REASONING ROUTINES

SURN Math Days
October 2022

CTLG Consulting

WILLIAM & MARY
MATH DAYS
— MOVING BEYOND: RECLAIMING BEST PRACTICE —

Skip Tyler
@SkipTylerMath
skipt@ctlgconsulting.com

Which gif best describes how you are feeling?

A

B

C

D

E

F

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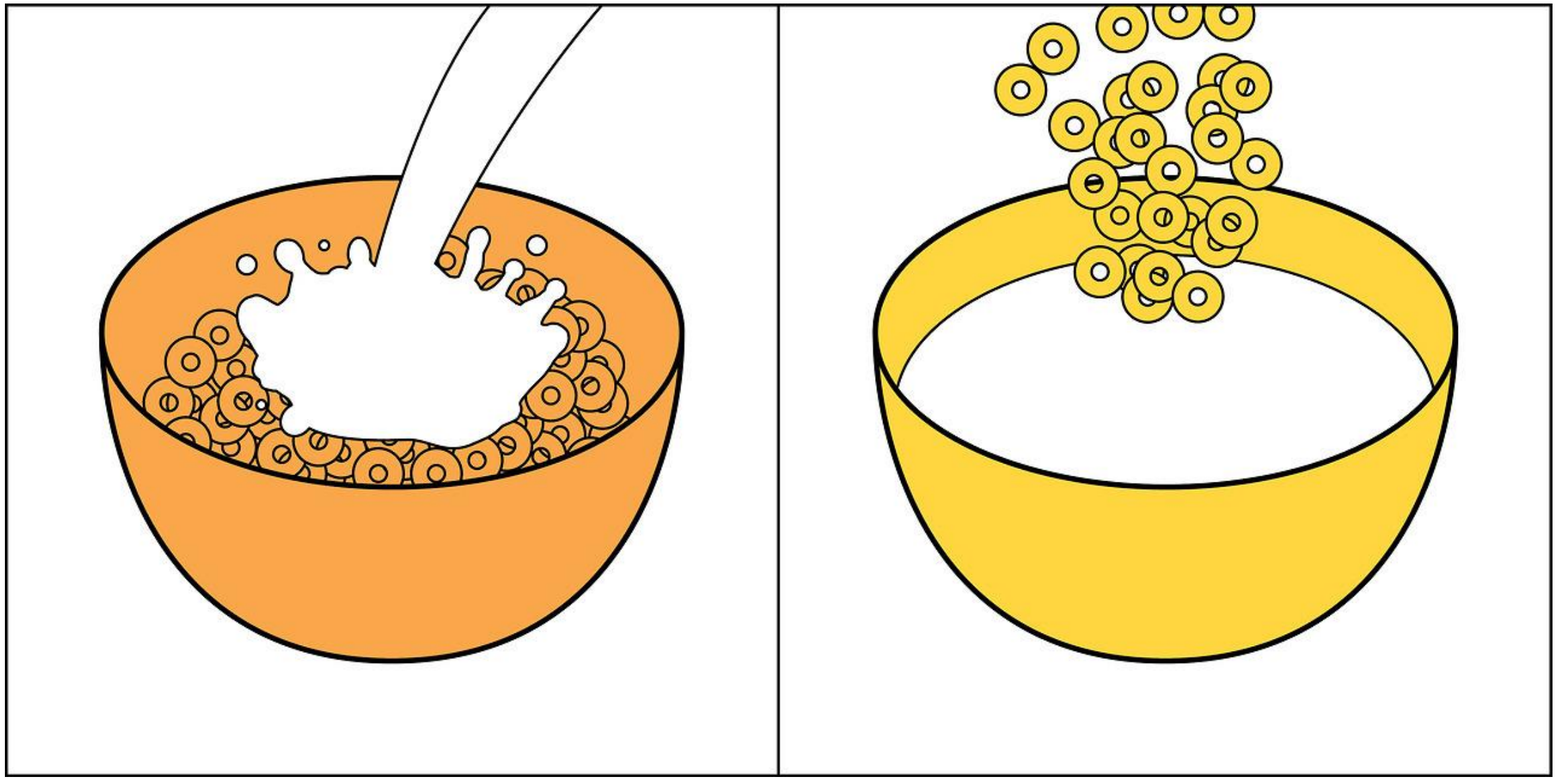
Skip Tyler
@SkipTylerMath
SkipTylerMath@gmail.com

REASONING ROUTINE

2 Kinds of People



LEARNING INTENTIONS

- Engage in a variety of High-Yield Reasoning Routines
- Gain awareness of different ways to formatively assess student understanding

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SUCCESS CRITERIA

- I will be able to use math talk moves to increase student discourse
- I will be able to find, modify, and create High-Yield Reasoning Routines to use in my classroom

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Elementary

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TRADITIONAL MATH LESSON STRUCTURE

5 minutes	**Warm Up**
20 minutes	**Student Independent Practice** Students attempt to solve problems in the same way the teacher solved them. The teacher walks around the room monitoring the students.
5 minutes	**Assign Homework**

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HAND SIGNALS & MATH TALK

When you come up with the same solution or strategy as another mathematician, silently signal **"Me too!"** to let other mathematicians know that you agree with them!

When you're solving a math equation in your brain, and you've already thought of two ways to find the solution, silently signal for **"I have the solution and one strategy!"** while other mathematicians continue to think!

When you're solving a math equation in your brain, and you've already thought of two ways to find the solution, silently signal for **"I have the solution and two strategies!"** then continue to think of additional strategies while other mathematicians also continue to think!

..... You can always add additional fingers as you come up with more and more strategies to find the solution! You're an amazing mathematician! .....

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SENTENCE STARTERS

Another idea I had was...	I was confused (wondering) about...	How or why did you…?	I agree with _____ because...
I have a different way to explain...	I have the same answer, but my explanation/strategy is...	Your answer/strategy reminds me of...	I disagree with _____ because...
Can you explain more about...	I have a different answer because...	One thing that I like about your answer is...	Your idea and my idea are similar because...
Your idea and my idea are different because...	I like how you used the math vocab, _____to explain it.	Instead of _____ , you can use the math word _____ to explain.	I would like to add on to that idea...

NUMBER TALKS & NUMBER STRINGS

8 + 2

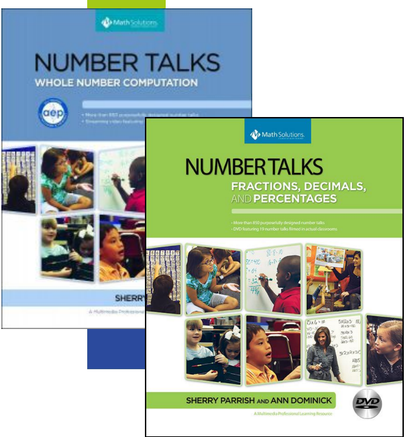
8 + 2 + 11

8 + 13

6 x 10

6 x 5

6 x 15



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TODAY'S NUMBER

$\frac{3}{4}$

TODAY'S NUMBER

Four consistent types of representations used across grade levels

- Composing/decomposing
- Representing relationships to other numbers
- Representing mathematics in the world
- Using models

$\frac{3}{4}$

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MYSTERY NUMBER

- My number has two digits.
- You say my number when you count by tens.
- My number is more than 20.
- My number is one less than 31.

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MYSTERY NUMBER

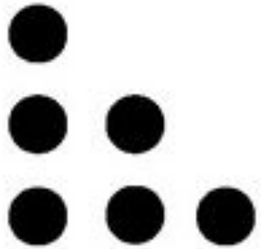
- My number is a multiple of 6.
- My number has six factors.
- My number is less than 5 x 5.
- When the digits of my number are added, they have a sum of 9.

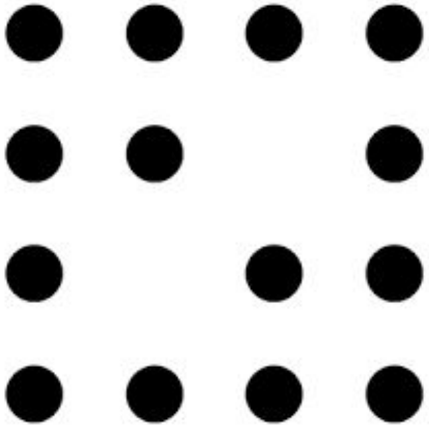
CLUES FOR 32

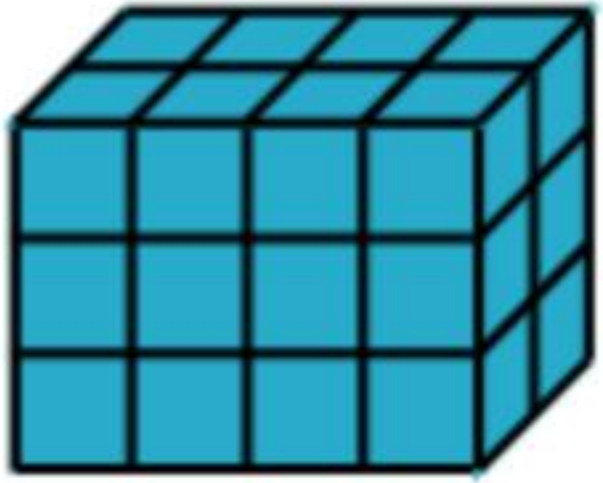
1. The number is even
2. It is after 31 and before 33
3. There is a 2 in the ones colome
4. There is a 3 in the tens colome

1. It is in the 30's.
2. It is an even number.
3. It has a 2.
4. It has a 3.

QUICK IMAGE

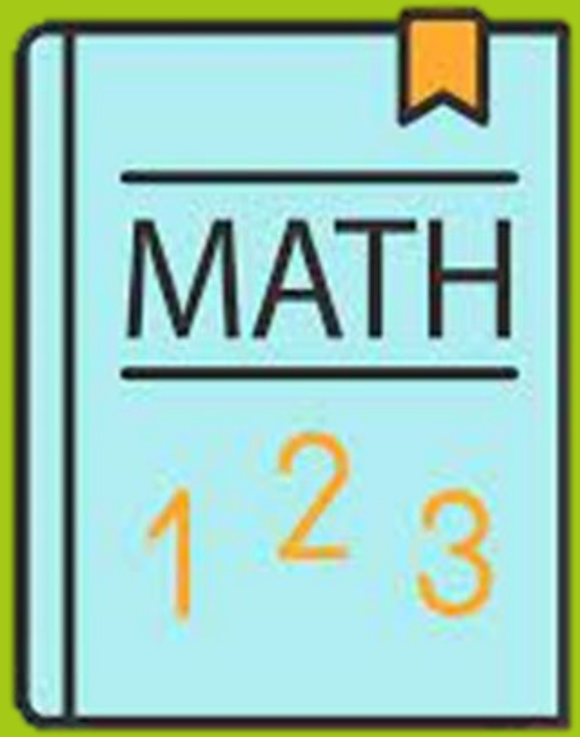






[Number Talk Images]

ALIKE AND DIFFERENT



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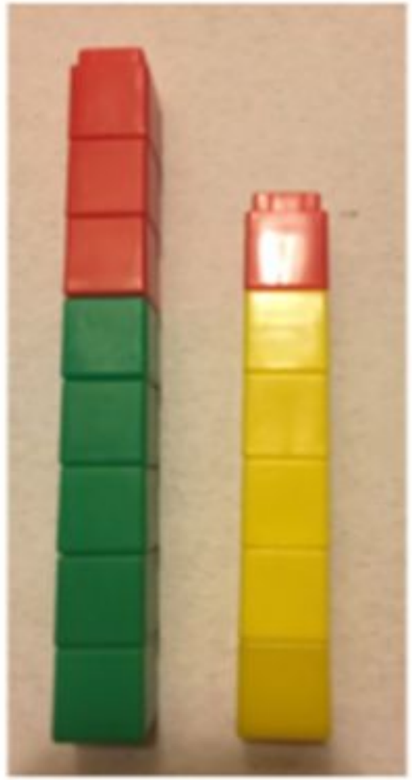
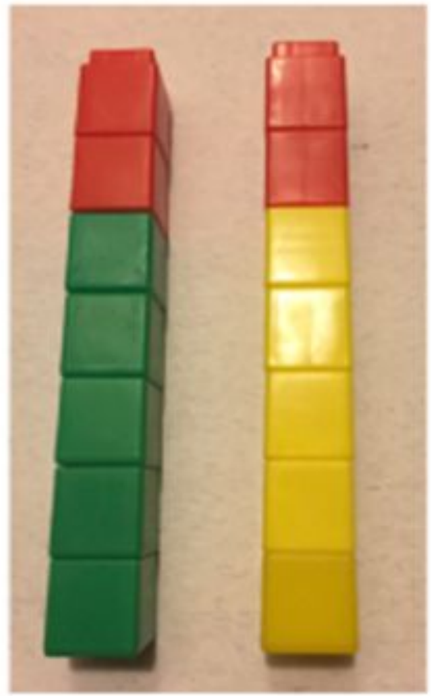
ALIKE AND DIFFERENT

CTLG Consulting

ALIKE AND DIFFERENT





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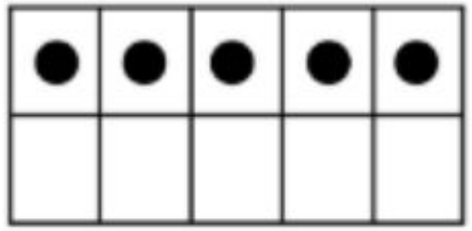

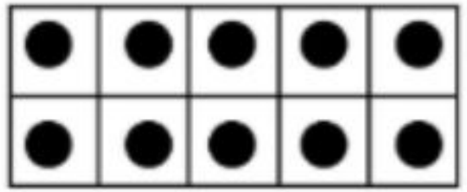

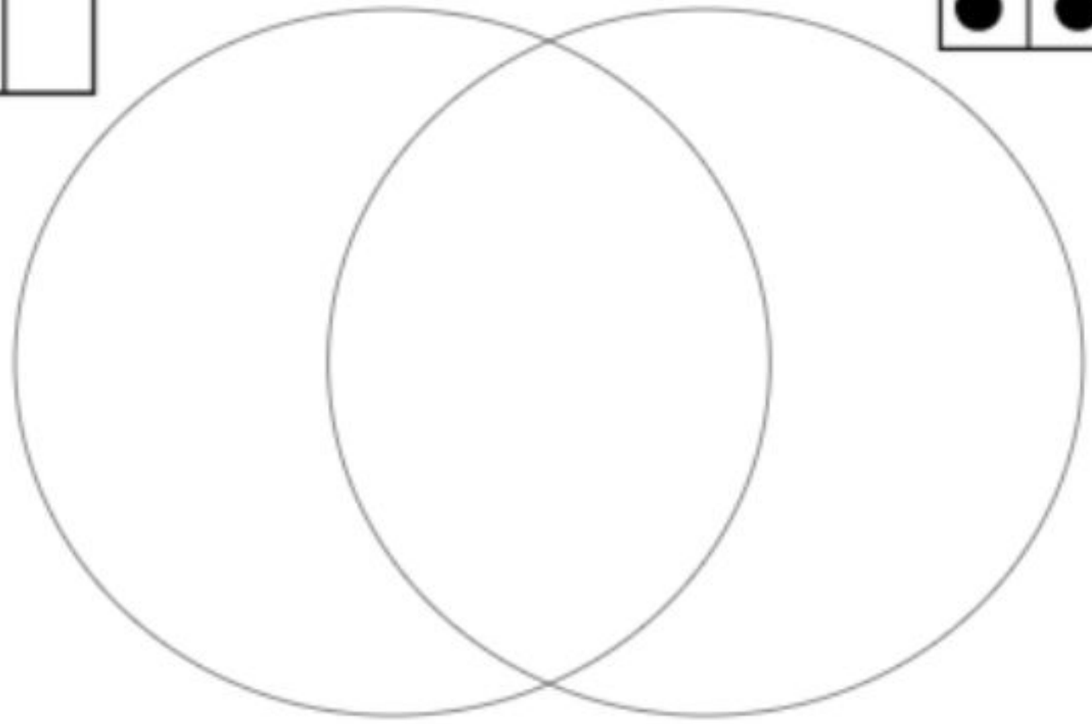

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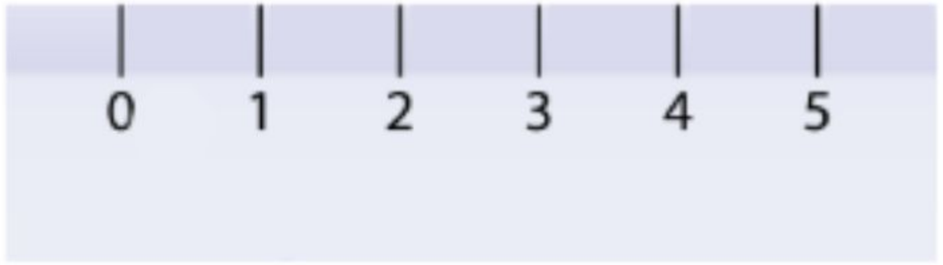

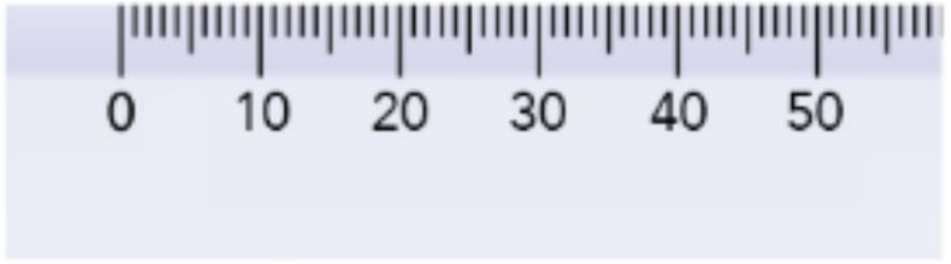

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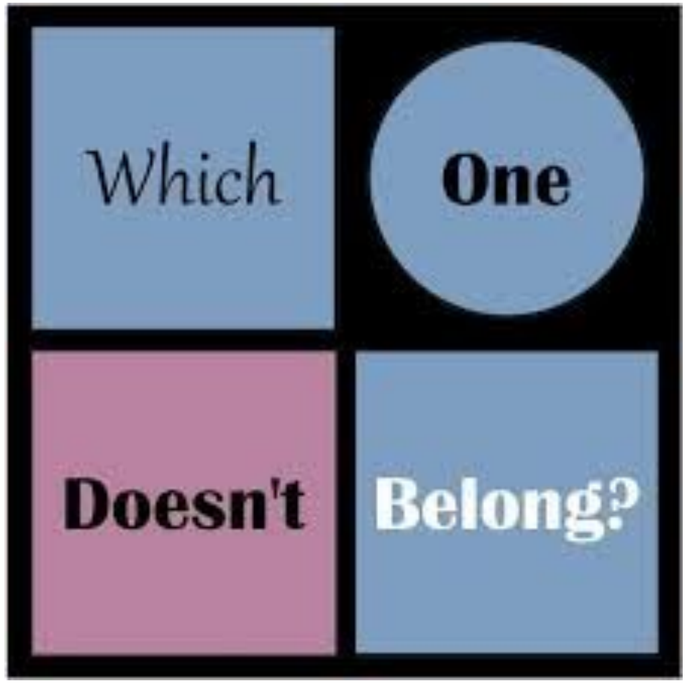
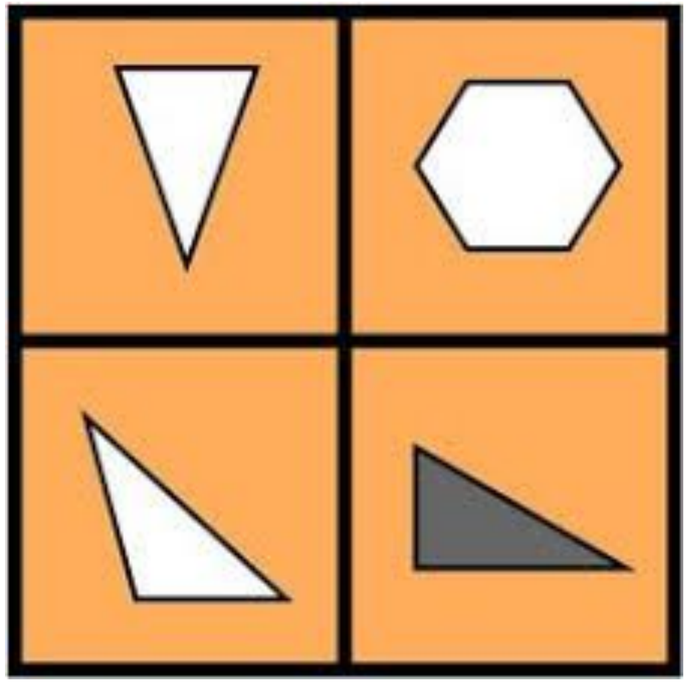
WHICH ONE DOESN'T BELONG



