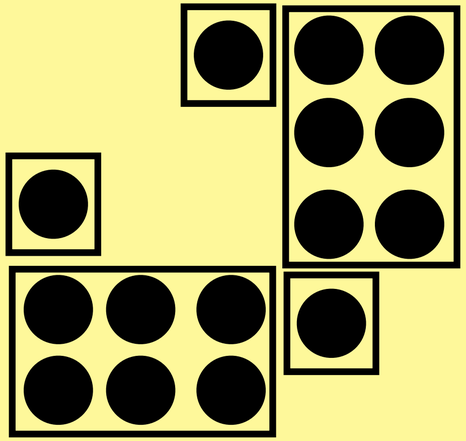


Explain how the rectangles relate to the quadratic expression below.

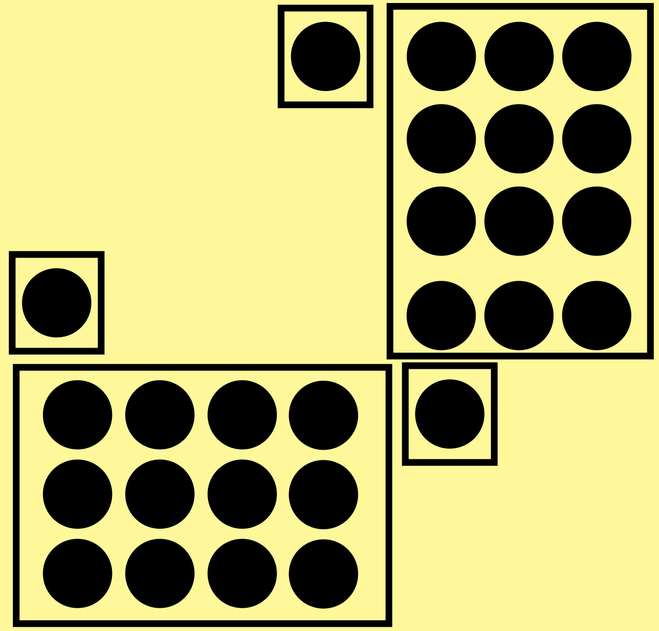
Case 1



Case 2



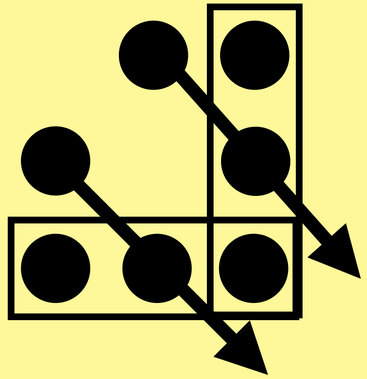
Case 3



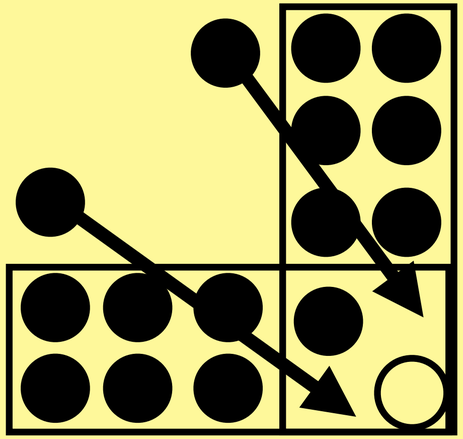
$$2[(c)(c+1)]+3$$

Write an expression that describes how the rectangles have been drawn below.

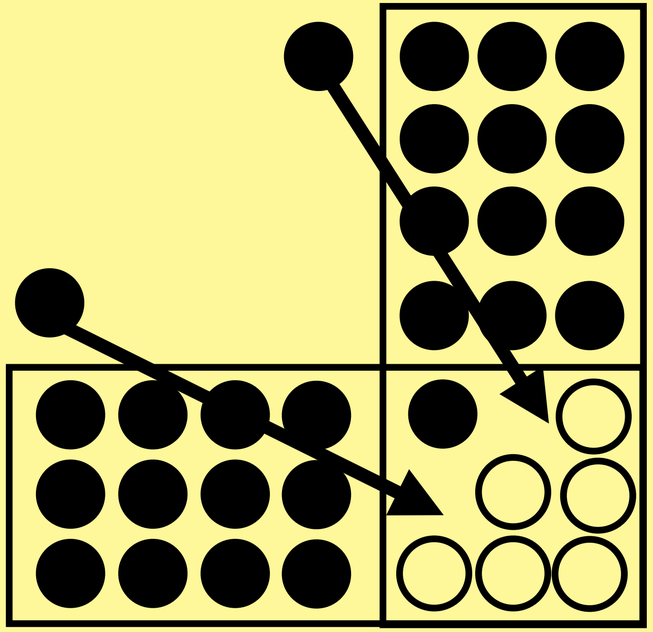
Case 1



Case 2

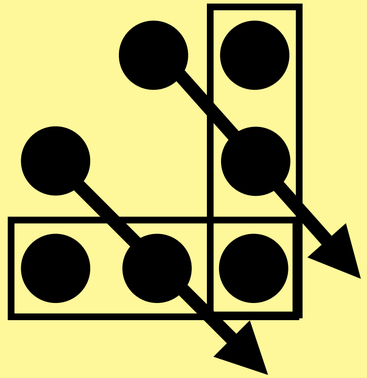


Case 3

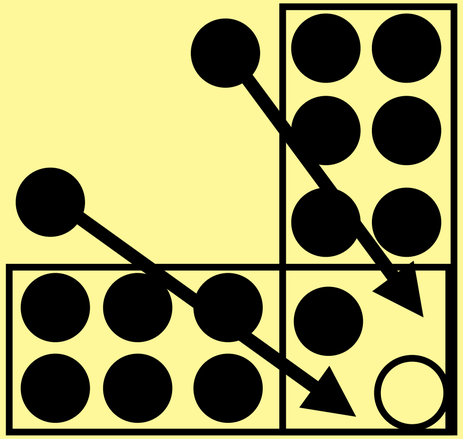


Explain how the rectangles relate to the quadratic expression below.

