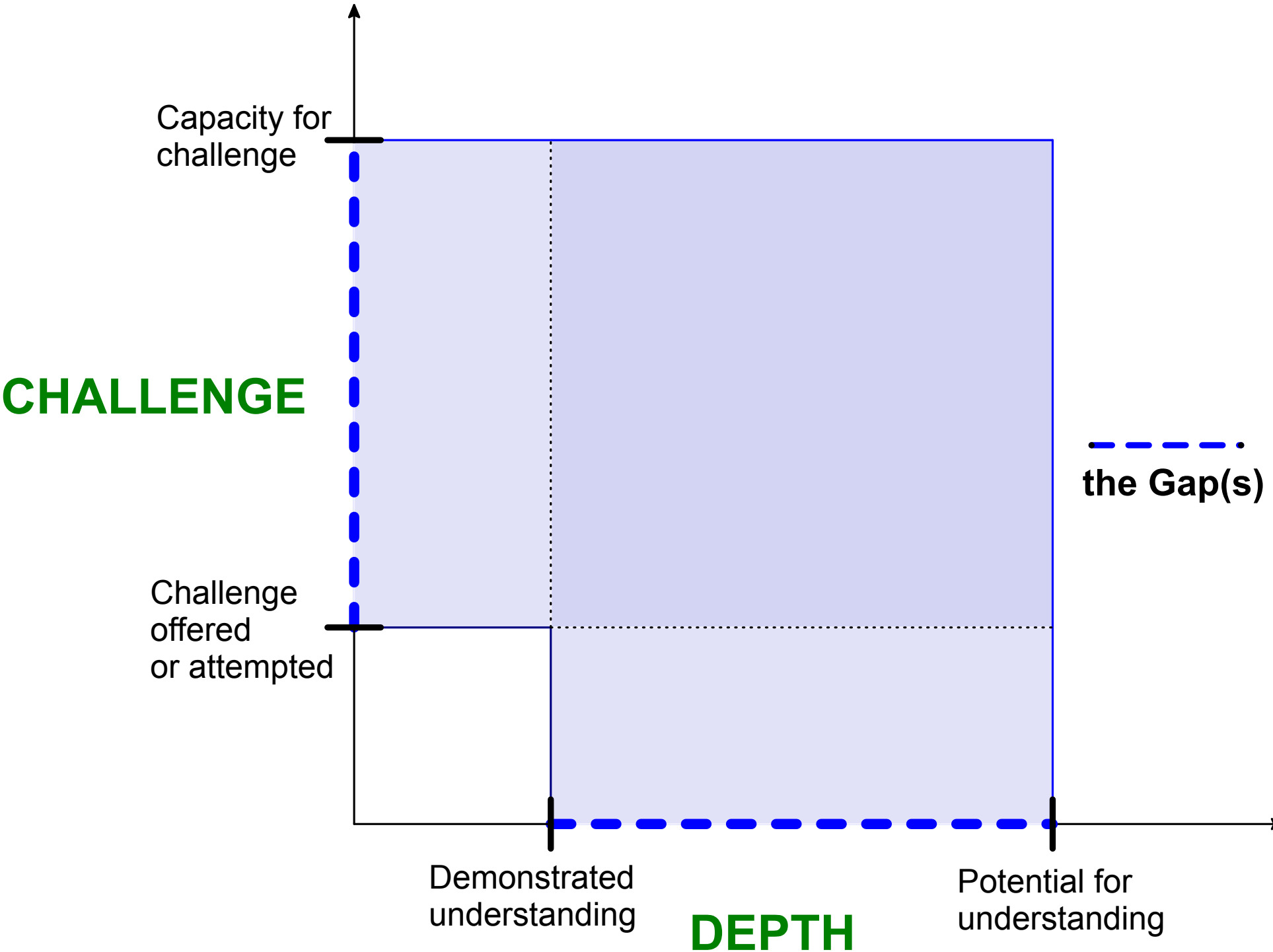


A Math Potential Gap

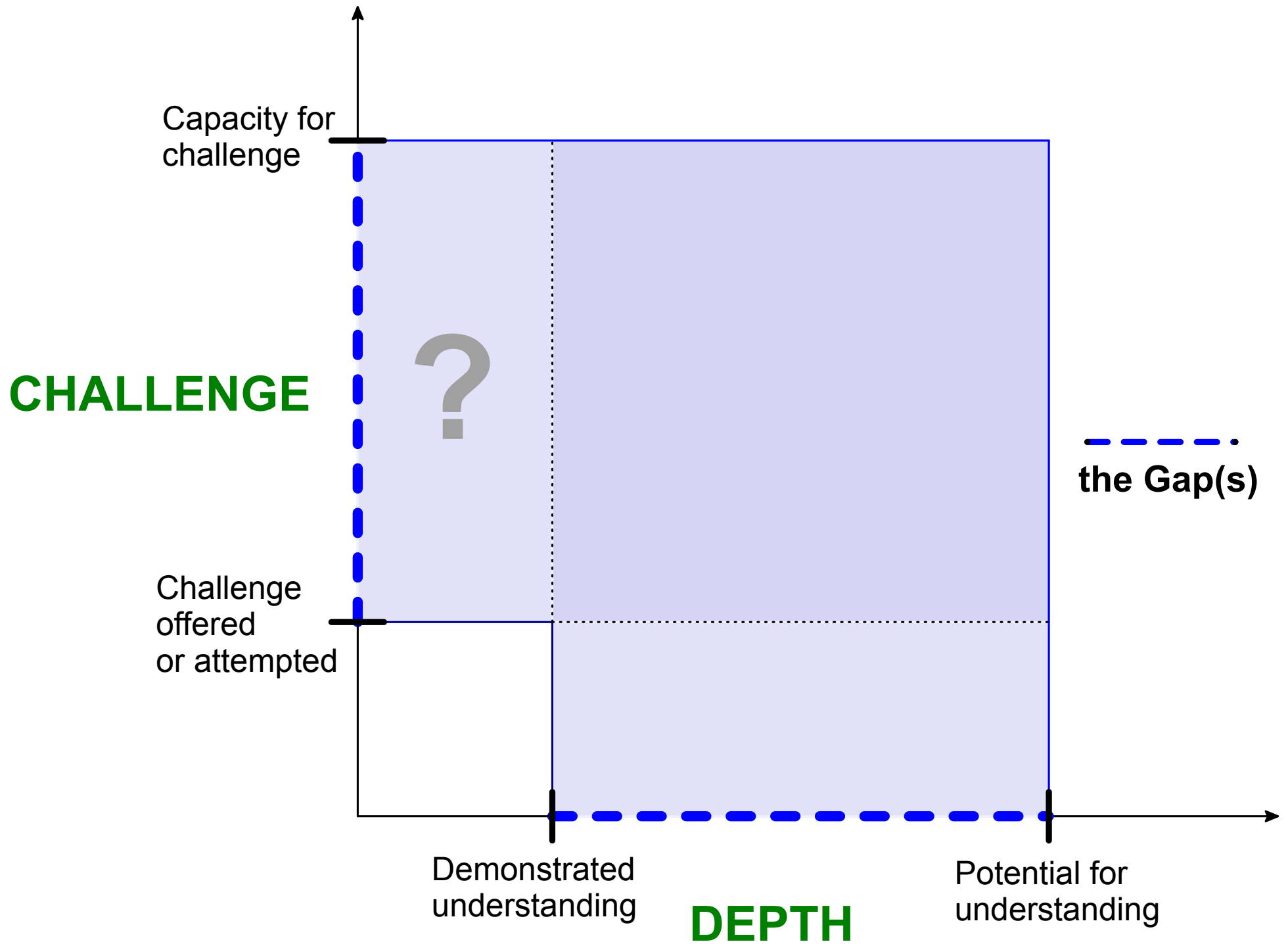
for gifted learners