9	25
16	43



http://wodb.ca/index.html

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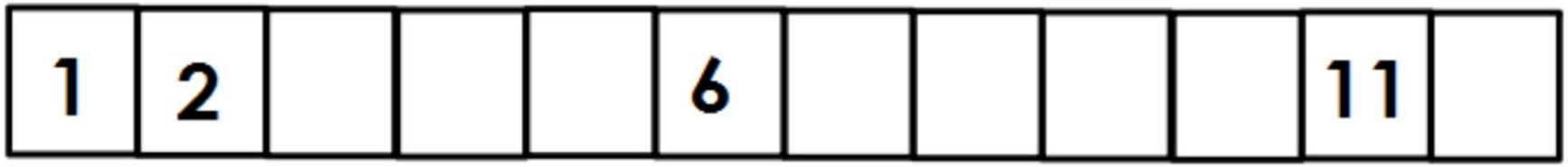
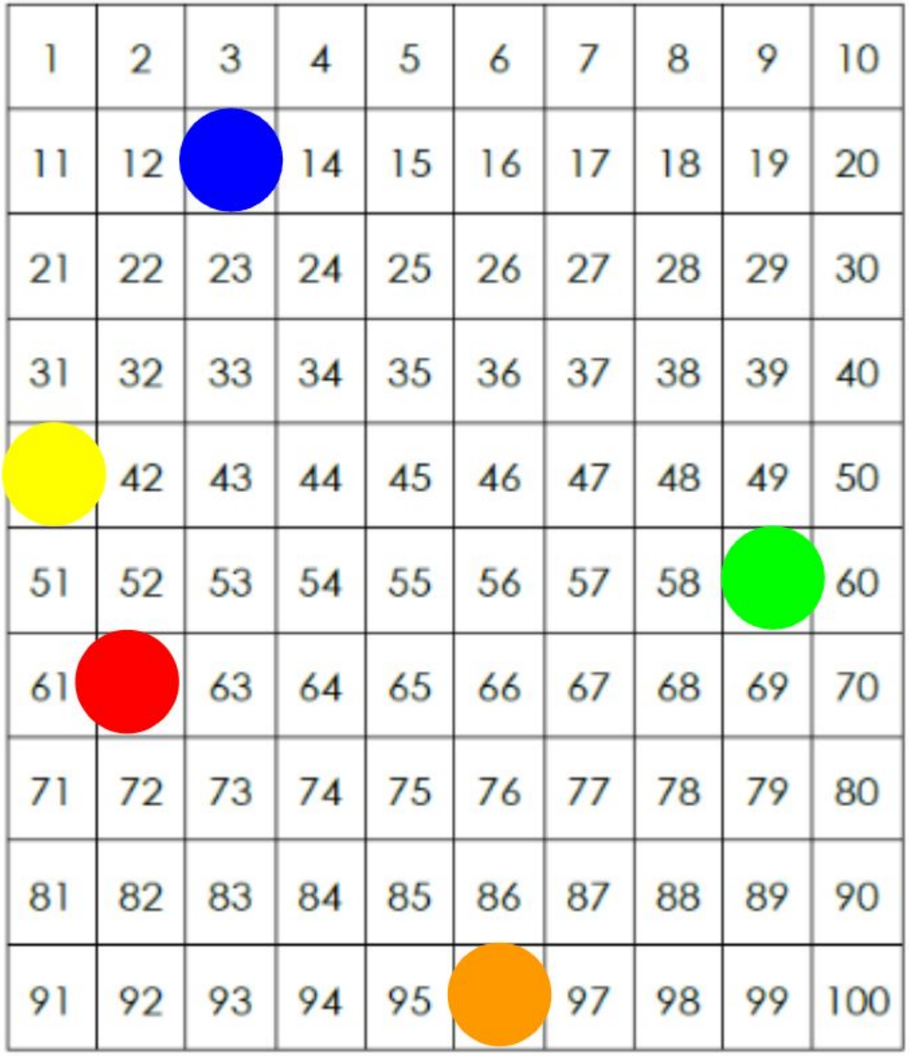
NUMBER LINES



NUMBER LINES



1	2	3	4	5	6	7	8	9	10
11	12		14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58		60
61		63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95		97	98	99	100

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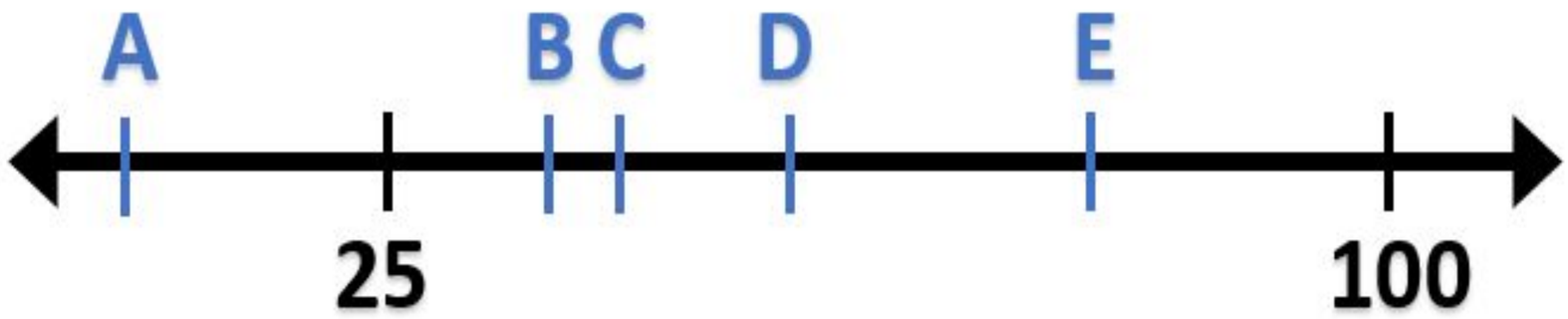
NUMBER LINES

What numbers could represent each of the letters and why?

Where is 75? Where is 400? How far apart are A and B?



[Clothesline Number Lines]

[Clothesline Math]
Estimation180.com

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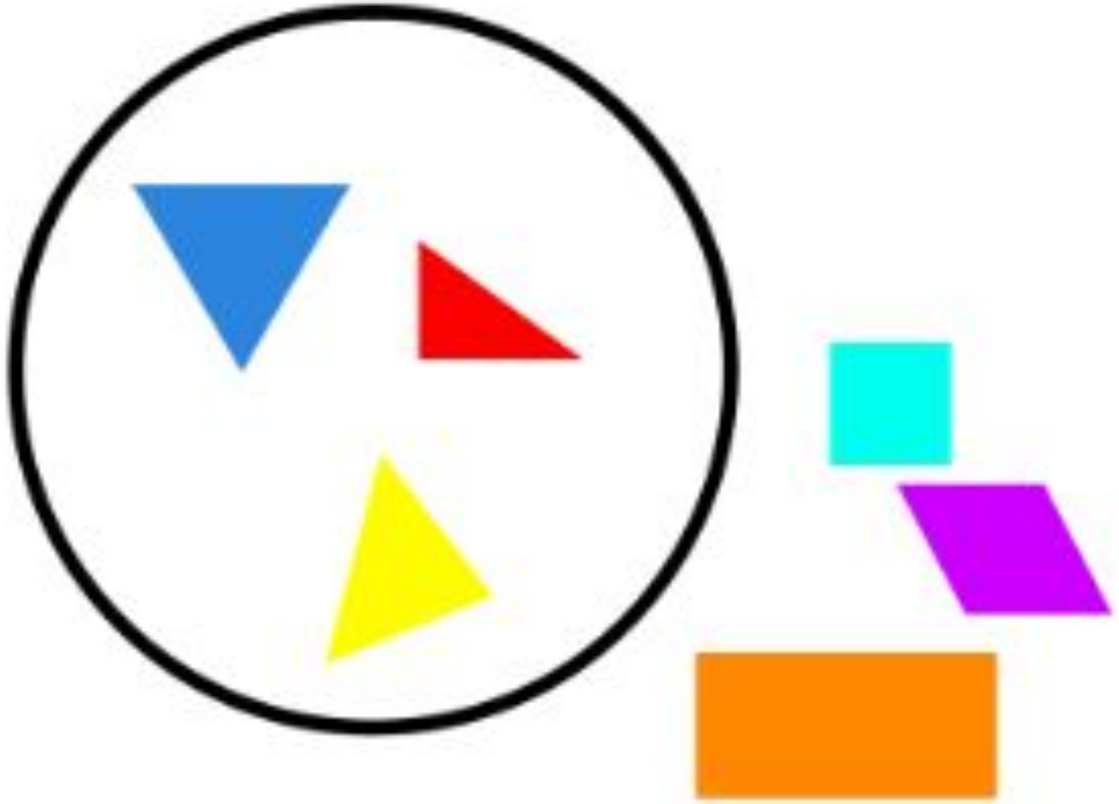
GUESS MY RULE



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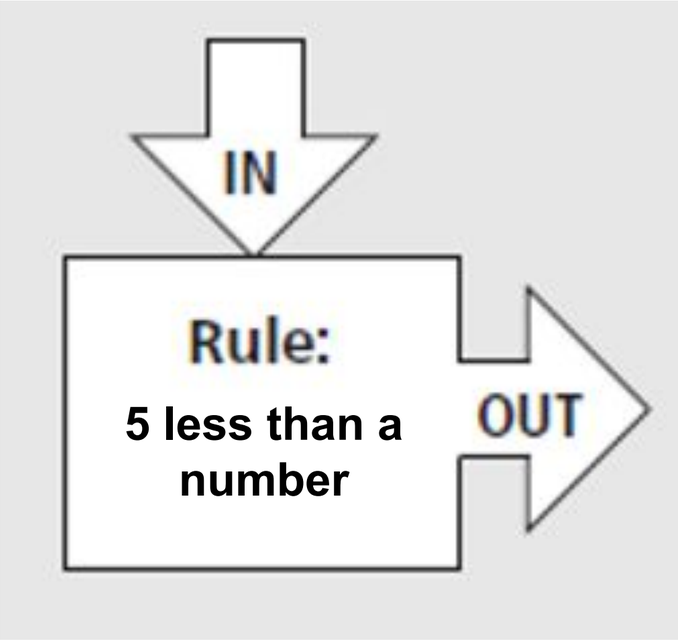

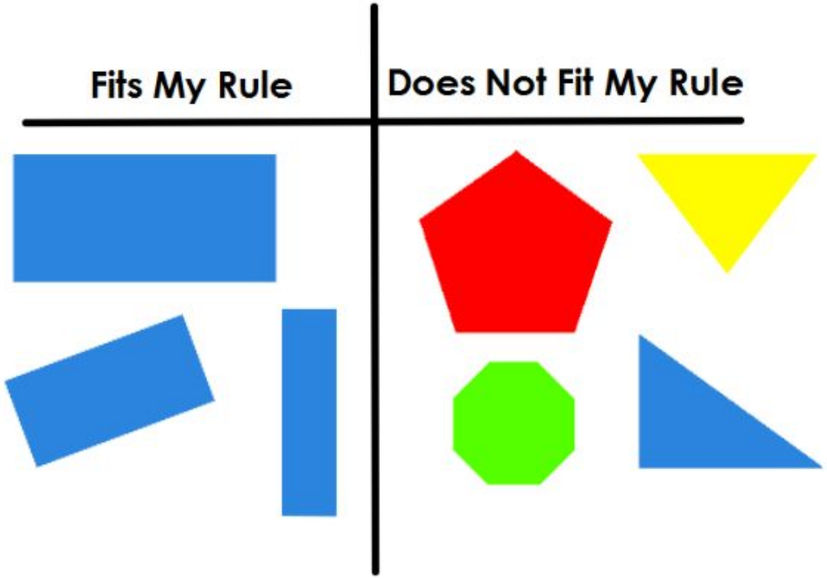

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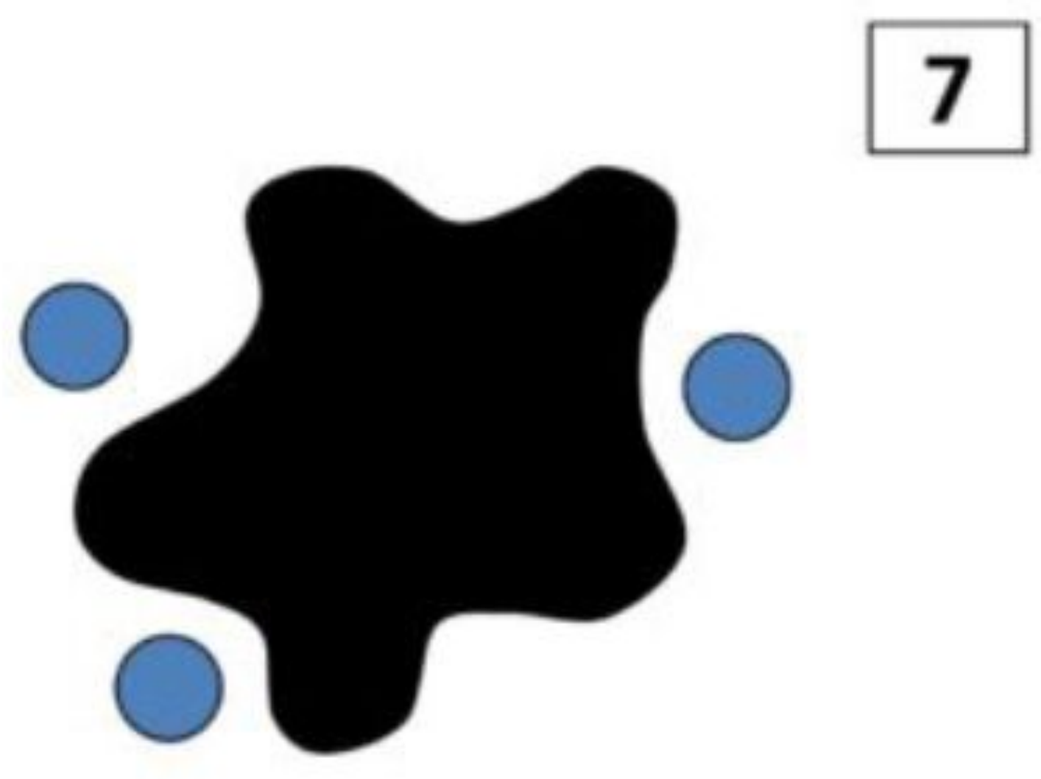
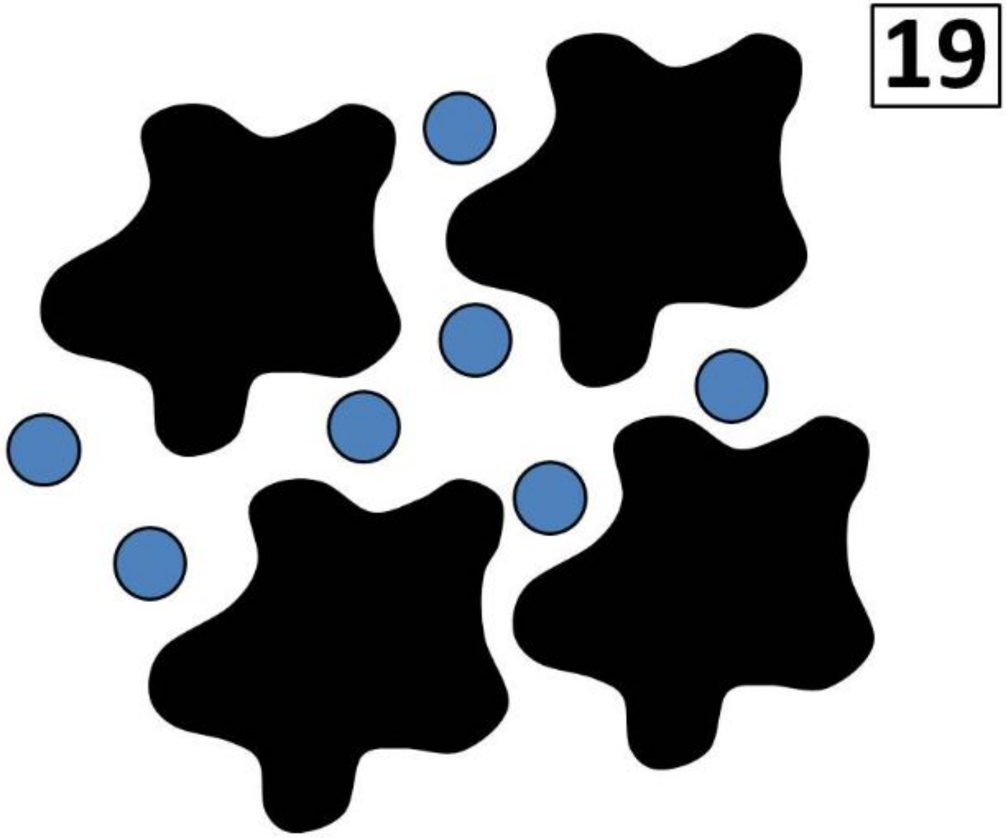
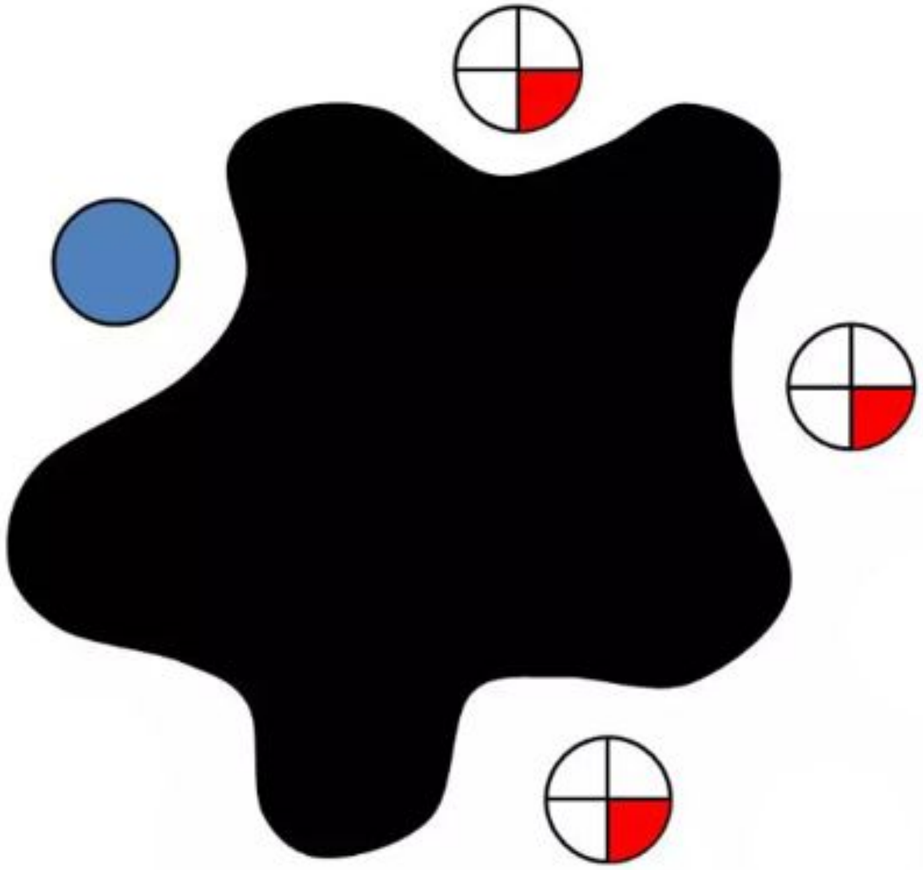
Splat!