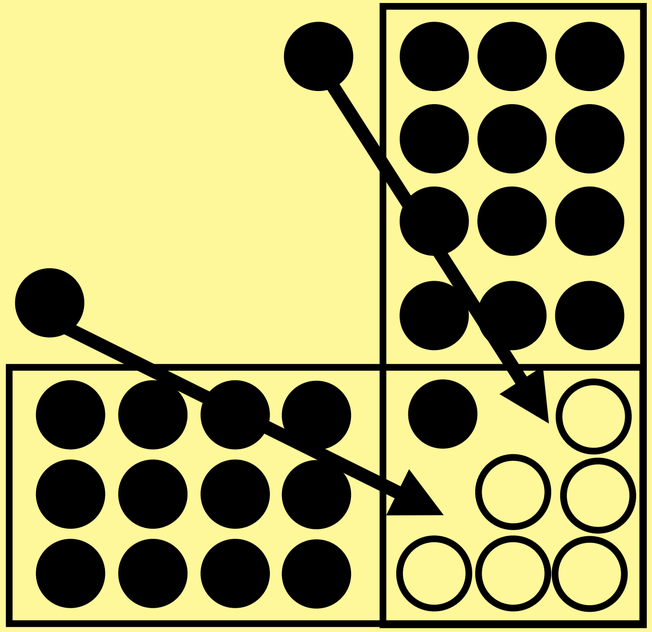
Case 1



Case 2



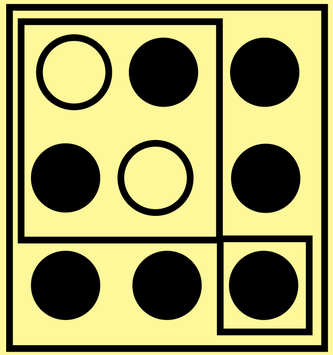
Case 3



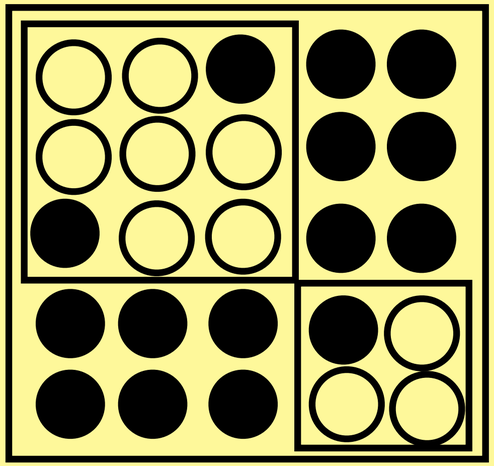
$$2[(c)(c+1+c)]-2c^2+3$$

Write an expression that describes how the rectangles have been drawn below.

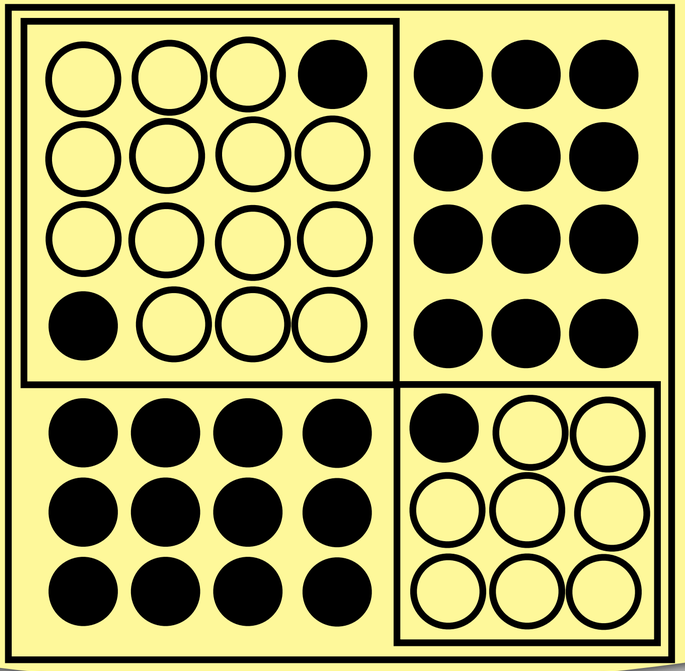
Case 1



Case 2

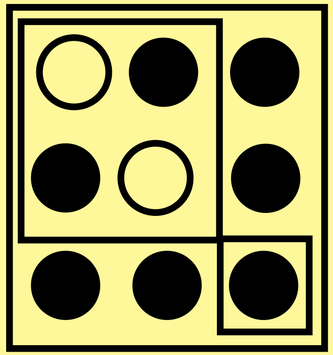


Case 3

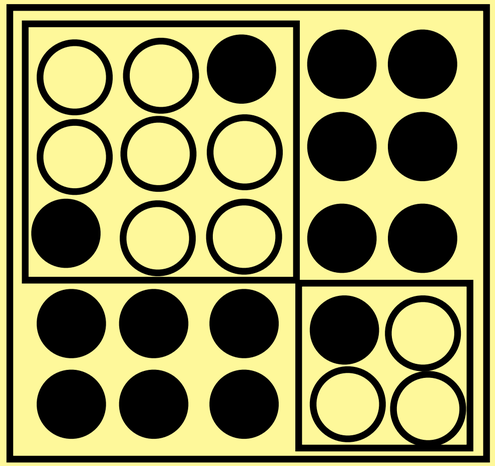


Write an expression that describes how the rectangles have been drawn below.