Splat!



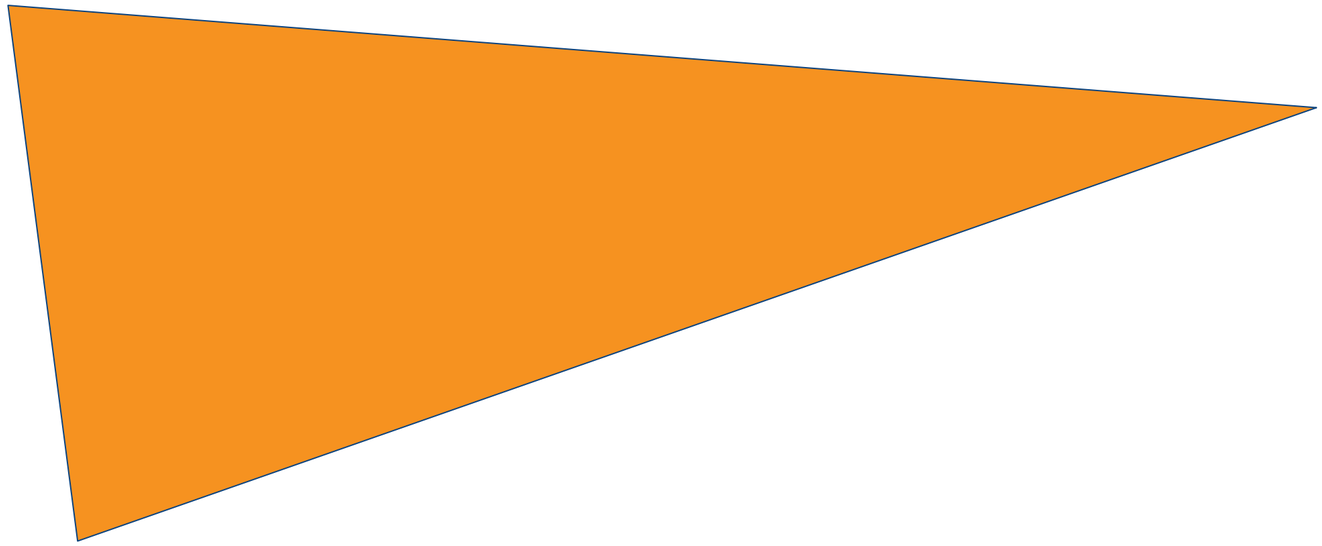
Splat!



7

HOW DO YOU KNOW?

- How do you know this is a triangle?



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CONVINCE ME!

Cereal box B is the better buy.

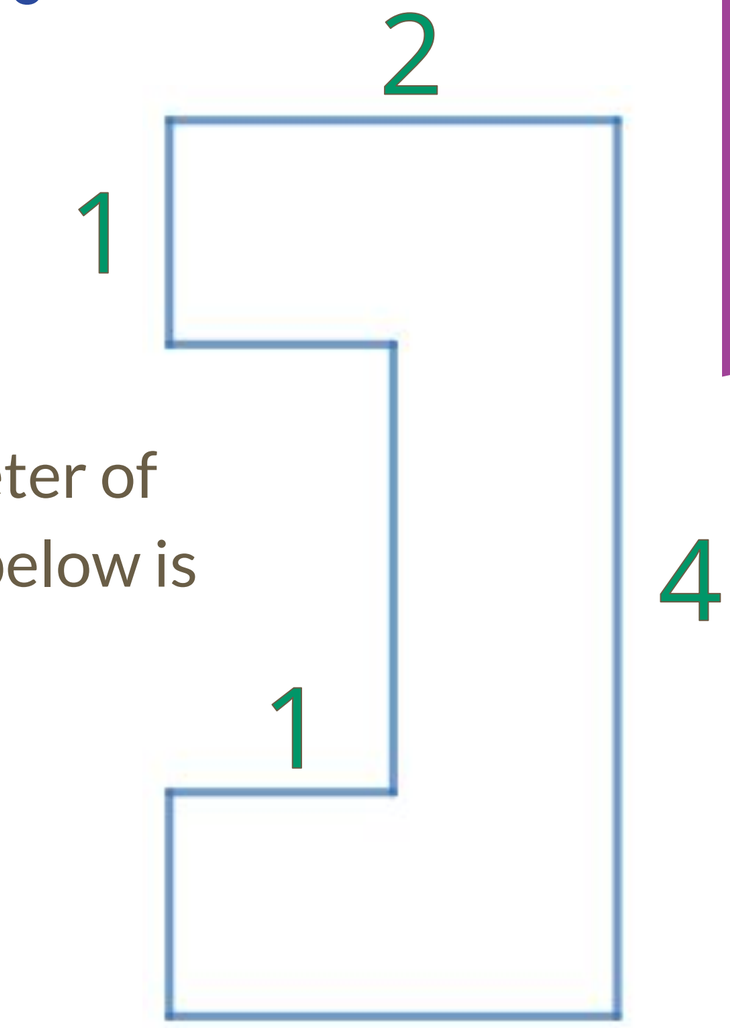
$3.79 ea.

Rice Krispies Cereal, Toasted Rice (12 oz)

$4.29 ea.

Rice Krispies Cereal, Toasted Rice (18 oz)

The perimeter of the shape below is 14 units.



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WOULD YOU RATHER

Would you rather have this many pennies or a nickel?

www.Wouldyourathermath.com

CTLG Consulting

WOULD YOU RATHER

sell Option A or Option B?

Option A:
Sell 3 dozen cookies for $0.50 each and cost $6.00 to make.

Option B:
Sell 36 cookies (the entire batch) for $18.00 and cost $8.00 to make.

www.Wouldyourathermath.com

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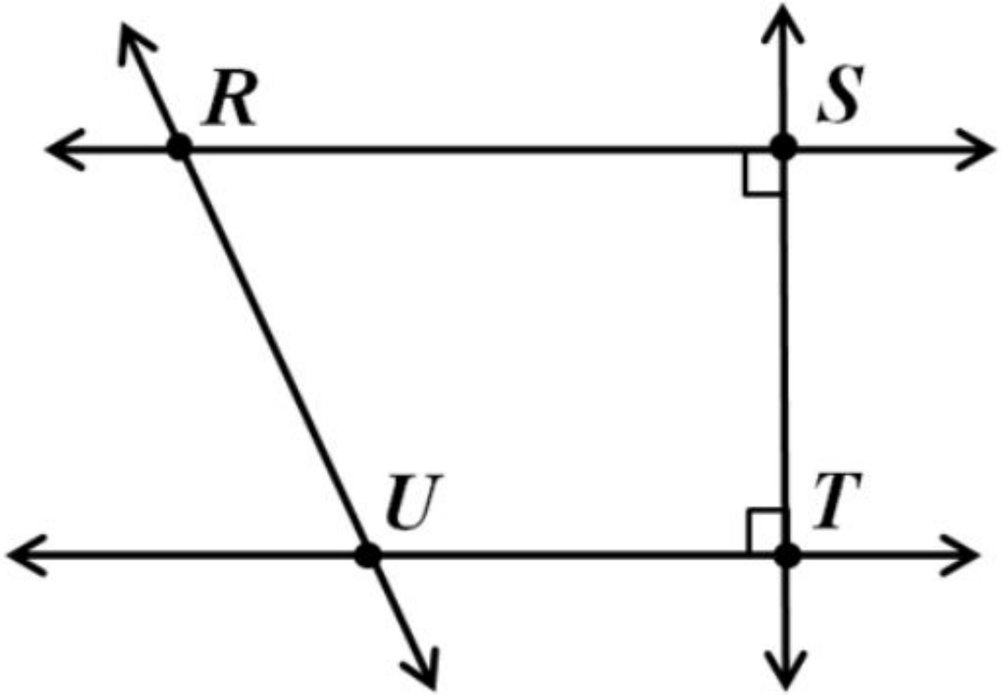
TWO TRUTHS AND A LIE



$\overleftrightarrow{RS} \perp \overleftrightarrow{ST}$

$\overleftrightarrow{UT} \perp \overleftrightarrow{ST}$

$\overleftrightarrow{RS} \perp \overleftrightarrow{UT}$

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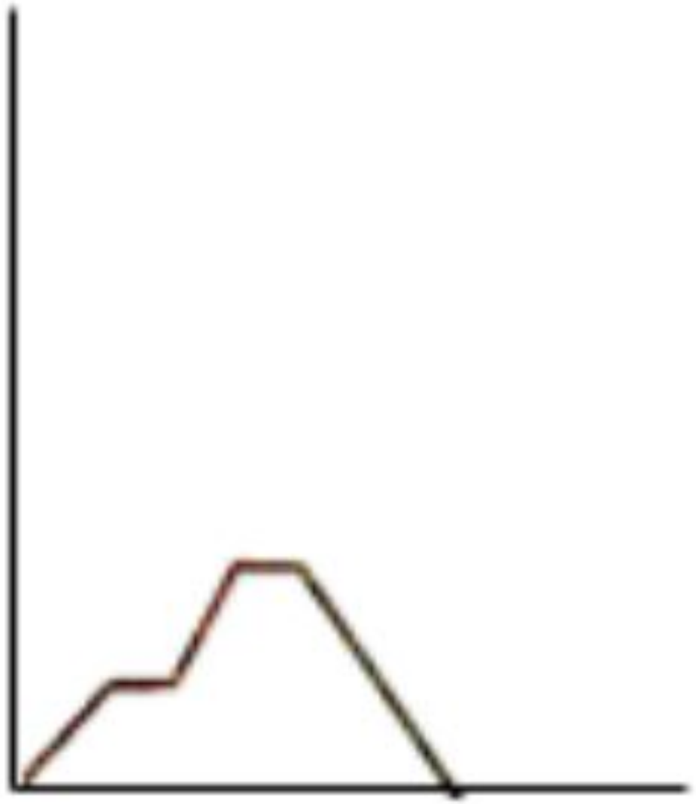
GRAPHING STORIES



WHAT'S NEXT?

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

48, 53, 58, 63, 68, __, __, __

Middle School

REASONING ROUTINES

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5 minutes	**Warm Up**
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SENTENCE STARTERS

Another idea I had was...	I was confused (wondering) about...	How or why did you…?	I agree with _____ because...
I have a different way to explain...	I have the same answer, but my explanation/strategy is...	Your answer/strategy reminds me of...	I disagree with _____ because...
Can you explain more about...	I have a different answer because...	One thing that I like about your answer is...	Your idea and my idea are similar because...
Your idea and my idea are different because...	I like how you used the math vocab, _____to explain it.	Instead of _____ , you can use the math word _____ to explain.	I would like to add on to that idea...

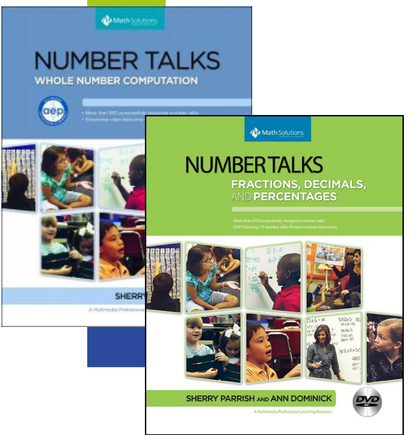
NUMBER TALKS & NUMBER STRINGS

3 + 2

-3 + 2

3 + (-2)

-3 + (-2)



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TODAY'S NUMBER

$\frac{3}{4}$

TODAY'S NUMBER

Four consistent types of representations used across grade levels

- Composing/decomposing
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- Representing mathematics in the world
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$\frac{3}{4}$

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TODAY'S NUMBER

15%

CTLG Consulting

TODAY'S NUMBER

Four consistent types of representations used across grade levels

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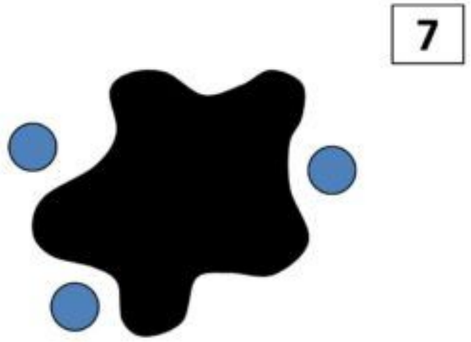
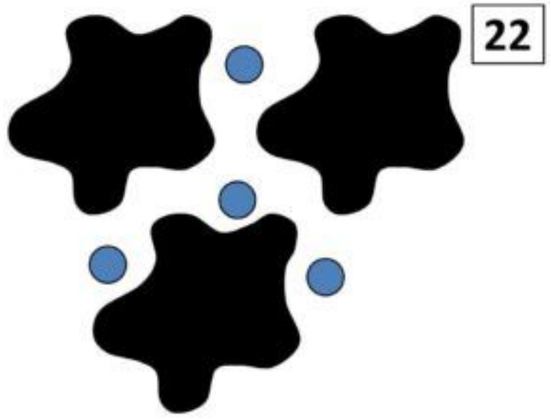
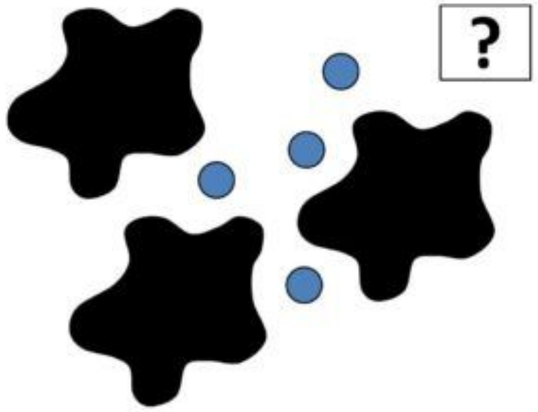
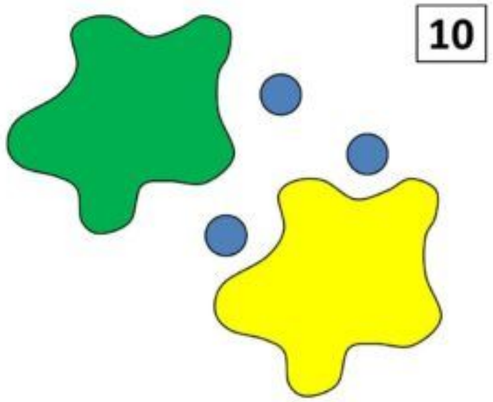
15%

NUMBER TALKS & NUMBER STRINGS









SPLAT!
https://stevewyborney.com/

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MYSTERY NUMBER

- My number is a multiple of 6.
- My number has six factors.
- My number is less than 5 x 5.
- When the digits of my number are added, they have a sum of 9.

MYSTERY NUMBER

- My number has 3 digits.
- My first two digits are even.
- My last two digits are consecutive.
- I am a perfect square.
- My square root is odd.

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CLUES FOR 32

1. The number is even
2. It is after 31 and before 33
3. There is a 2 in the ones colome
4. There is a 3 in the tens colome

1. It is in the 30's.
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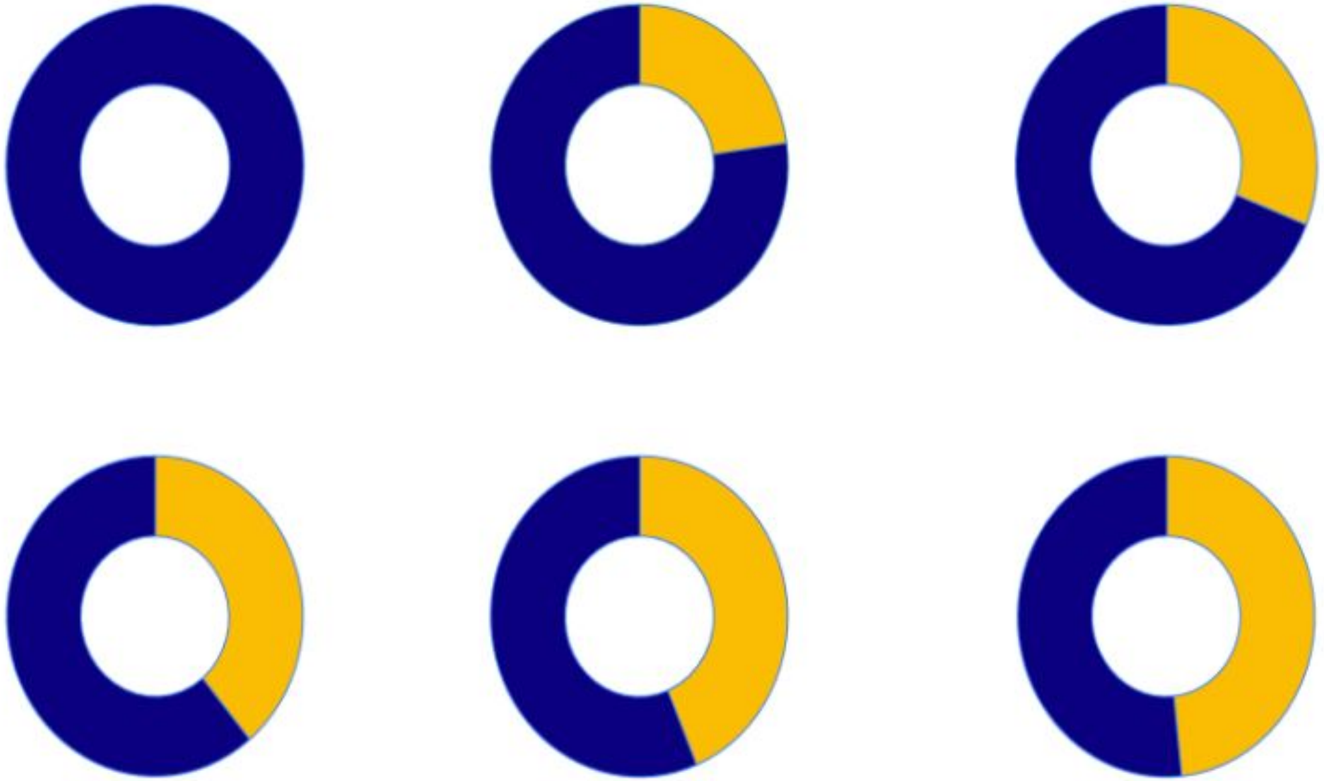
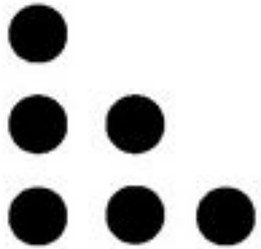
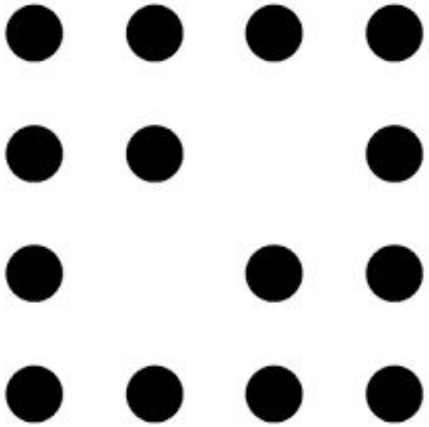
MYSTERY NUMBER VARIATION

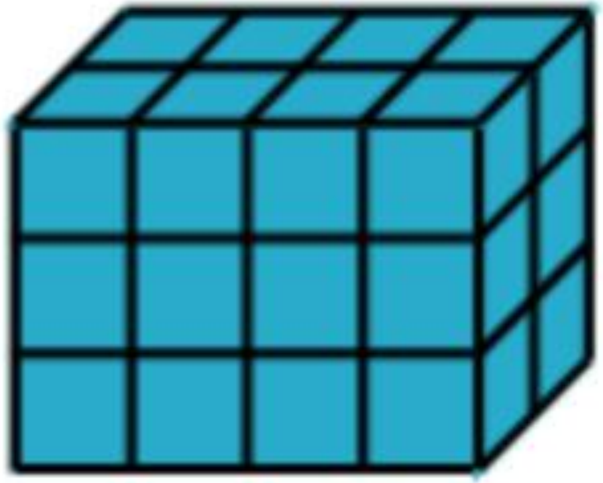


[Slow Reveal Graphs - From Bridging Math Strength website]

QUICK IMAGE







[Number Talk Images]

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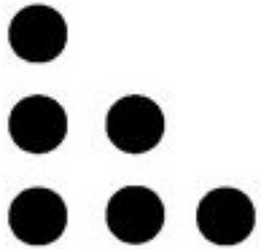

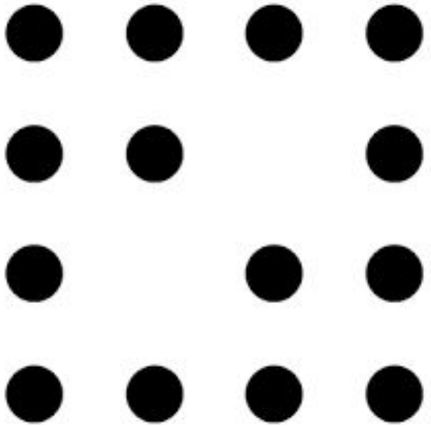

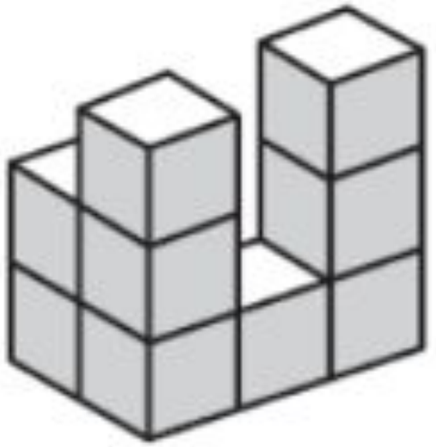

ALIKE AND DIFFERENT

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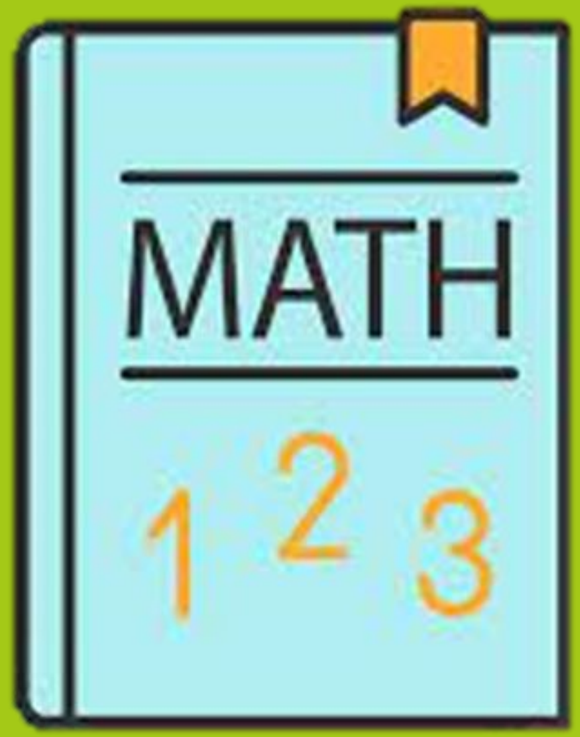
ALIKE AND DIFFERENT



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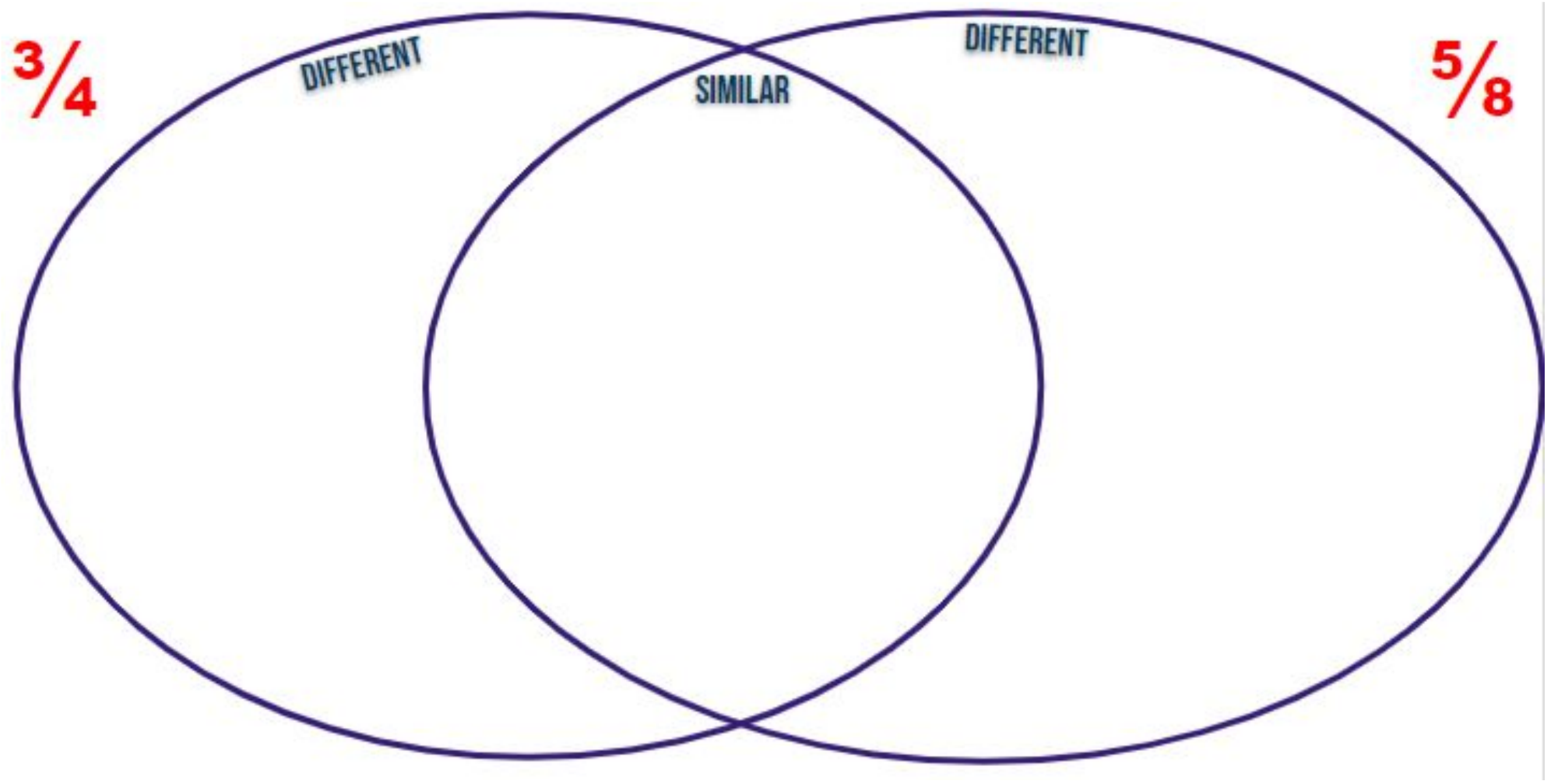
ALIKE AND DIFFERENT



ALIKE AND DIFFERENT

x	y
1	3
2	4
3	5

x	y
3	1
4	2
5	3

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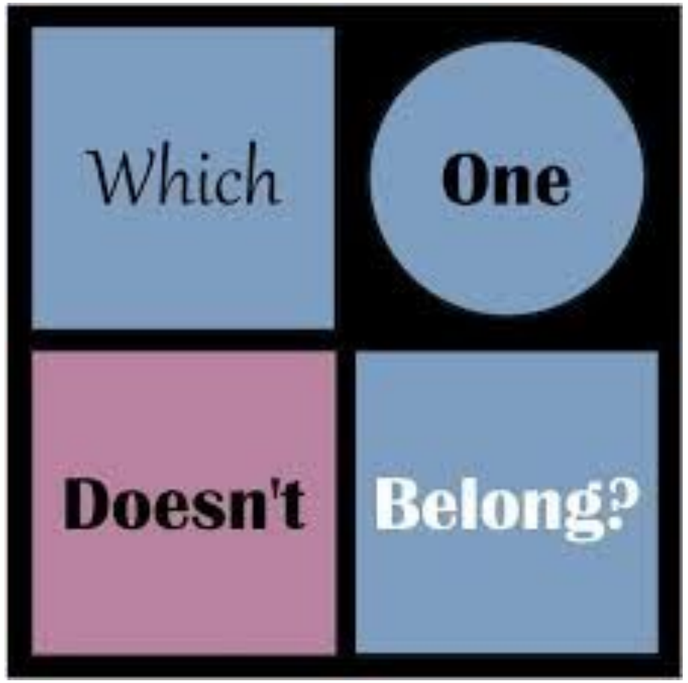
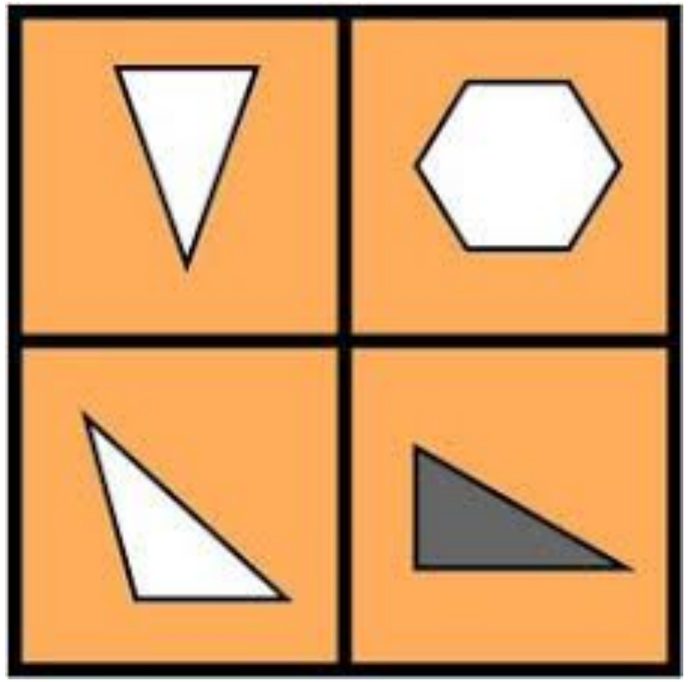
WHICH ONE DOESN'T BELONG



9	25
16	43



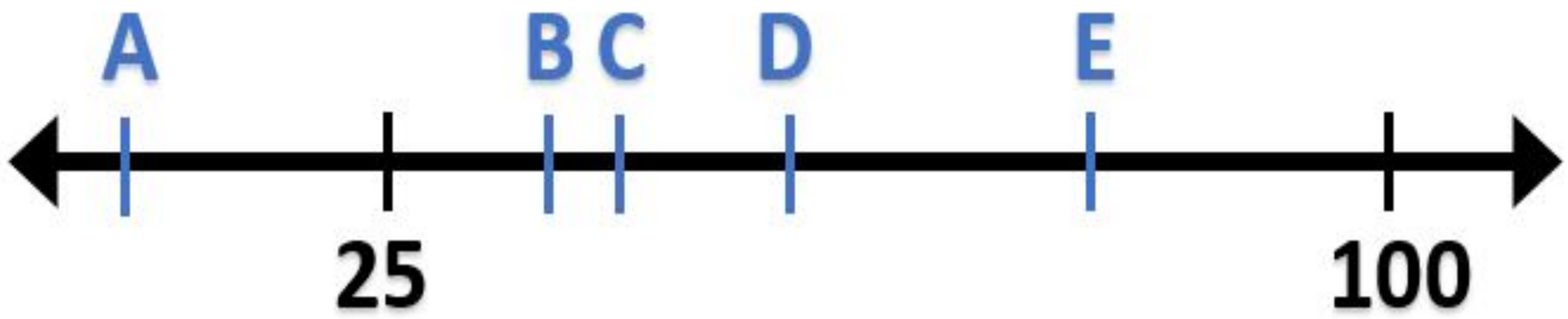
http://wodb.ca/index.html

CTLG Consulting

NUMBER LINES

What numbers could represent each of the letters and why?

Where is 75? Where is 400? How far apart are A and B?



[Clothesline Number Lines]

[Clothesline Math]
Estimation180.com

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NUMBER LINES

Solving Equations

$2x + 3 = 11$

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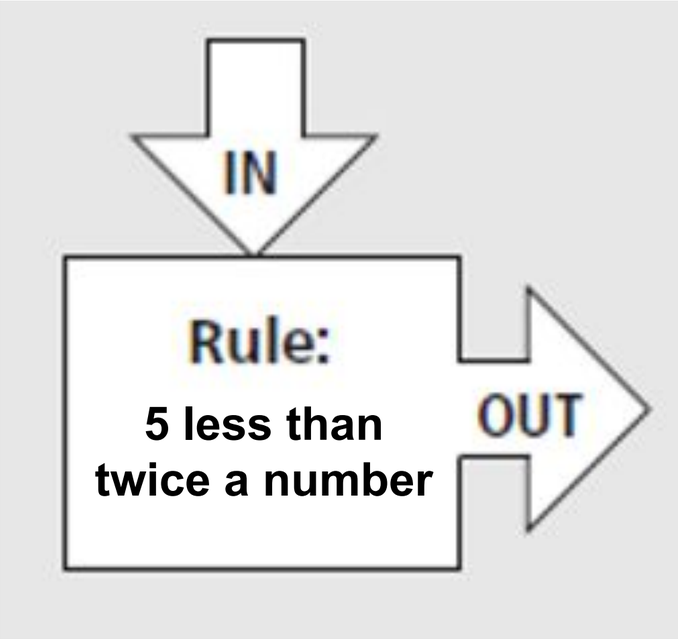
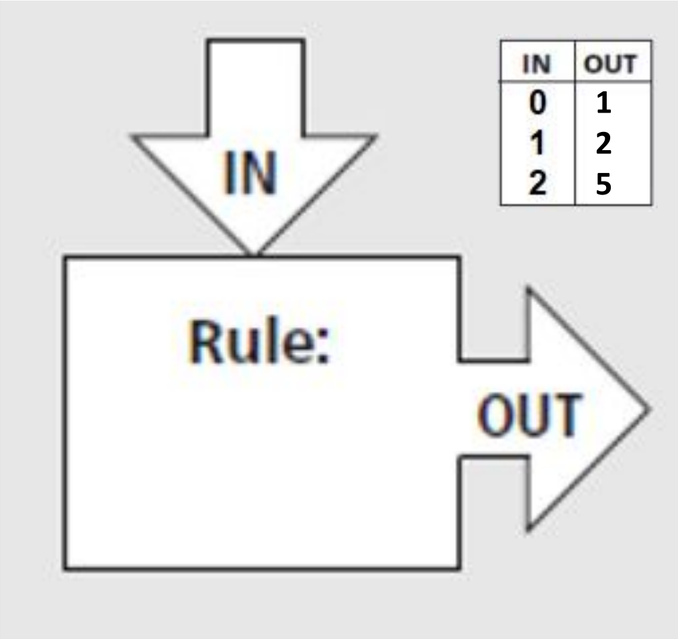
GUESS MY RULE





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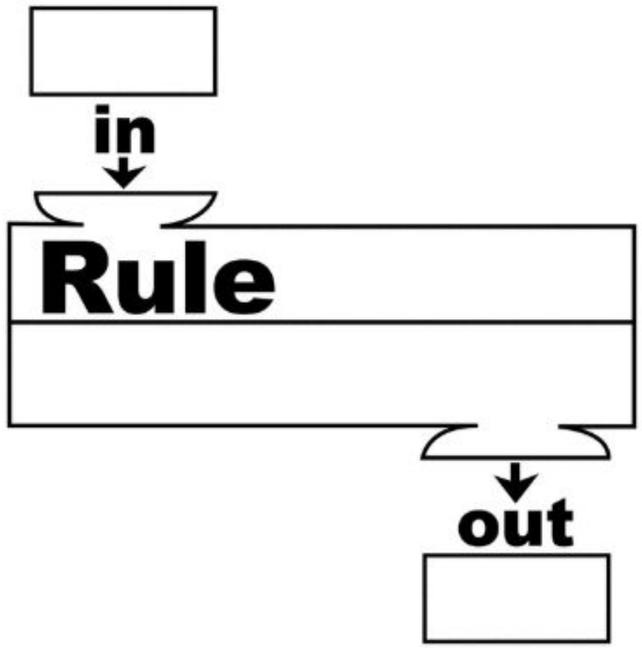
GUESS MY RULE



Input	Output
-1	7
2	1
1	3
0	5

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HOW DO YOU KNOW?