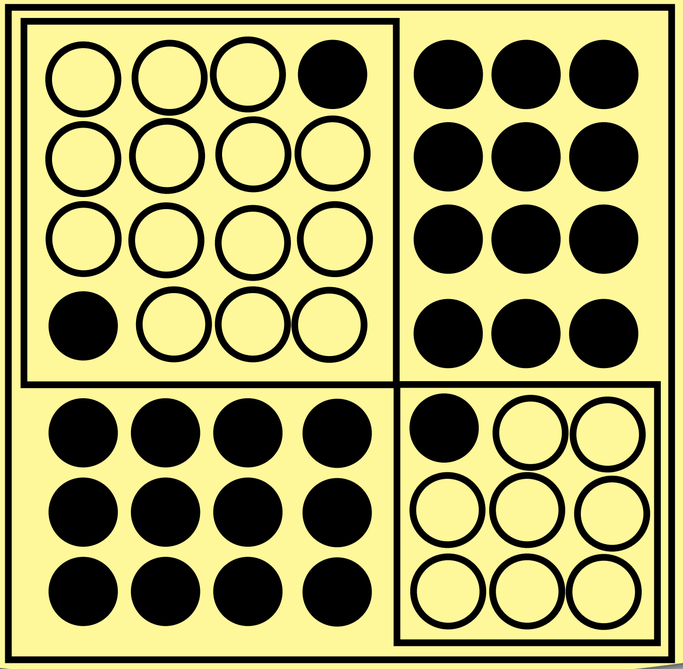
Case 1



Case 2



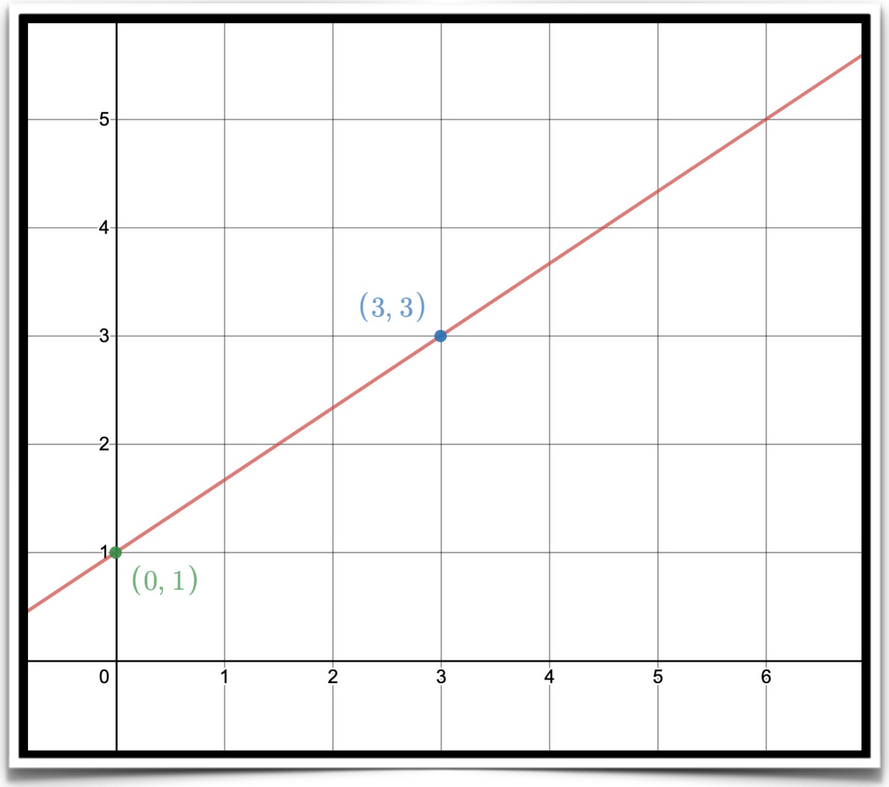
Case 3



$$(2c+1)^2-(c+1)^2+2-(c)^2+1$$

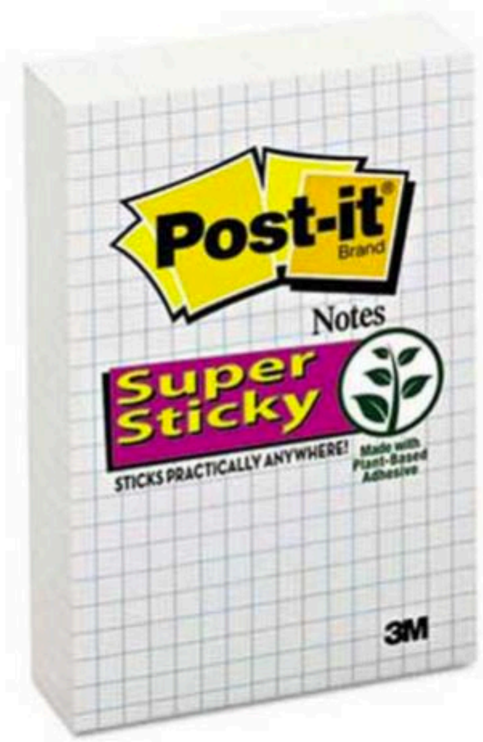
Sticky Math

Graphing

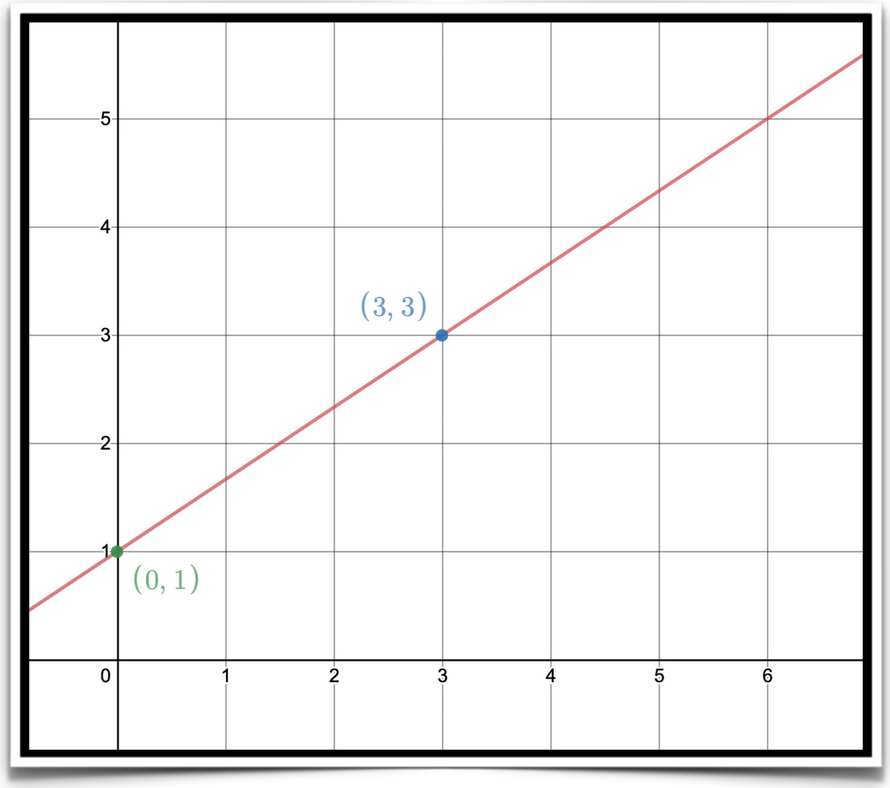


MATH THAT STICKS

Sticky Math



Graphing,
Pairs, Triads,
Comparisons
& Matching

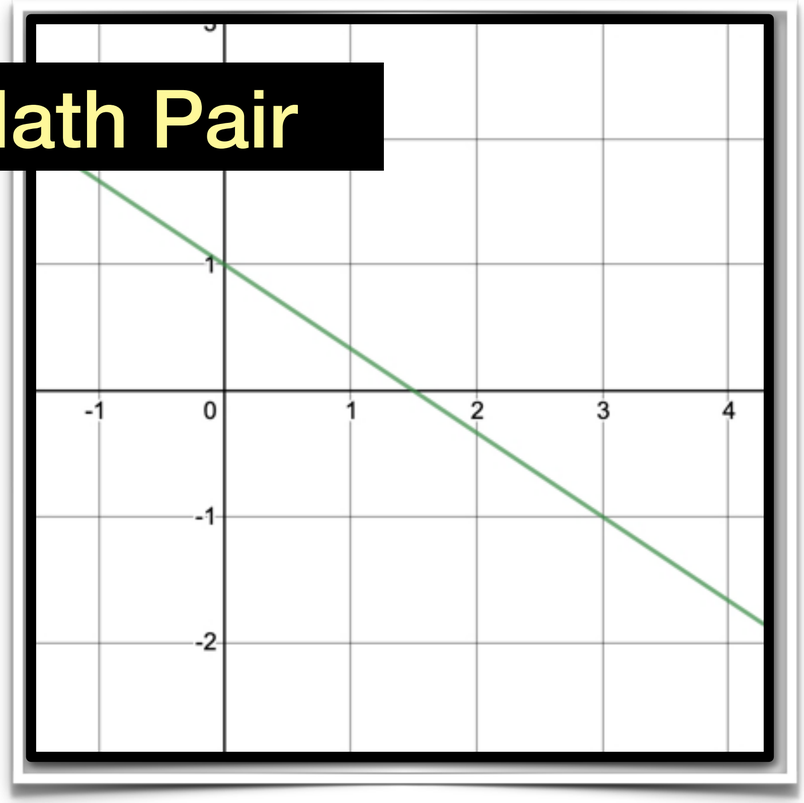


MATH THAT STICKS

Find as many connections as you can between the representations; describe the meaning of any symbols.

Sticky Math Pair

$$y = \frac{-2}{3}x + 1$$



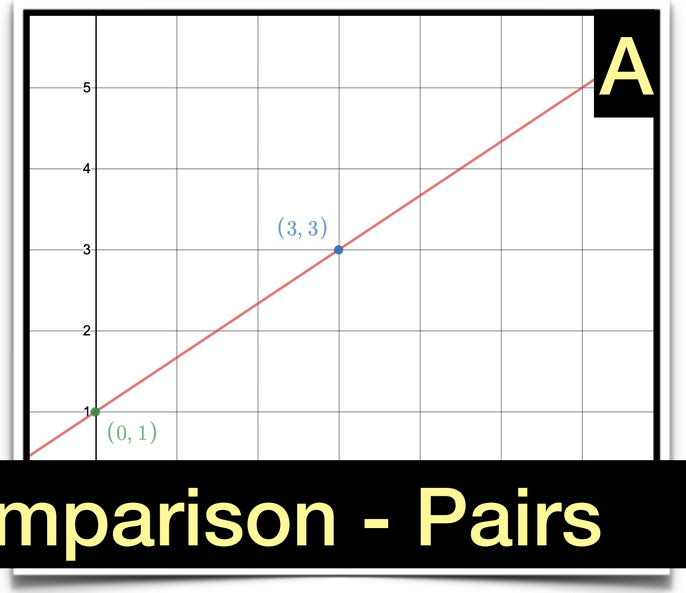
When you finish, create additional representations.