- How do you know that 2 is the slope of $y = 2x - 1$?
- How do you know that 8/10 and 12/15 are equivalent?
- How do you know that $5 \div \frac{1}{2} = 5 \times 2$?
- How do you know this is a rectangle?

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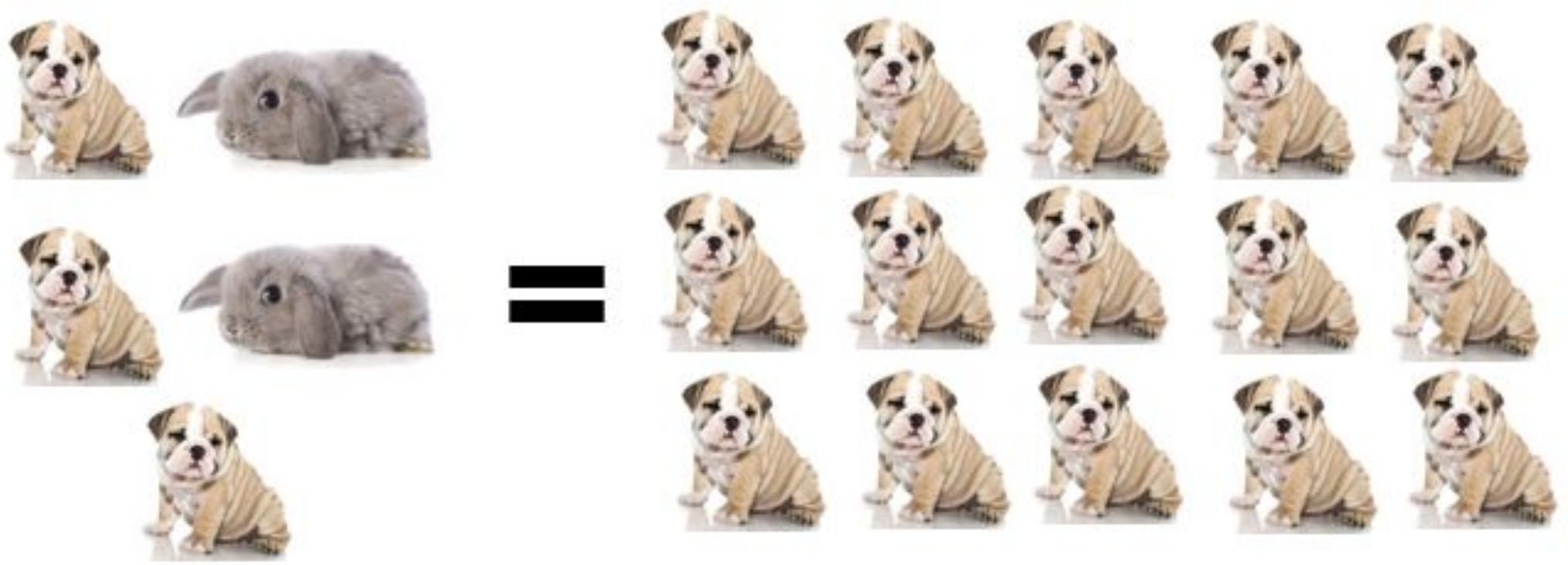
HOW DO YOU KNOW?

One rabbit = 6 dogs



CONVINCE ME!

Cereal box B is the better buy.

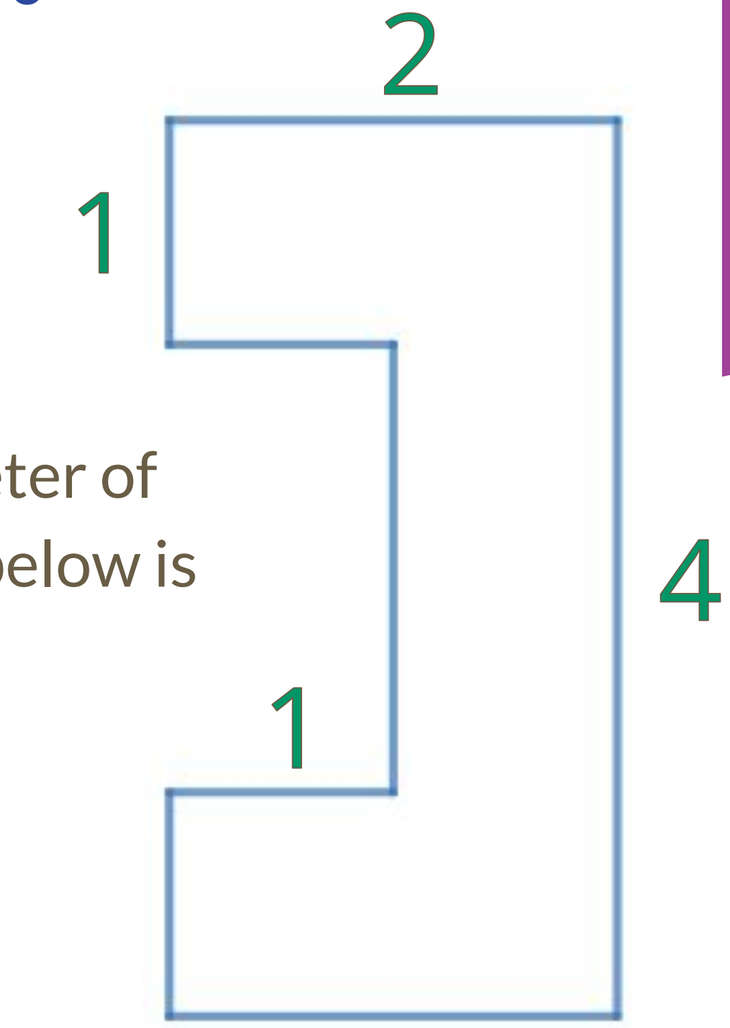
$3.79 ea.

Rice Krispies Cereal, Toasted Rice (12 oz)

$4.29 ea.

Rice Krispies Cereal, Toasted Rice (18 oz)

The perimeter of the shape below is 14 units.



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CONVINCE ME!

If I triple the height of a rectangular prism, the volume will also triple.

Or

If I triple any dimension of a rectangular prism, the volume will also triple.

WOULD YOU RATHER

BE GIVEN

- $5 A DAY

  OR

- A PENNY THE FIRST DAY, TWO PENNIES THE SECOND DAY, FOUR ON THE THIRD DAY, EIGHT ON THE FOURTH DAY AND SO ON?

www.Wouldyourathermath.com

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WOULD YOU RATHER

Run the circumference of the circle OR perimeter of the rectangle?

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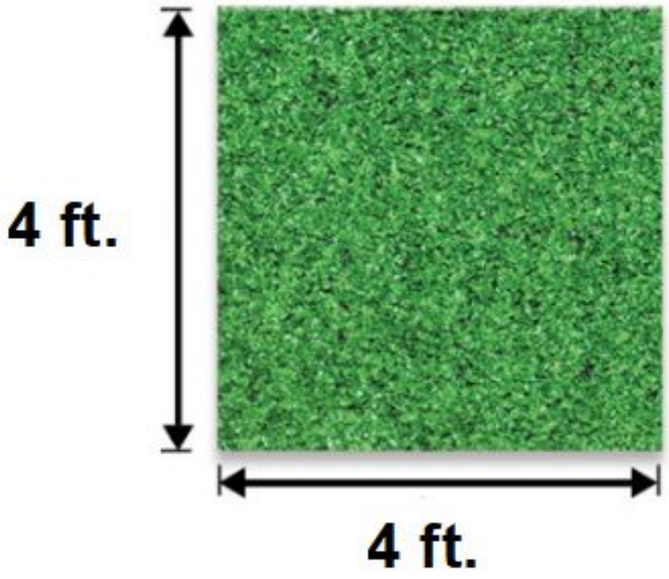
WOULD YOU RATHER

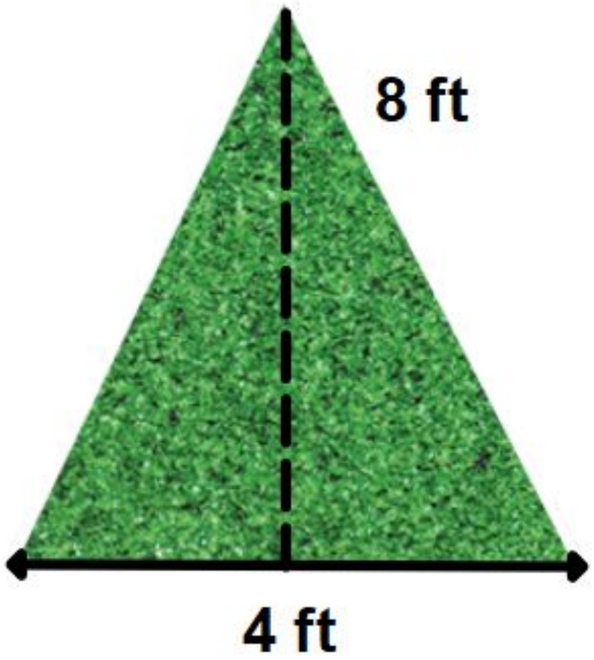
Your yard needs 1600 sq. feet of sod.

Would you rather use Sample A or Sample B?

SAMPLE A



SAMPLE B



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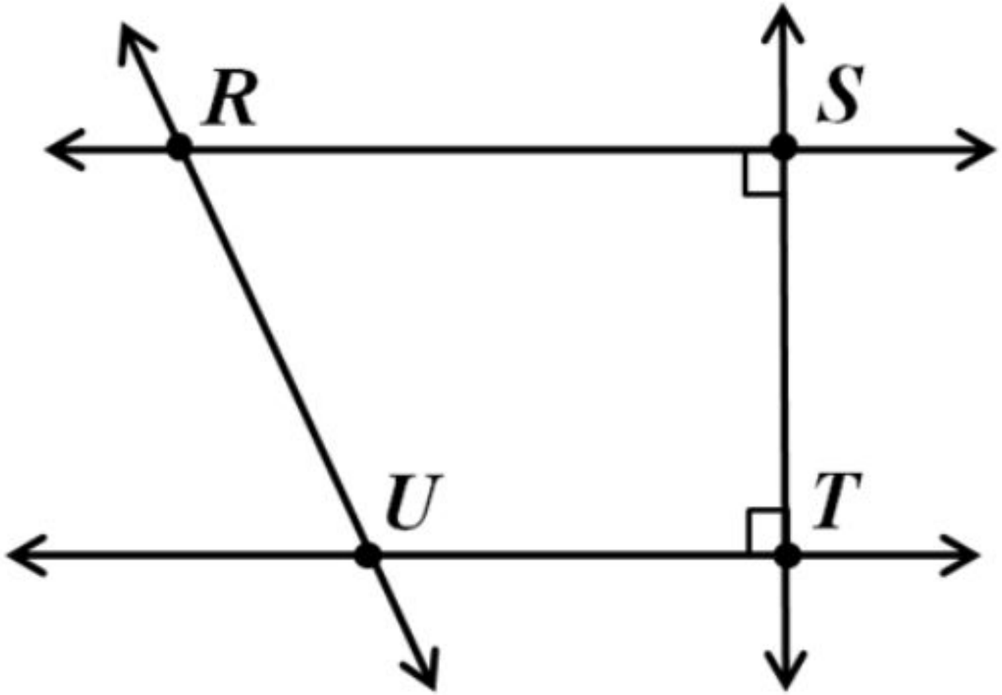
TWO TRUTHS AND A LIE



$\overleftrightarrow{RS} \perp \overleftrightarrow{ST}$

$\overleftrightarrow{UT} \perp \overleftrightarrow{ST}$

$\overleftrightarrow{RS} \perp \overleftrightarrow{UT}$

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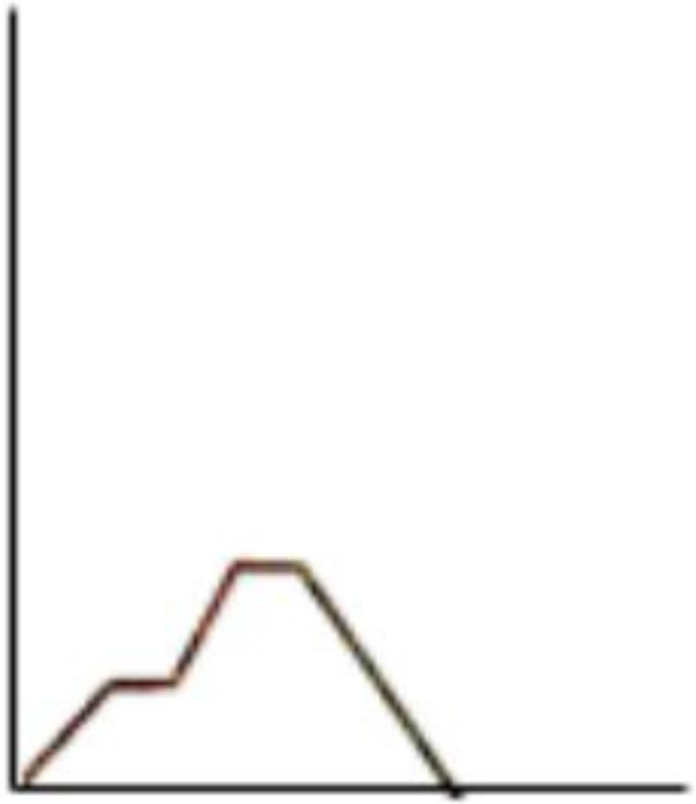
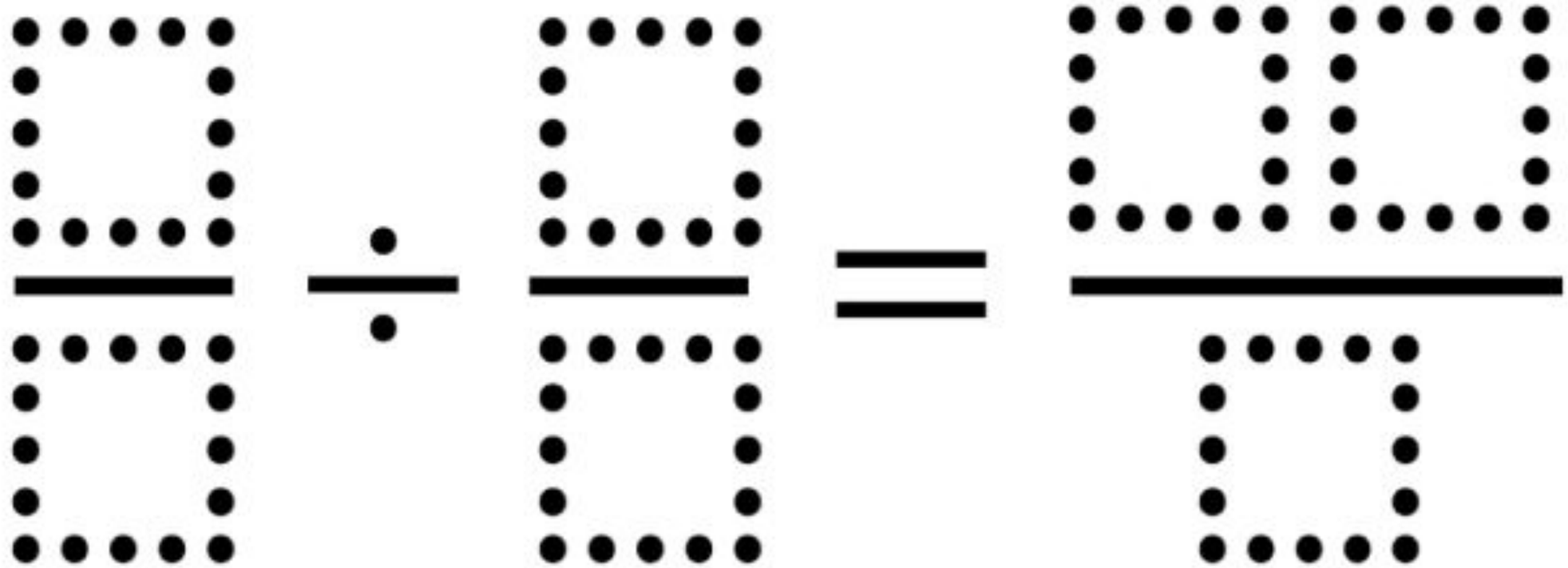
GRAPHING STORIES



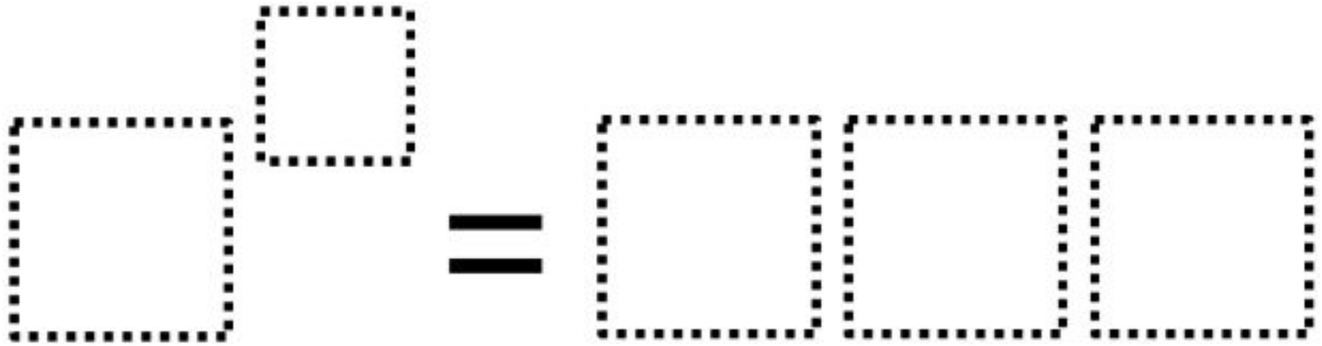
OPEN MIDDLE

Directions: Use the digits 0 through 9, without repeats, to solve the problem below.



OPEN MIDDLE

Directions: Use the digits 1 to 9, at most one time each, to fill in the boxes to make a result that has the greatest value possible.



WHAT'S NEXT?

What's Next?

1, 2, 4, 7, 11, 16, ____, ____, ____,
____, ____, ____, 79, ____, ____, ____,
____, ____, ____, ____, ____, ____, ____,
____, ____, ____, ____...

1, 11, 21, 1211,
111221, 312211, _____

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High School

REASONING ROUTINES

SURN Math Days
October 2022

WILLIAM & MARY
MATH DAYS
— MOVING BEYOND: RECLAIMING BEST PRACTICE —

Skip Tyler
@SkipTylerMath
skipt@ctlgconsulting.com

TRADITIONAL MATH LESSON STRUCTURE

5 minutes	**Warm Up**
20 minutes	**Student Independent Practice** Students attempt to solve problems in the same way the teacher solved them. The teacher walks around the room monitoring the students.
5 minutes	**Assign Homework**

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HAND SIGNALS & MATH TALK

When you come up with the same solution or strategy as another mathematician, silently signal **"Me too!"** to let other mathematicians know that you agree with them!