What do you notice when comparing these 2 Sticky Math examples?

Example A

A

$$y = \frac{2}{3}x + 1$$

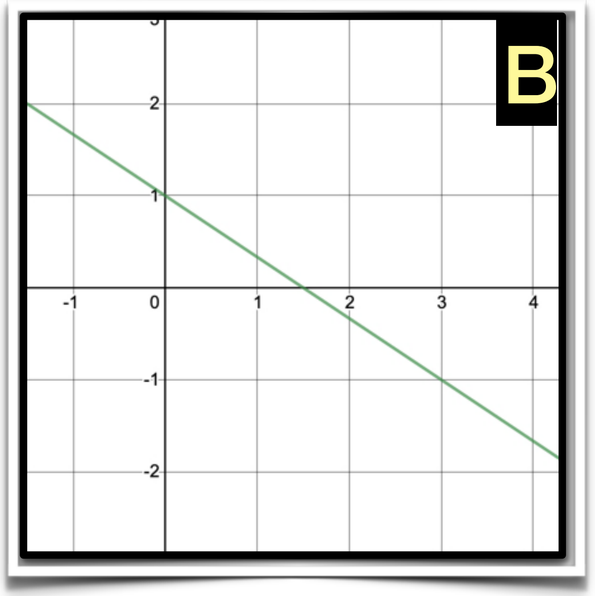


Sticky Math Comparison - Pairs

Example B

B

$$y = \frac{-2}{3}x + 1$$

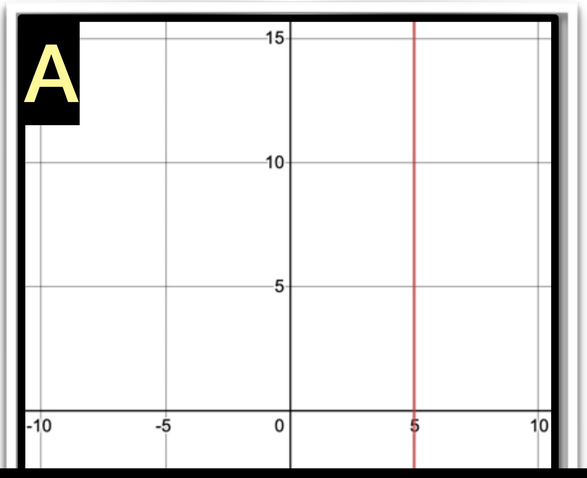


What do you notice when comparing these 2 Sticky Math examples?

Example A

A

$x = 5$



A

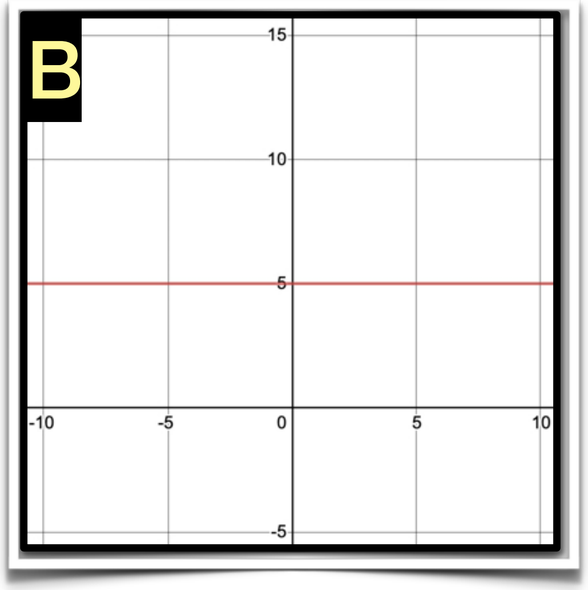
$x = 0y + 5$

Sticky Math Comparison - Triads

Example B

B

$y = 5$



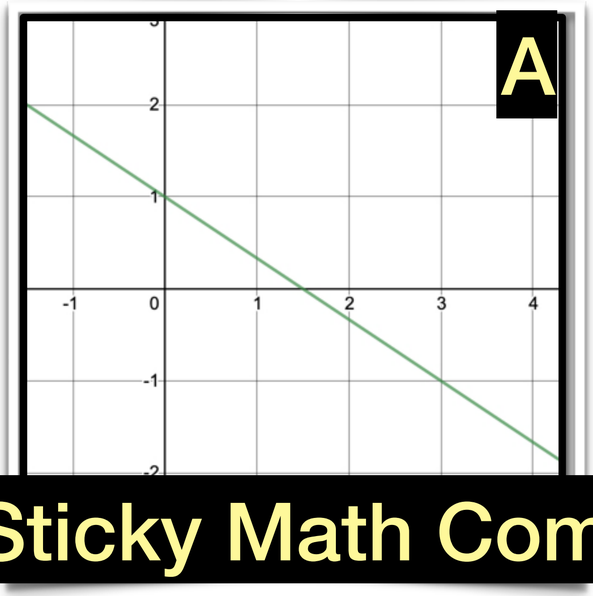
B

$y = 0x + 5$

What do you notice when comparing these 4 Sticky Math examples?

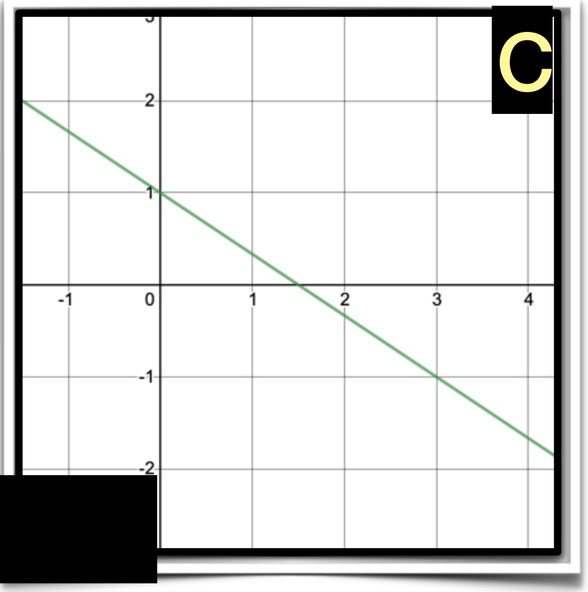
A

$$y = \frac{2}{-3}x + 1$$



C

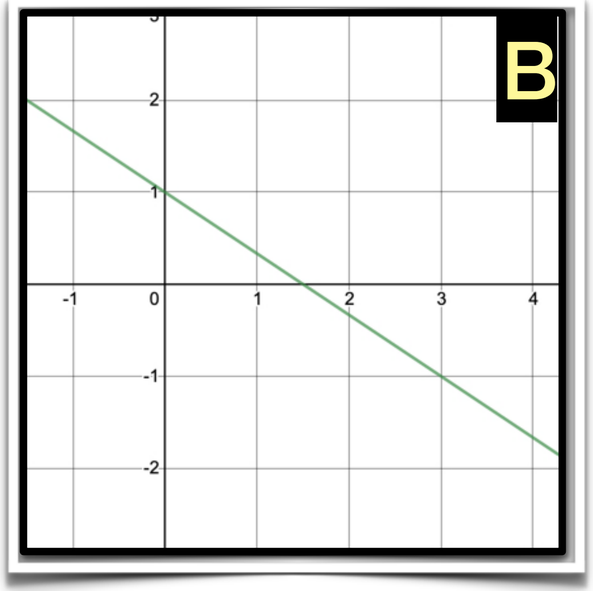
$$y = -\frac{2}{3}x + 1$$



Sticky Math Comparison - 4 Pairs

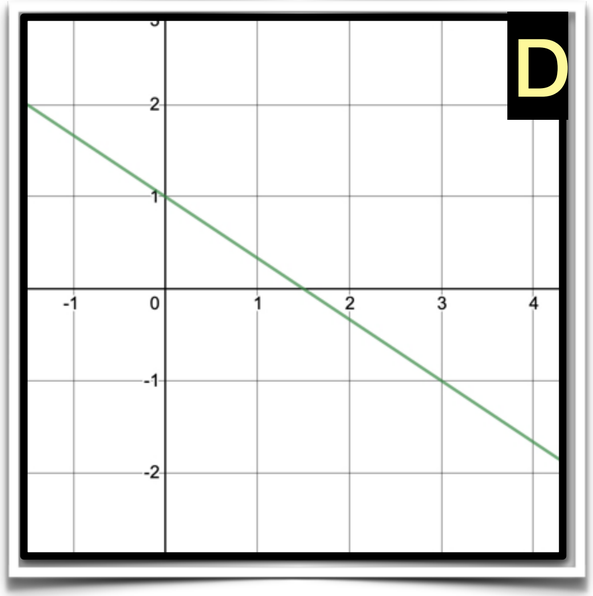
B

$$y = \frac{-2}{3}x + 1$$



D

$$y = \frac{-\frac{2}{3}}{1}x + 1$$

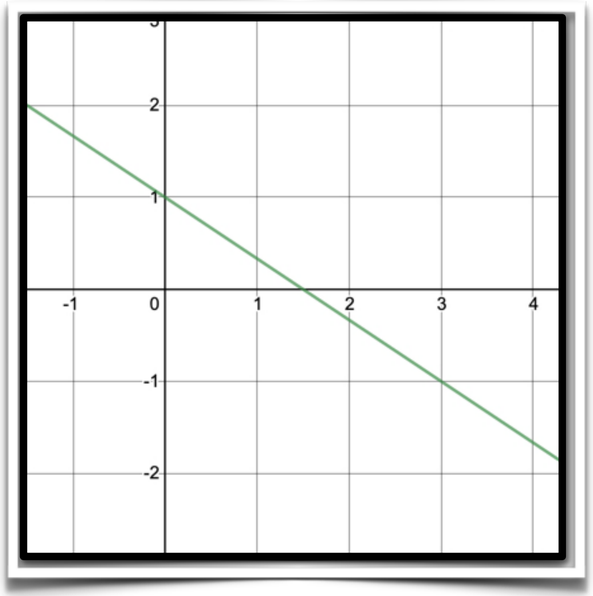


Sticky Math Matching: Use As Is

I started with one dollar. I lost 2/3 of a dollar each day.

x	y
0	1
3	3
6	5
9	7

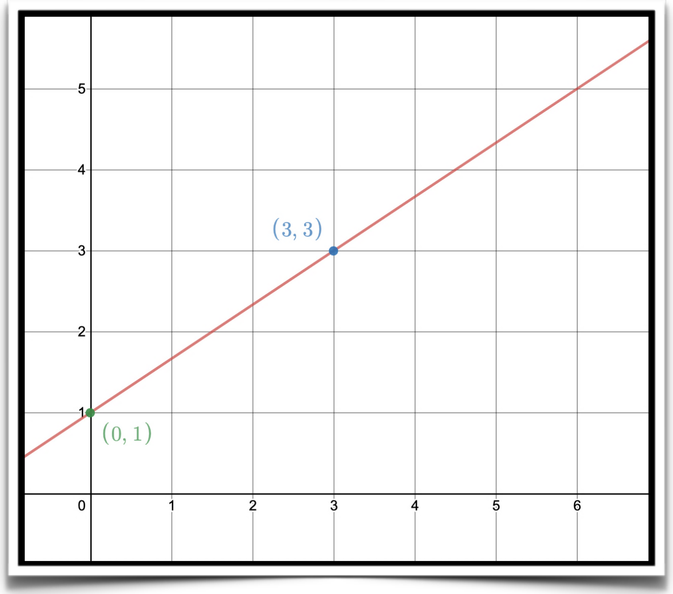
$$y = \frac{2}{3}x + 1$$



$$y = -\frac{2}{3}x + 1$$

x	y
0	1
1	1/3
2	-1/3
3	-1

I started with one dollar. I got 2 dollars every 3 days.



Sticky Math Matching! (Use as is.)

A

$$y = 10x^2$$

$$y = \frac{1}{10}x^2$$

B

$$y = x^2 - 0x$$

$$y = x^2 - 10x$$

C

$$y = x^2 + 0x$$

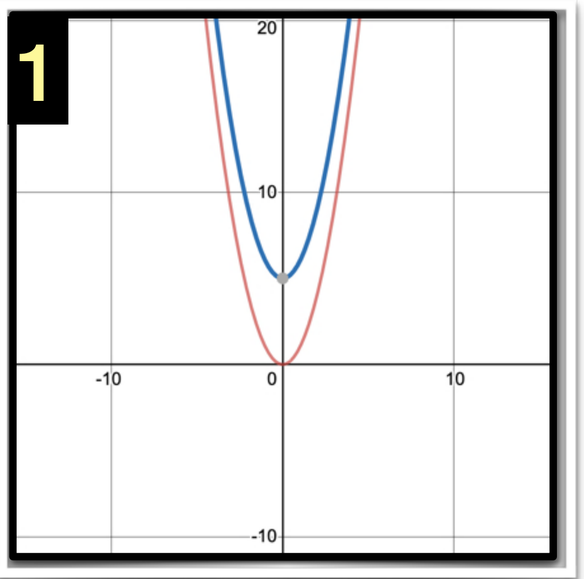
$$y = x^2 + 10x$$

D

$$y = x^2 + 0$$

$$y = x^2 + 5$$

1



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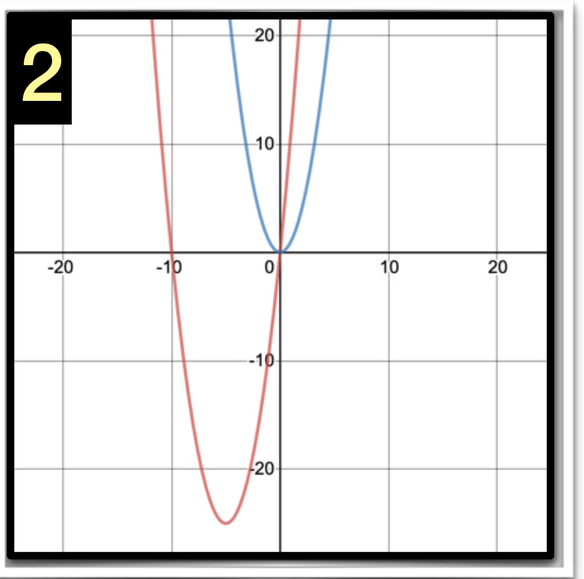