When you're solving a math equation in your brain, and you've already thought of two ways to find the solution, silently signal for **"I have the solution and one strategy!"** while other mathematicians continue to think!

When you're solving a math equation in your brain, and you've already thought of two ways to find the solution, silently signal for **"I have the solution and two strategies!"** then continue to think of additional strategies while other mathematicians also continue to think!

..... You can always add additional fingers as you come up with more and more strategies to find the solution! You're an amazing mathematician! .....

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SENTENCE STARTERS

Another idea I had was...	I was confused (wondering) about...	How or why did you…?	I agree with _____ because...
I have a different way to explain...	I have the same answer, but my explanation/strategy is...	Your answer/strategy reminds me of...	I disagree with _____ because...
Can you explain more about...	I have a different answer because...	One thing that I like about your answer is...	Your idea and my idea are similar because...
Your idea and my idea are different because...	I like how you used the math vocab, _____to explain it.	Instead of _____ , you can use the math word _____ to explain.	I would like to add on to that idea...

NUMBER TALKS & NUMBER STRINGS

14 x 12

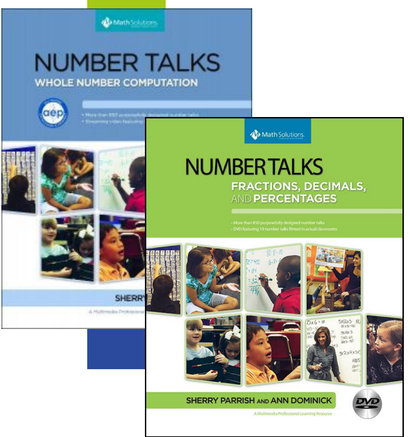
4 x 12

4(10 + 2)

14(10 + 2)

(10 + 4)(10 + 2)

(x + 4)(x + 2)



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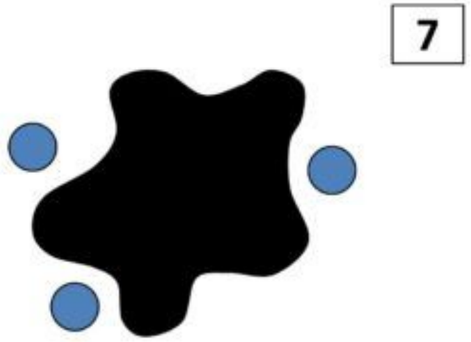
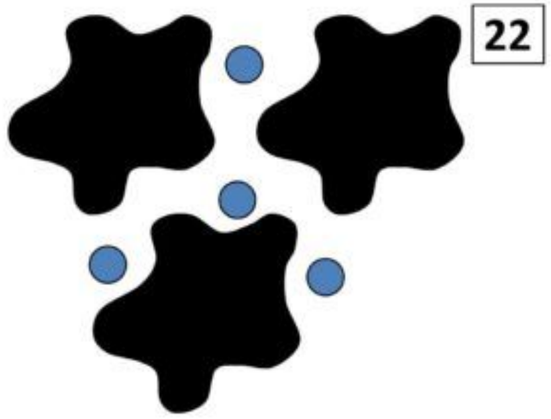
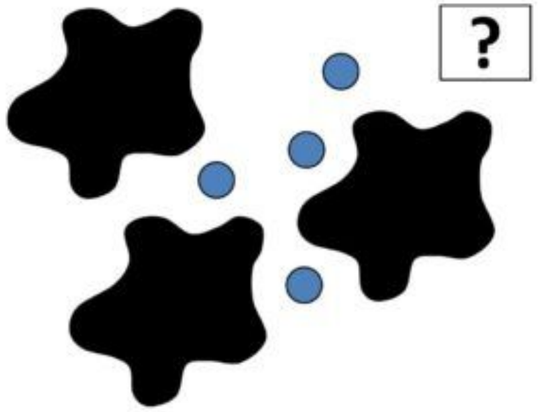
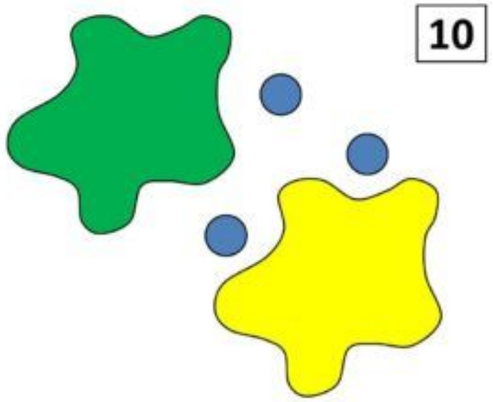
NUMBER TALKS & NUMBER STRINGS









SPLAT!
https://stevewyborney.com/

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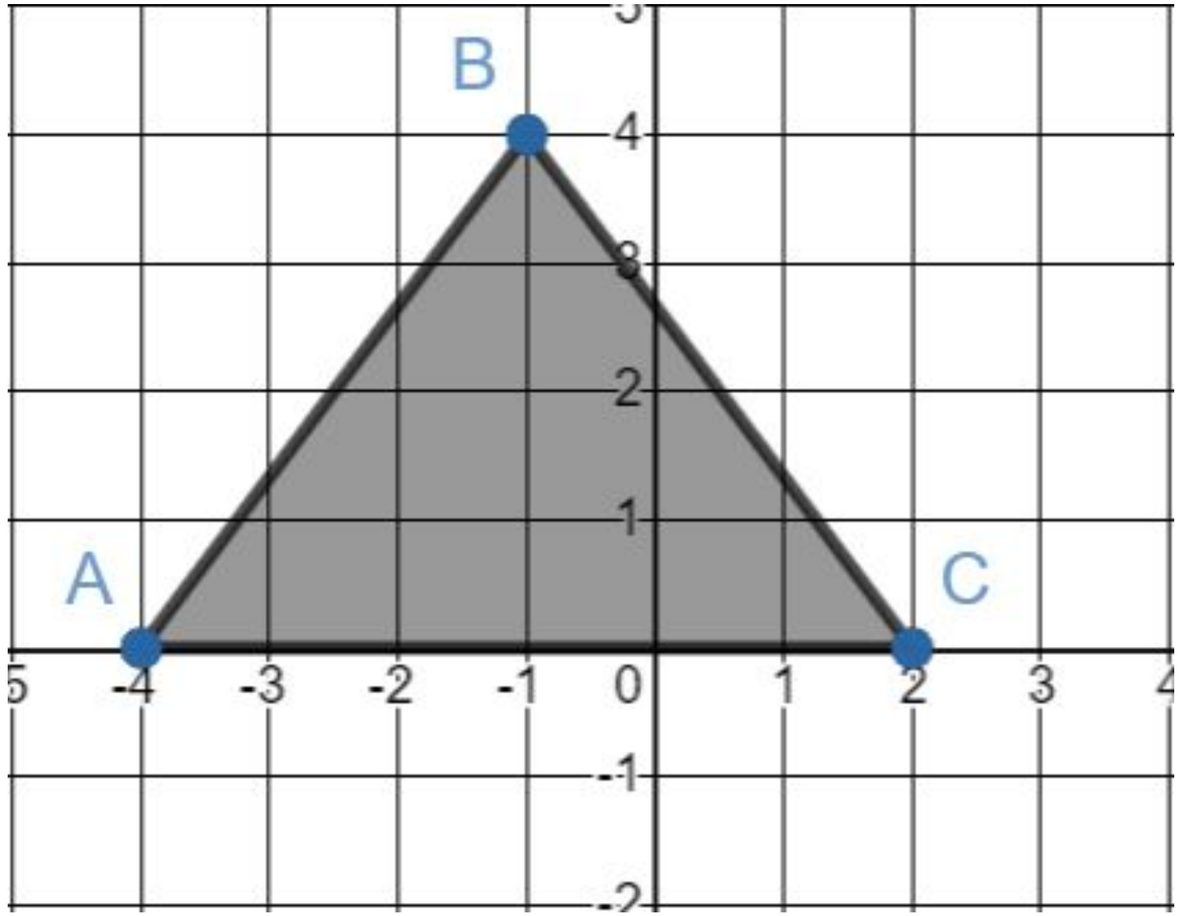
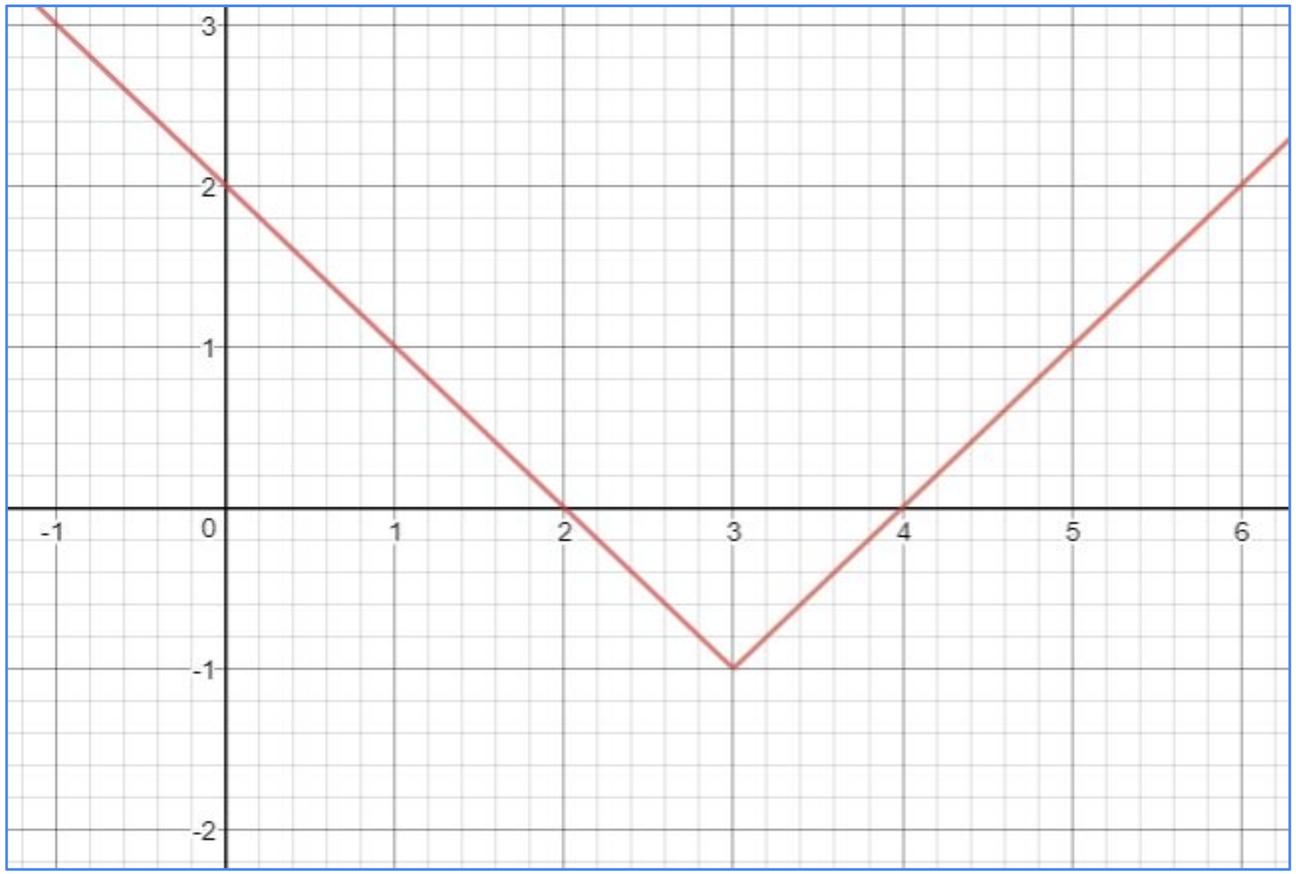
TODAY'S ~~NUMBER~~ DIAGRAM



TODAY'S ~~NUMBER~~ GRAPH



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MYSTERY NUMBERS

- I am thinking of two unique whole numbers.
- Their sum is 12.
- The larger number is even.
- Twice the smaller number is 6 less than the larger number.

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MYSTERY ANGLE

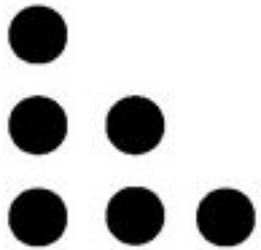
- I am an acute angle
- The sum of my digits is 8
- My complement is a multiple of 5
- The sum of the digits of my linear pair is 10

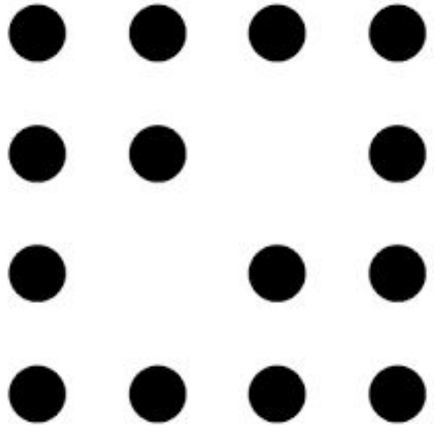
CLUES FOR 32

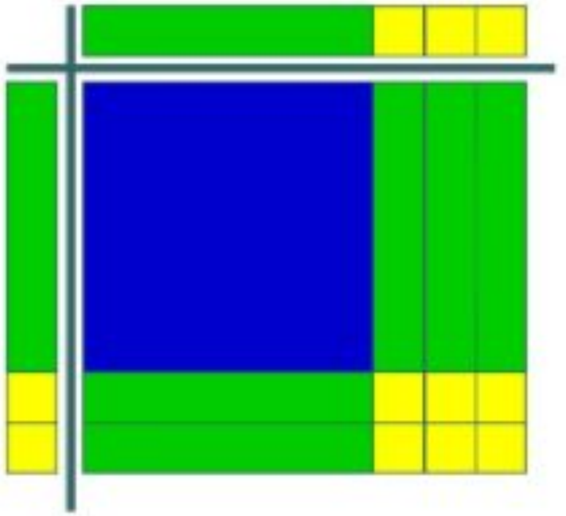
1. The number is even
2. It is after 31 and before 33
3. There is a 2 in the ones colome
4. There is a 3 in the tens colome

1. It is in the 30's.
2. It is an even number.
3. It has a 2.
4. It has a 3.

QUICK IMAGE







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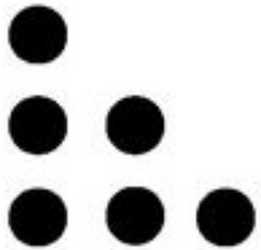

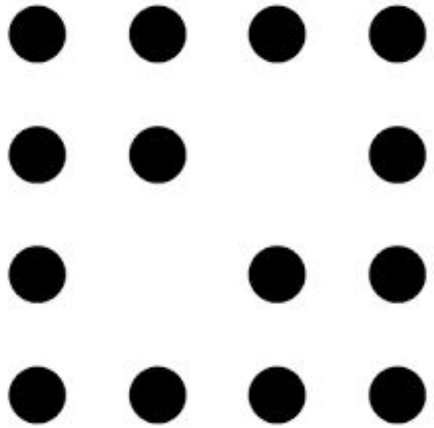

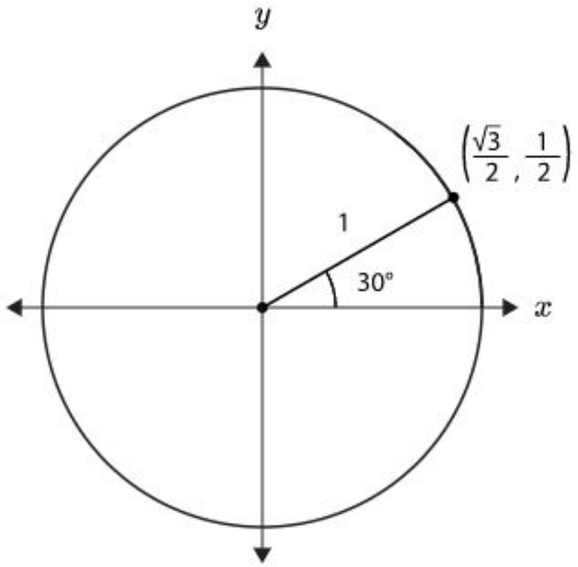

ALIKE AND DIFFERENT

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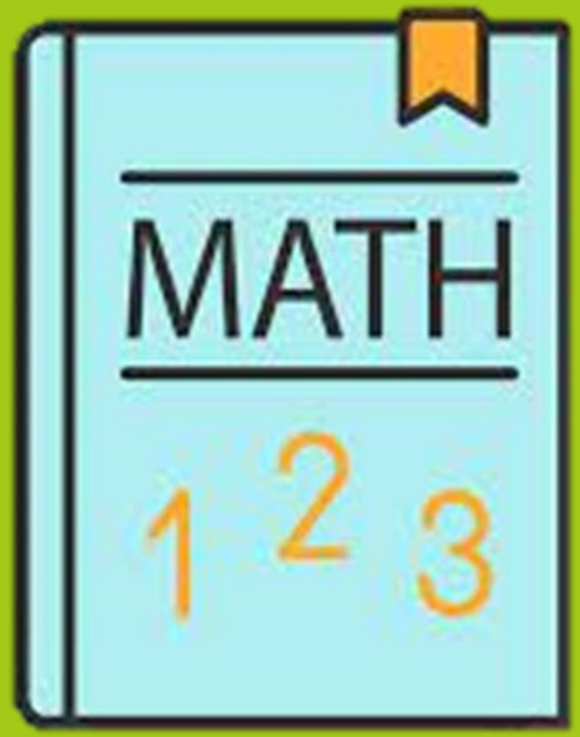
ALIKE AND DIFFERENT



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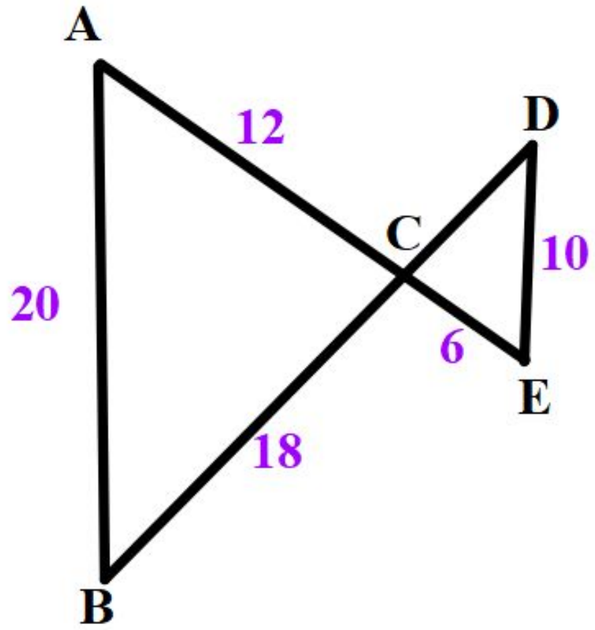
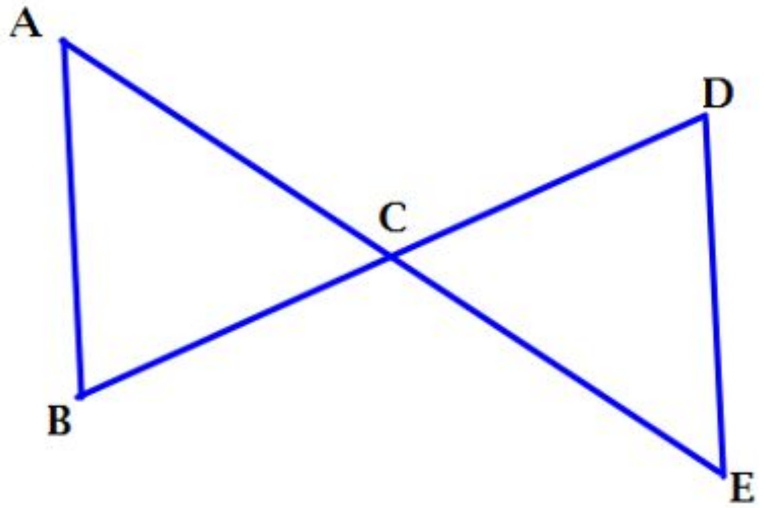
ALIKE AND DIFFERENT

$\Delta ABC \sim \Delta EDC$



$\Delta ABC \cong \Delta EDC$



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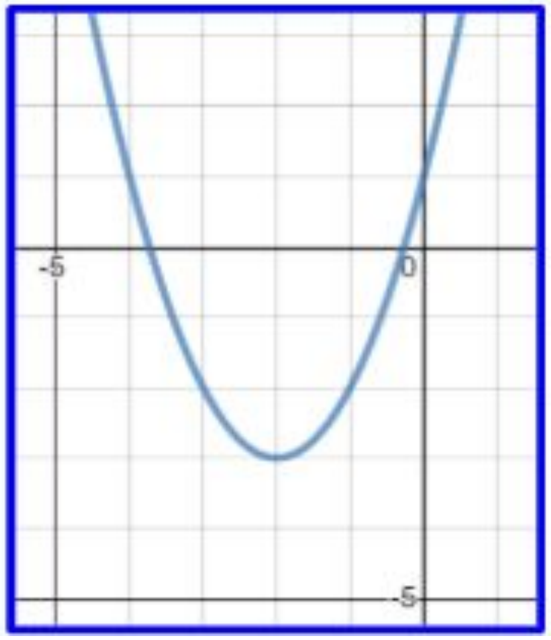
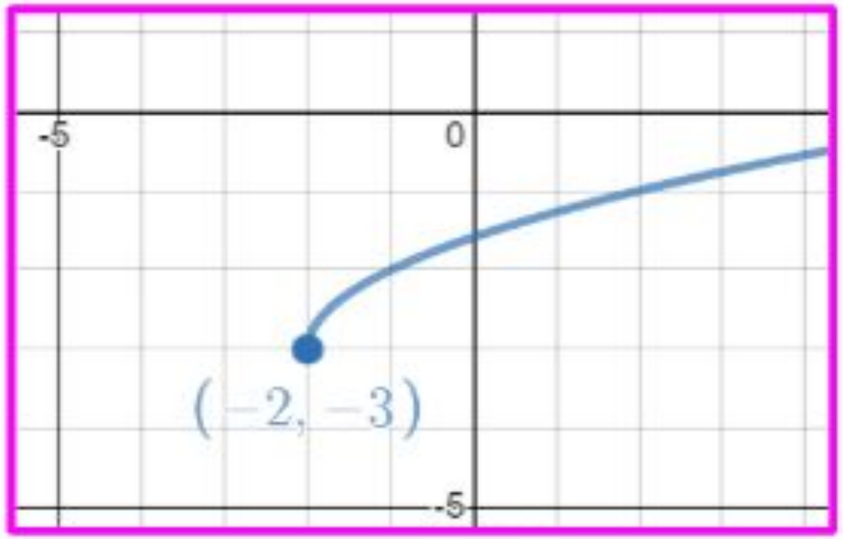
ALIKE AND DIFFERENT

$$y = (x+2)^2 - 3$$



$$y = \sqrt{x+2} - 3$$



www.wodb.ca/graphs.html

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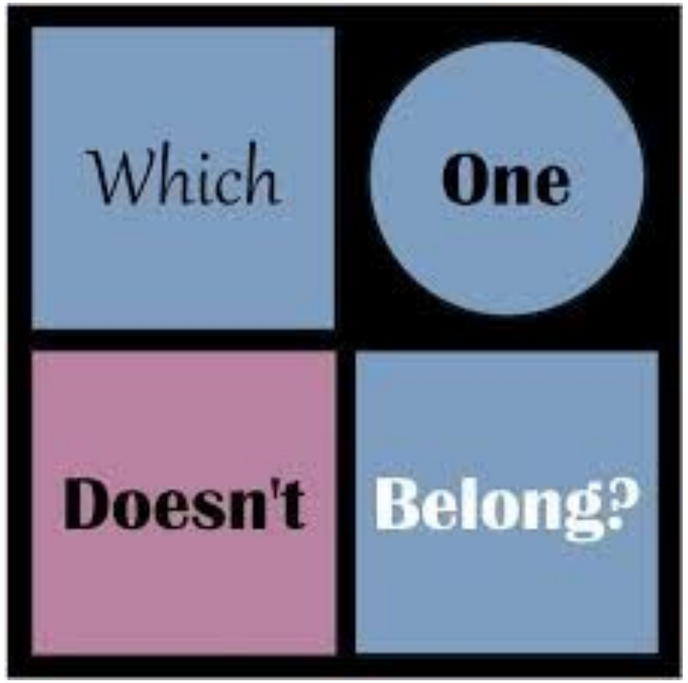
WHICH ONE DOESN'T BELONG



9	25
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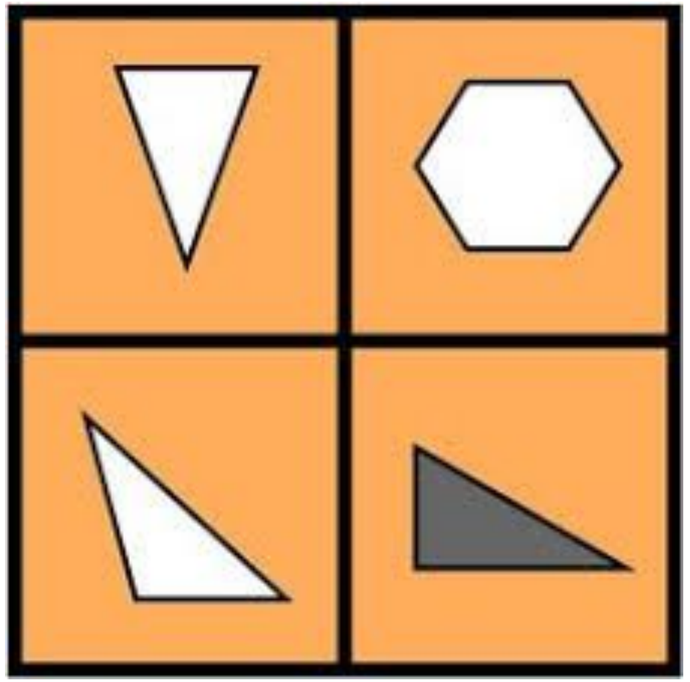

http://wodb.ca/index.html

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NUMBER LINES

What numbers could represent each of the letters and why?

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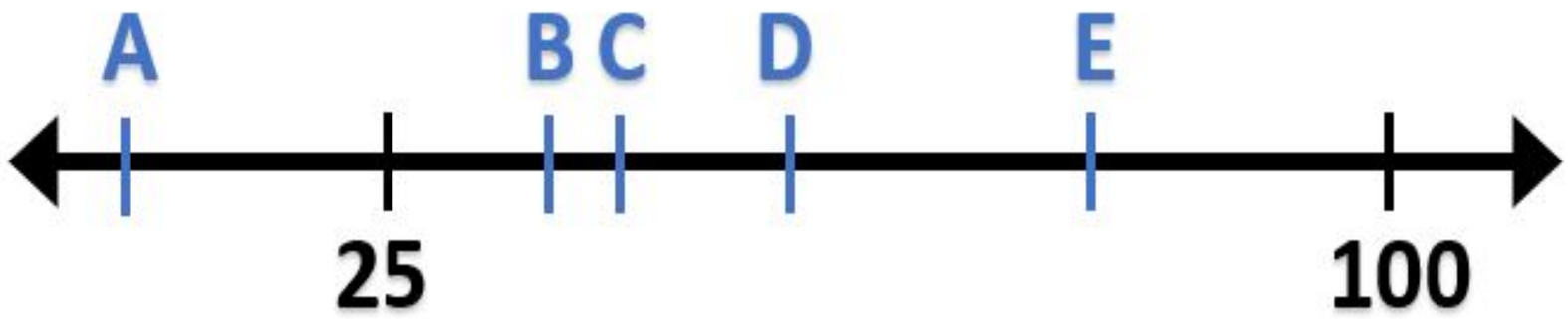

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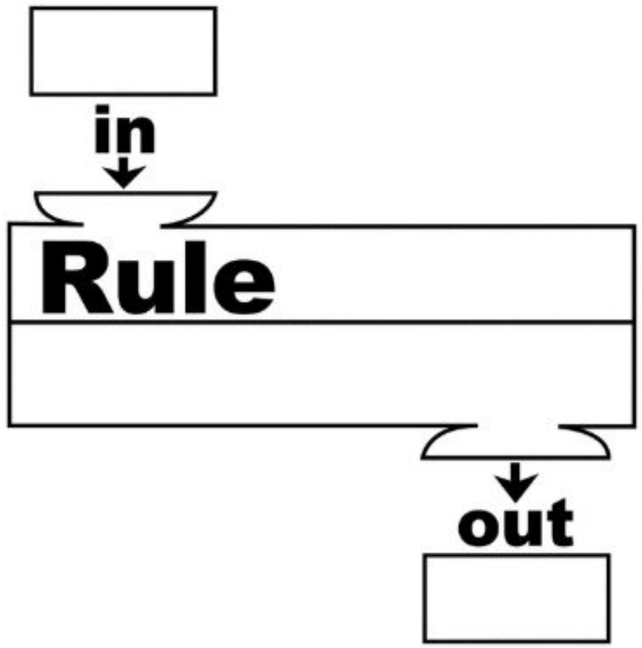
NUMBER LINES

Solving Equations

$2x + 3 = 11$

CTLG Consulting

GUESS MY RULE



x	f(x)
1	-3
9	-1
25	1
64	4

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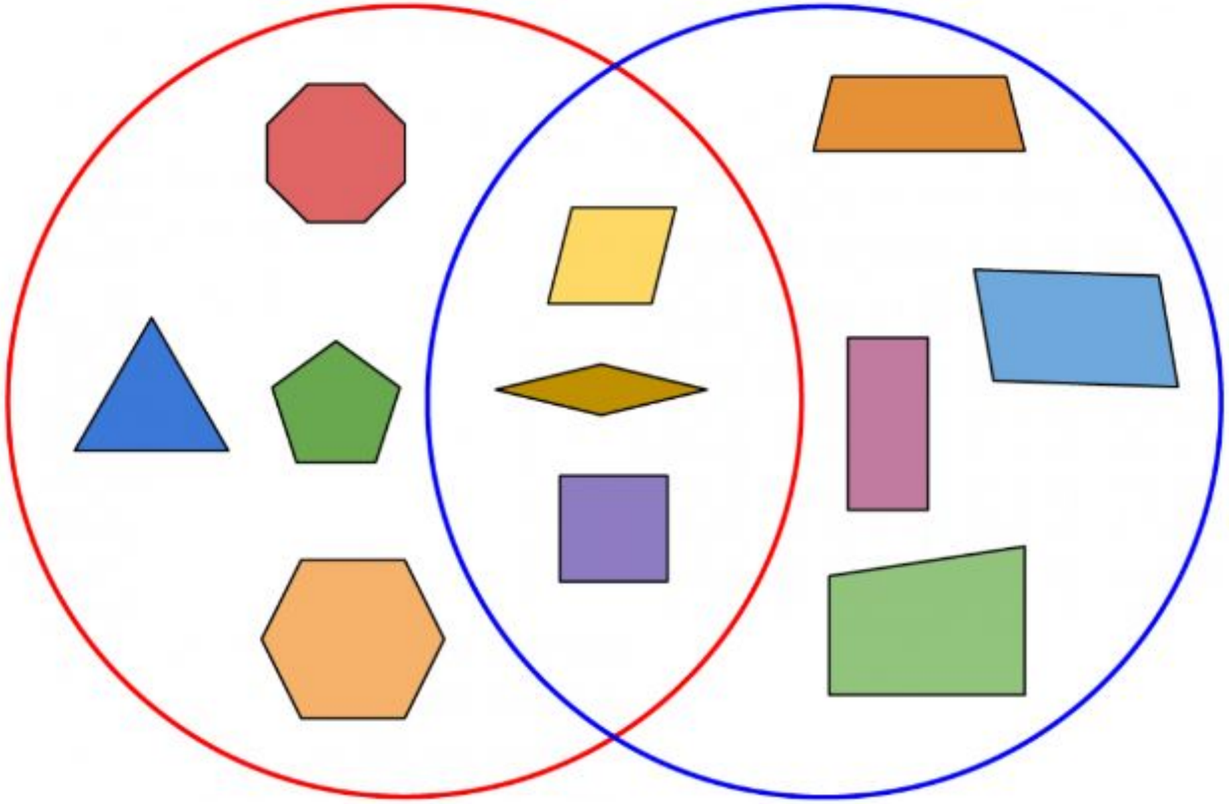
GUESS MY RULE

Polygon Sort



HOW DO YOU KNOW?

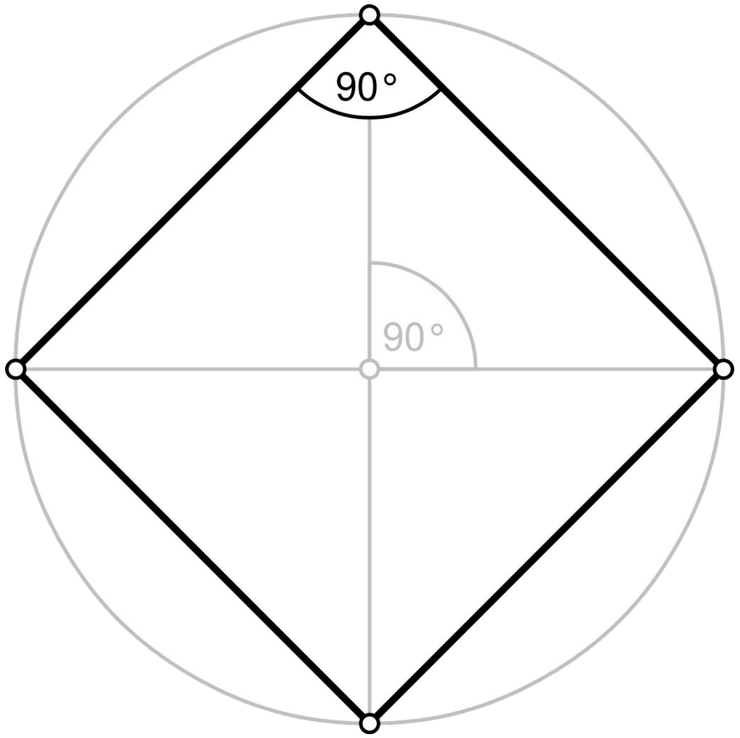
The systems are grouped with the best method to solve?

Graphing	Substitution	Elimination
$y = 2x - 1$ $y = -1/2x + 3$	$4x + 5y = 10$ $x = 6y - 8$	$2x + 4y = 8$ $7x - 4y = 12$

CTLG Consulting

HOW DO YOU KNOW?

Based on the square, the outside figure must be a circle.



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CONVINCE ME!

If it takes 4 hours for 5 painters to paint a house, then it should take 2 hours for 10 painters to paint the house.

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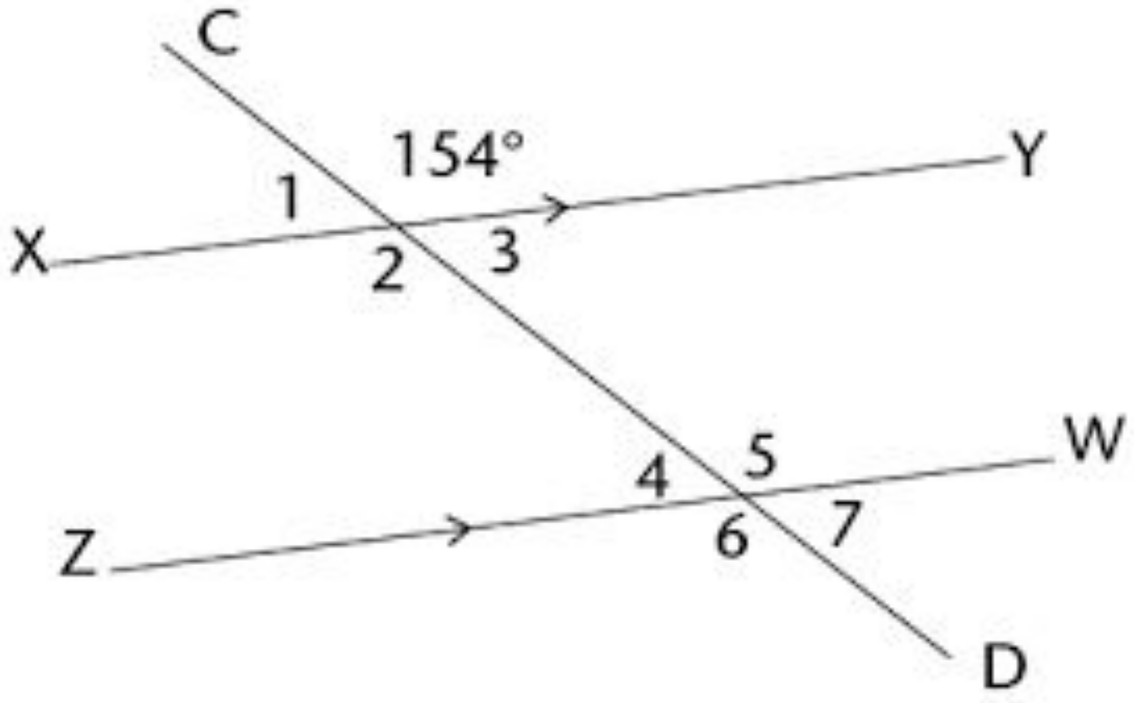
CONVINCE ME!

A square is a parallelogram, a rectangle and a rhombus.

A rectangle is a parallelogram, but a parallelogram doesn’t have to be a rectangle.

CONVINCE ME!

In order for lines x and z to be parallel, angle 6 must be 154 degrees. Convince me!



WOULD YOU RATHER

BE GIVEN

- $5 A DAY

  OR

- A PENNY THE FIRST DAY, TWO PENNIES THE SECOND DAY, FOUR ON THE THIRD DAY, EIGHT ON THE FOURTH DAY AND SO ON?