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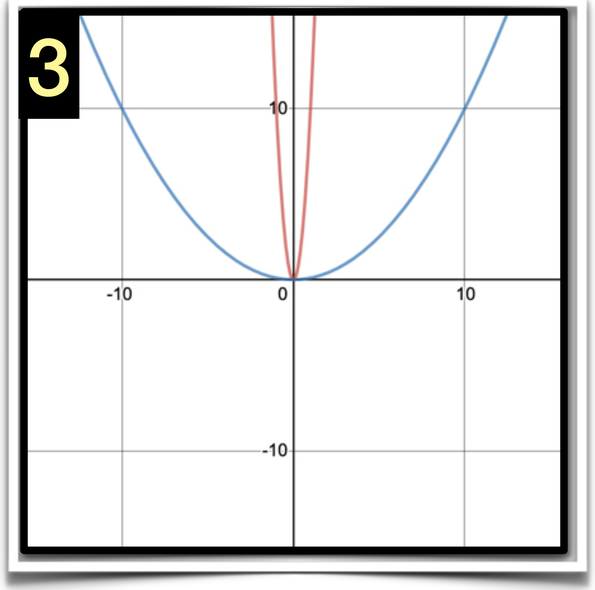

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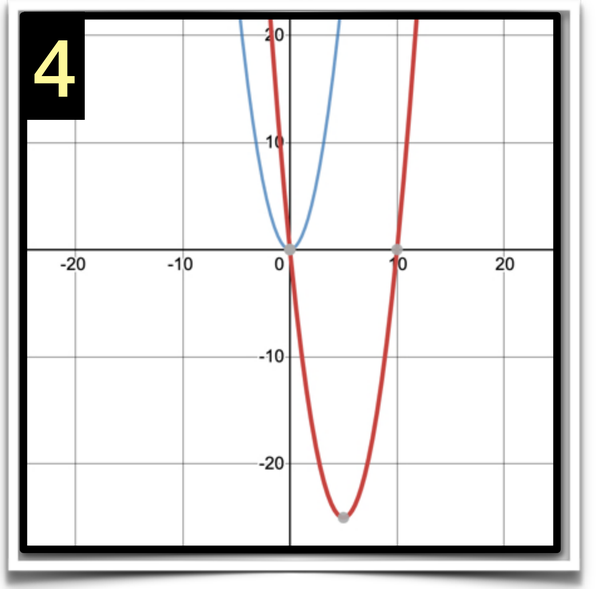


Sticky Math Matching! (Use as is.)

A

$y = 1(x + 5) + 10$

B

$y = 1(x + 5) - 10$

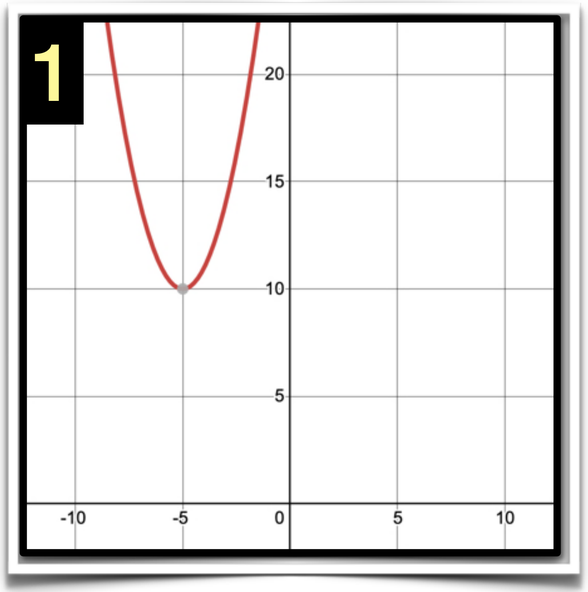
C

$y = 1(x - 5) - 10$

D

$y = 1(x - 5) + 10$

1



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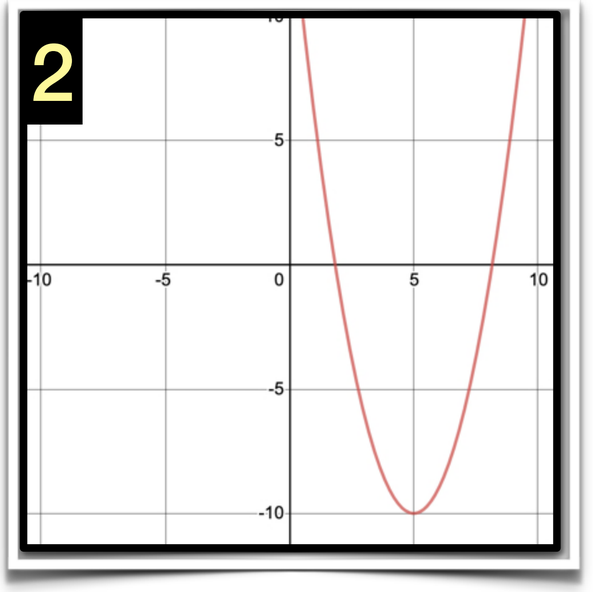

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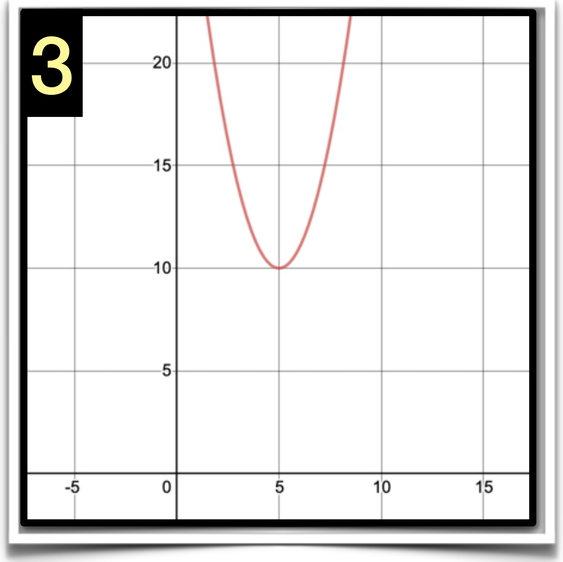

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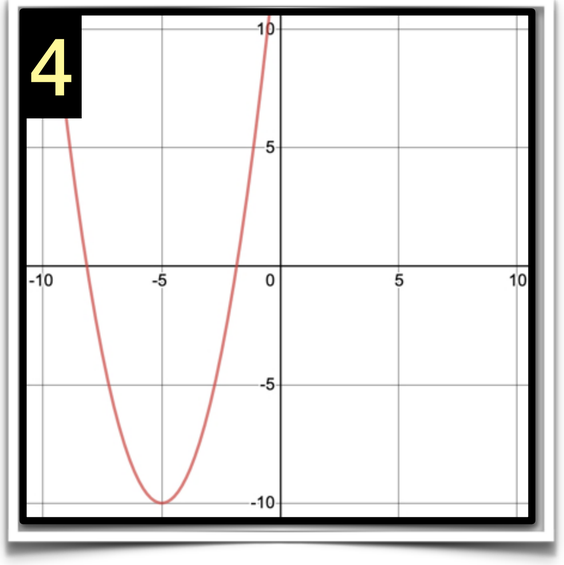


Sticky Math

Effective Mathematics Teaching Practices

For Teachers

MATH THAT STICKS

NCTM's Effective Mathematics Teaching Practices

Establish mathematics goals to focus learning.

Implement tasks that promote reasoning and problem solving.

Use and connect mathematical representations.

Facilitate meaningful mathematical discourse.

Pose purposeful questions.