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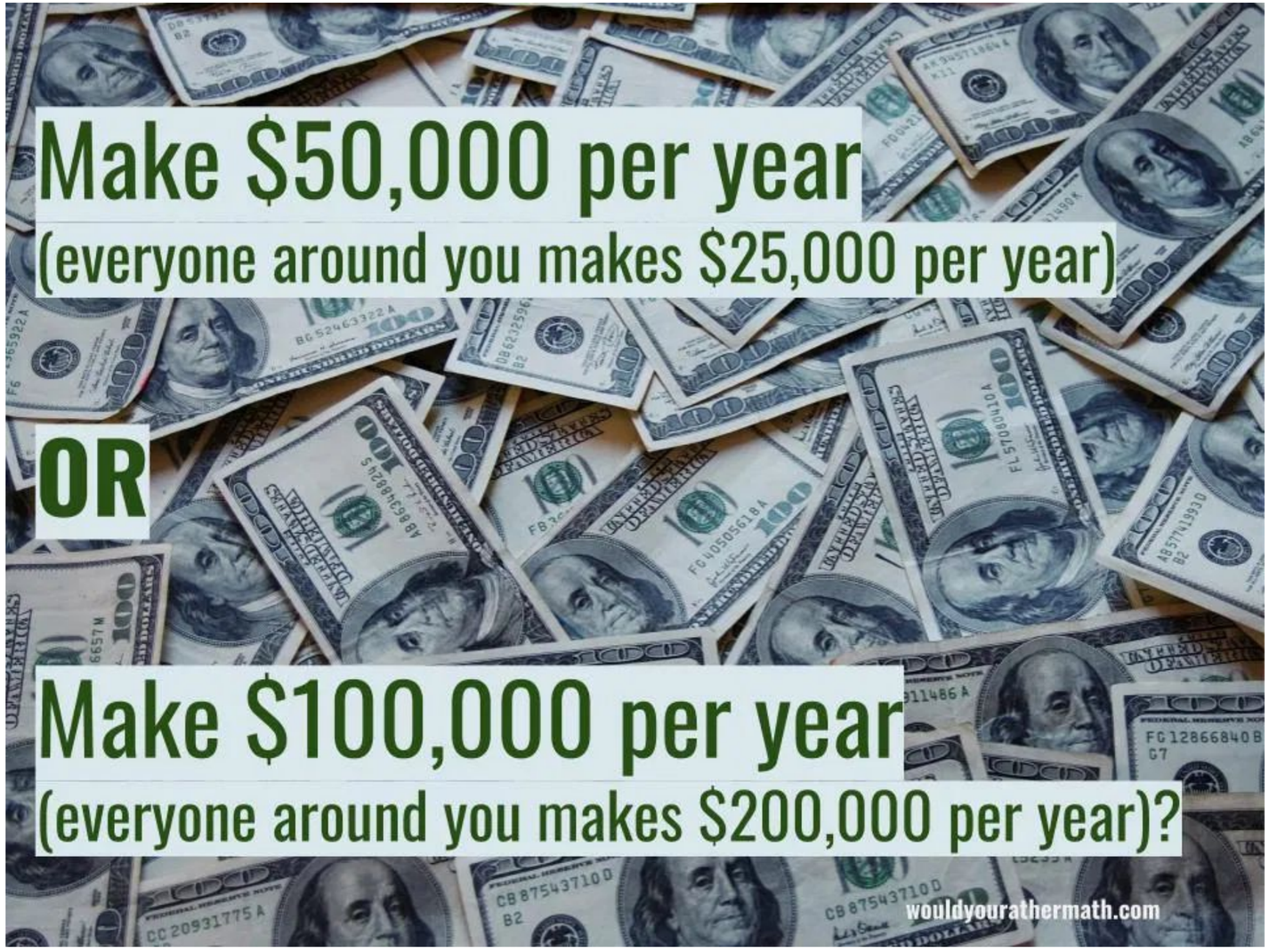
WOULD YOU RATHER



WOULD YOU RATHER

Run the circumference of the circle OR perimeter of the rectangle?

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OPEN MIDDLE

HIGHEST DEGREE POLYNOMIALS

Directions: Make a polynomial of the highest degree by using the whole numbers 1 through 9 at most one time each.

$$(\square x^{\square}+\square)^{\square}\cdot(\square x^{\square}+\square)^{\square}$$

www.openmiddle.com

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OPEN MIDDLE

Use any number from -9 to 9, without repeating, so that the midpoint is correctly located on a line segment.

$$Endpoint\ (\square, \square)$$

$$Midpoint\ (5, \square)$$

$$Endpoint\ (\square, 3)$$

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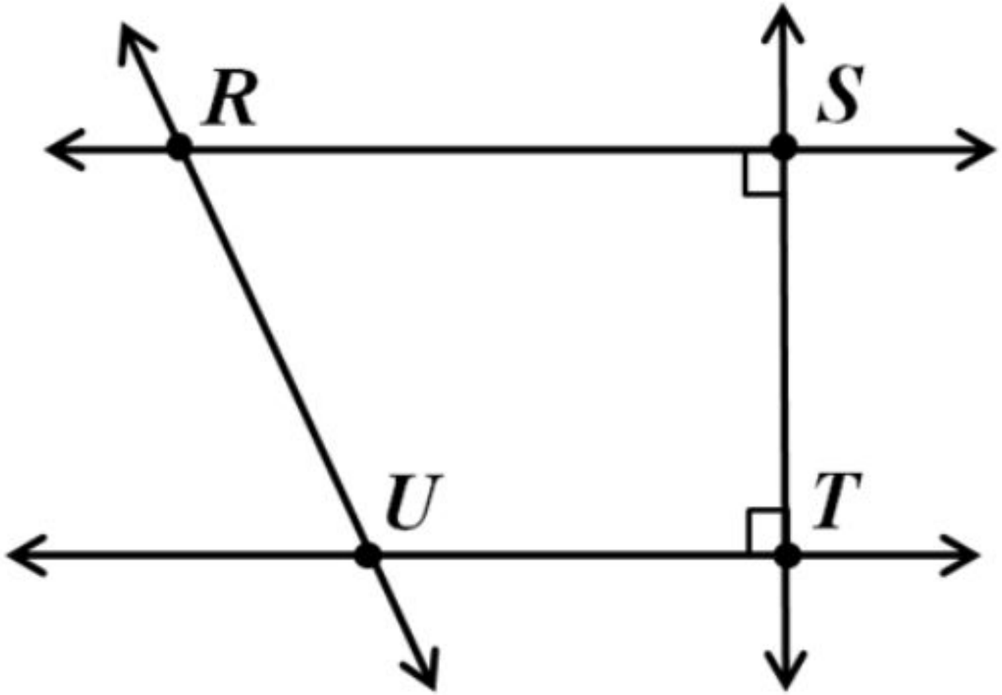
TWO TRUTHS AND A LIE



$\overleftrightarrow{RS} \perp \overleftrightarrow{ST}$

$\overleftrightarrow{UT} \perp \overleftrightarrow{ST}$

$\overleftrightarrow{RS} \perp \overleftrightarrow{UT}$

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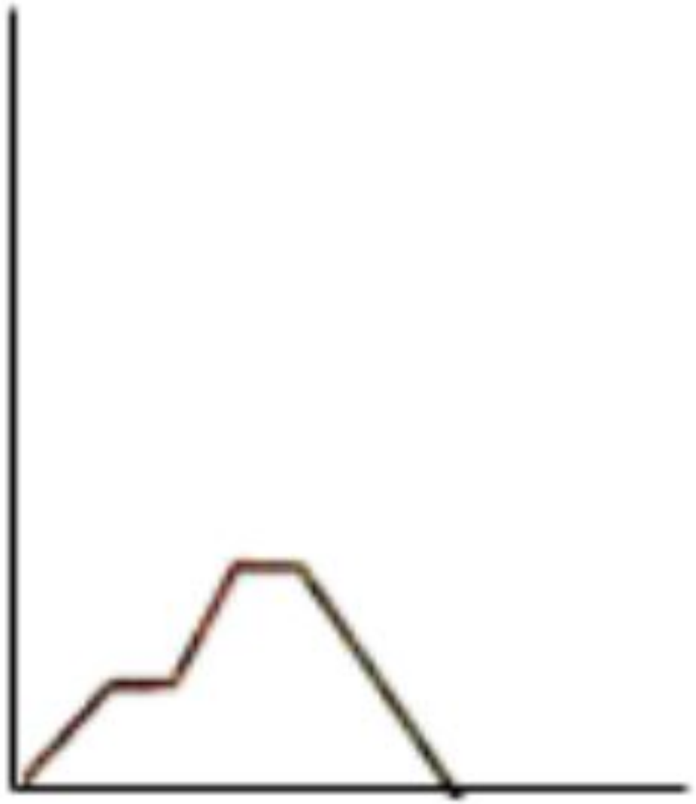
GRAPHING STORIES



WHAT'S NEXT?

What's Next?

1, 2, 4, 7, 11, 16, ____, ____, ____,
____, ____, ____, 79, ____, ____, ____,
____, ____, ____, ____, ____, ____, ____,
____, ____, ____, ____...

1, 11, 21, 1211,
111221, 312211, _____

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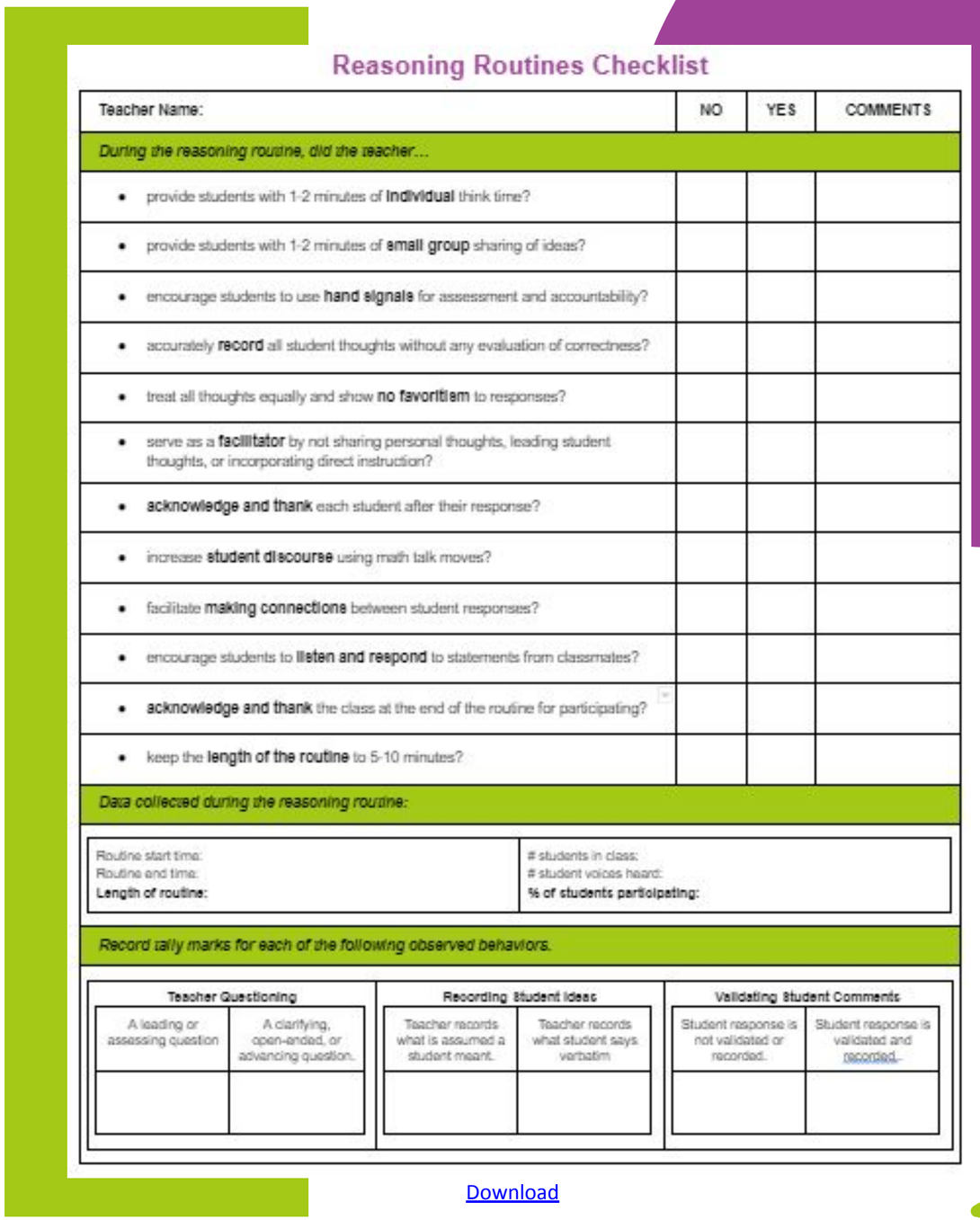
BEST PRACTICES

- Length is around 5-10 minutes at the beginning of class
- Hand signals are used during routines (and throughout the class!)
- Students are given 1-2 minutes of independent and small group think time
- Teacher encourages math talk moves to build class community
- All student responses are recorded without teacher comments on correctness
- All student responses are treated equally
- Teacher does not interject own thoughts or direct instruction
- Students are thanked for their participation



Reasoning Routines Checklist

Teacher Name:	NO	YES	COMMENTS
During the reasoning routine, did the teacher…			
• provide students with 1-2 minutes of **individual** think time?			
• provide students with 1-2 minutes of **small group** sharing of ideas?			
• encourage students to use **hand signals** for assessment and accountability?			
• accurately **record** all student thoughts without any evaluation of correctness?			
• treat all thoughts equally and show **no favoritism** to responses?			
• serve as a **facilitator** by not sharing personal thoughts, leading student thoughts, or incorporating direct instruction?			
• **acknowledge and thank** each student after their response?			
• increase **student discourse** using math talk moves?			
• facilitate **making connections** between student responses?			
• encourage students to **listen and respond** to statements from classmates?			
• **acknowledge and thank** the class at the end of the routine for participating?			
• keep the **length of the routine** to 5-10 minutes?			

Data collected during the reasoning routine:

Routine start time: Routine end time: **Length of routine:**	# students in class: # student voices heard: **% of students participating:**

Record tally marks for each of the following observed behaviors.

Teacher Questioning		Recording Student Ideas		Validating Student Comments	
A leading or assessing question	A clarifying, open-ended, or advancing question.	Teacher records what is assumed a student meant.	Teacher records what student says verbatim	Student response is not validated or recorded.	Student response is validated and recorded.

Download

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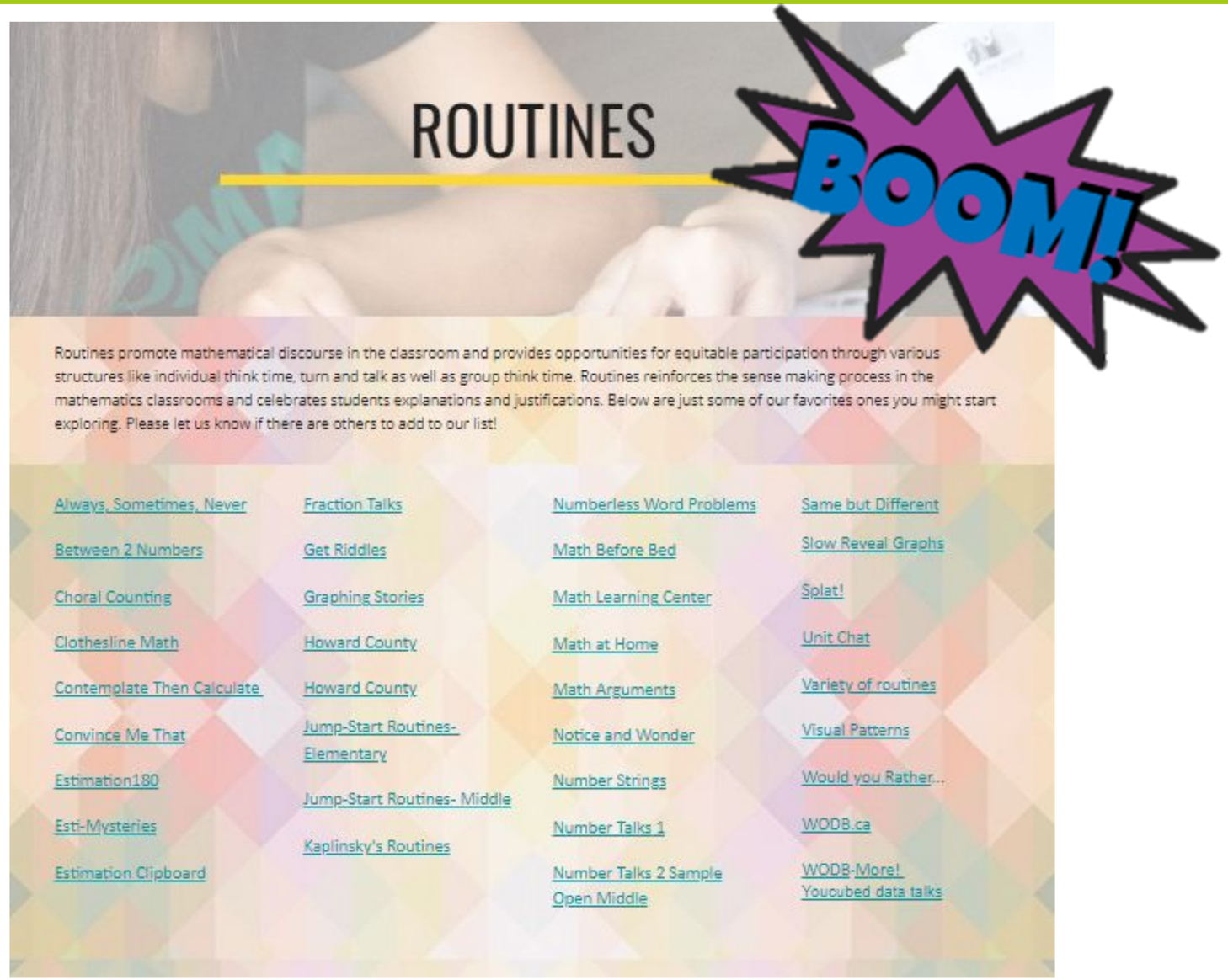
WHERE CAN I FIND THESE RESOURCES?



[Teach at the Speed of Learning]

[Cognitively Guided Instruction]

[Fostering Math Practices]

[Henrico County High Yield Routines]

[Which One Doesn't Belong?]

[Meaningful Math Moments Blog]

[Bridging for Math Strength]

[Steve Wyborney Splat]

[Graphing Stories]

[Slow Reveal Graphs]

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MOVING STUDENTS FORWARD

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SUCCESS CRITERIA

- I will be able to use math talk moves to increase student discourse
- I will be able to find, modify, and create High-Yield Reasoning Routines to use in my classroom

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REFLECTION, FEEDBACK, ACTION

Reflection

What impacted you the most?

Feedback

What feedback do you have for us?
What questions do you still have about discourse and routines?

Action

Based upon today's session, identify one thing you would like to implement prior to our next session.

Write your responses on an index card

[Google Form]

Select the ECPS Professional Development Attendance Log_2022-23 (Quarter 1):
https://forms.gle/kcCSZEdnkkfeA2mD9

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