Build procedural fluency from conceptual understanding.

Support productive struggle in learning mathematics.

Elicit and use evidence of student thinking.

Sticky Math

Standards for Mathematical Practice

For Students

MATH THAT STICKS

Standards for Mathematical Practice

1. Make sense of problems and persevere in solving them.

2. Reason abstractly and quantitatively.

3. Construct viable arguments and critique the reasoning of others.

4. Model with mathematics.

5. Use appropriate tools strategically.

6. Attend to precision.

7. Look for and make use of structure.

8. Look for and express regularity in repeated reasoning.

Sticky Math

stickymath.org

Navigating the Website

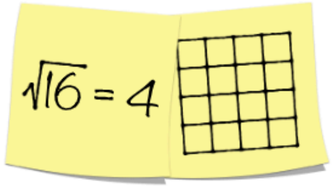
MATH THAT STICKS

Remember the .org!

Choose a grade level...

Not Secure stickymath.org

ABOUT BLOG LESSONS TEMPLATES SPEAKING CONTACT SUBMIT YOUR OWN!



Sticky Math
MATH THAT STICKS

K 1st 2nd 3rd 4th 5th 6th 7th 8th High School

Math that sticks.

Sticky Math develops students' conceptual understanding and procedural fluency without overwhelming their working memory.

Make connections. Deepen understanding. No "math" required.

AS SIMPLE AS MATH GETS

Choose a domain...

Seventh Grade

RATIOS & PROPORTIONAL RELATIONSHIPS

THE NUMBER SYSTEM

EXPRESSIONS AND EQUATIONS

SEVENTH GRADE GEOMETRY

STATISTICS AND PROBABILITY

Ratios & Proportional Relationships

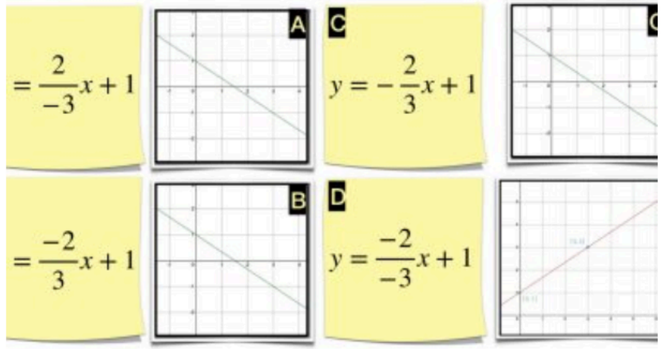
Functions

Blogposts elaborate on how to implement Sticky Math and group sets of stickies into possible full lesson formats.

Which One & Why?

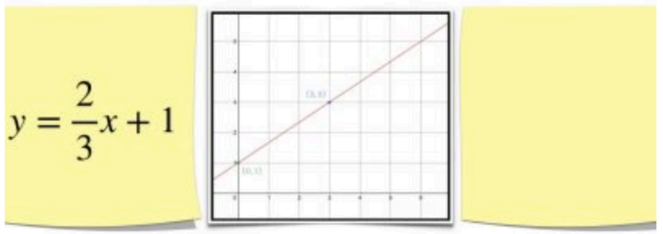
by David Mattoon | Feb 16, 2020 | 6th Expressions & Equations, 7th Expressions & Equations, 8th Functions, HS Functions, HS Structure

Another way to use Sticky Math, which emphasizes constructing a viable argument and provides an opportunity to critique the reasoning of others (MP3).



Negatives in a Slope Fraction

by David Mattoon | Jan 12, 2020 | 8th Functions

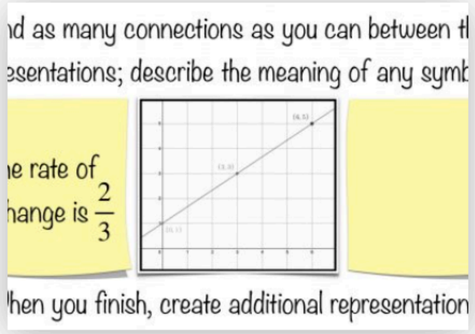


Slope Intercept Form

by David Mattoon | Jan 11, 2020 | 8th Functions

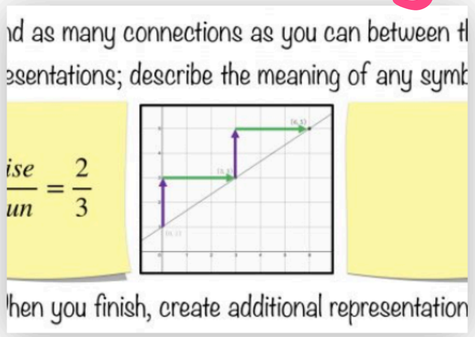
Expressions & Equations

Click on any image in the gallery to see it full screen or present it digitally to students.



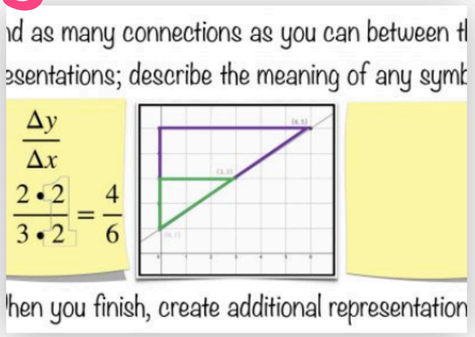
Rate of Change

David Mattoon



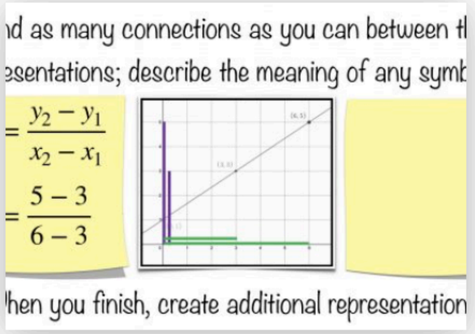
Rise over Run

David Mattoon



Change in y over Change in x

David Mattoon



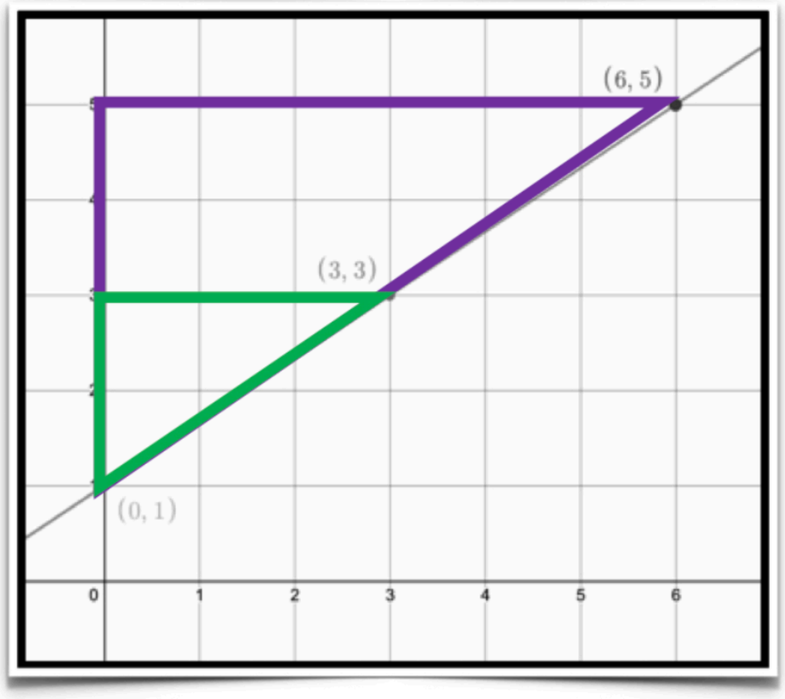
Slope Formula

David Mattoon

Find as many connections as you can between the representations; describe the meaning of any symbols.

$$\frac{\Delta y}{\Delta x}$$

$$\frac{2}{3} = \frac{2 \cdot 2}{3 \cdot 2} = \frac{4}{6}$$



Move back & forth between full screen activities.

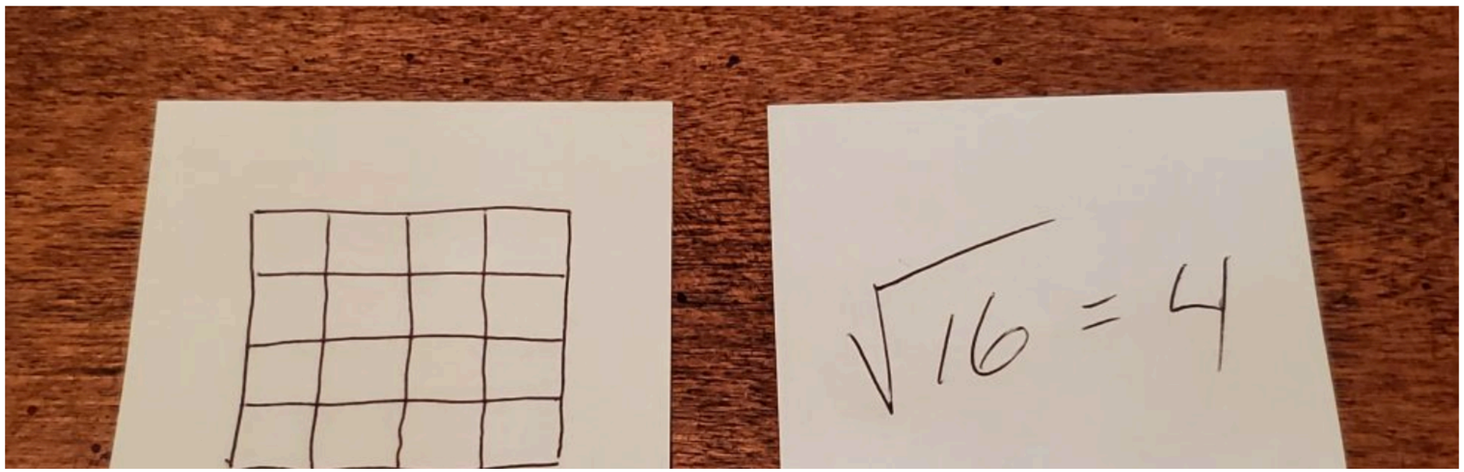
When you finish, create additional representations.

Find the newest lessons.

Which One & Why?

by David Mattoon | Feb 16, 2020 | 6th Expressions & Equations, 7th Expressions & Equations, 8th Functions, HS Functions, HS Structure

Common Core Standards (different examples support different standards): 6.EE.A.2, 7.EE.A.1, 8.F.A.2, 8.F.A.3, HSA.SSE.A.1.A, HSF.IF.B.4 Besides using Sticky Math to compare two different representations or match representations, you could provide two nonequivalent...



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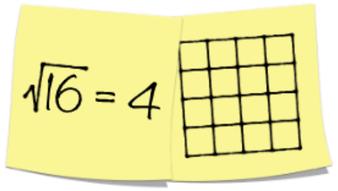


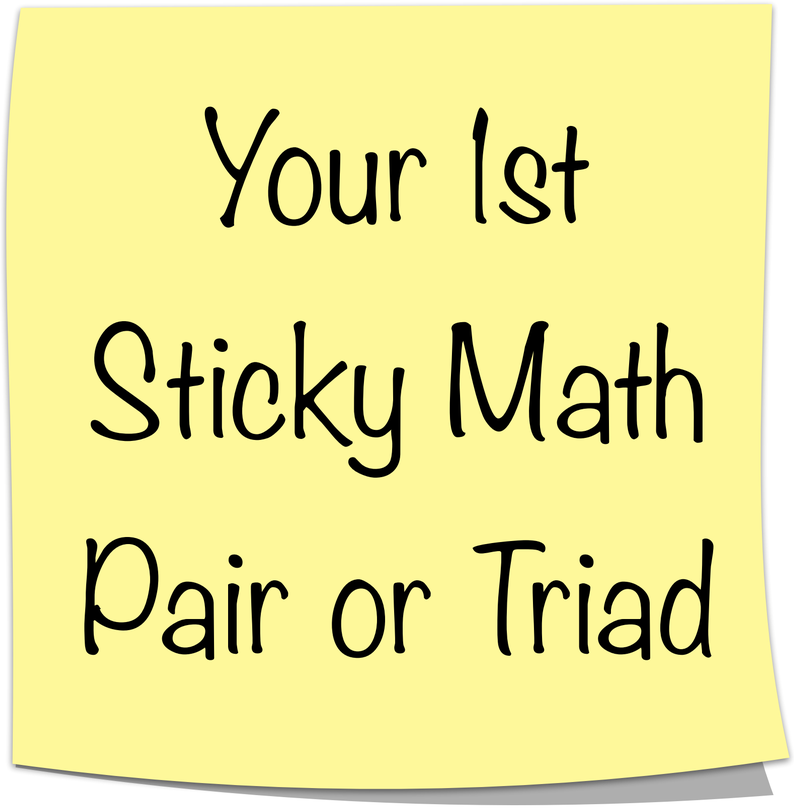
Sticky Math
MATH THAT STICKS

K 1st 2nd 3rd 4th 5th 6th 7th 8th High School

Pairs / Triads Weekly Warmup Recording Sheet

Comparison Recording Sheet (2 Days + Compare)

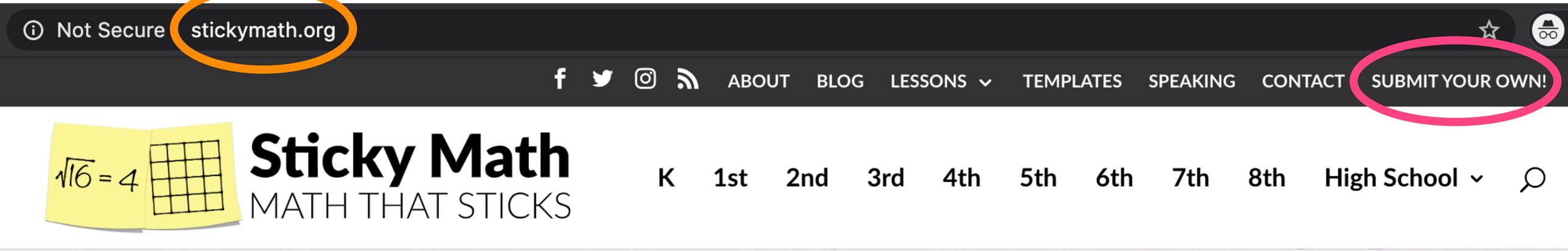
Sticky Math



MATH THAT STICKS

Remember the .org!

Upload pictures, pdfs, docs...



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MATH THAT STICKS

Sticky Math

David
Mattoon

david@stickymath.org

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Eval

Session 2:
Connection &
Structure to
Build Fluency

SESSION EVALUATION