Jerry Burkhart
5280math.com



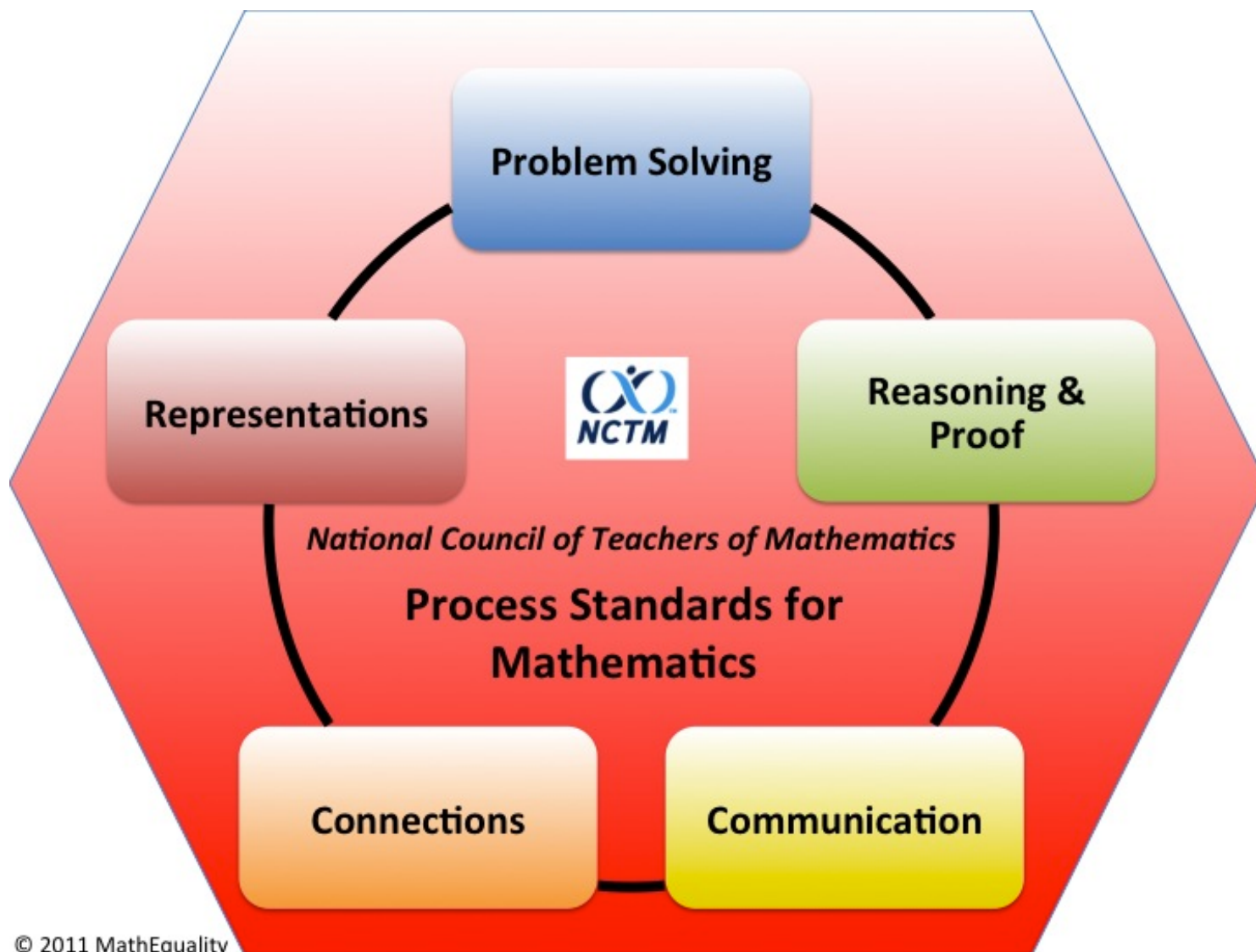
Goals

- Visualize the Math Potential Gap.
- Identify causes and consequences.
- Imagine change.
- Explore implications for all learners.
- Start a conversation.





NCTM Process Standards



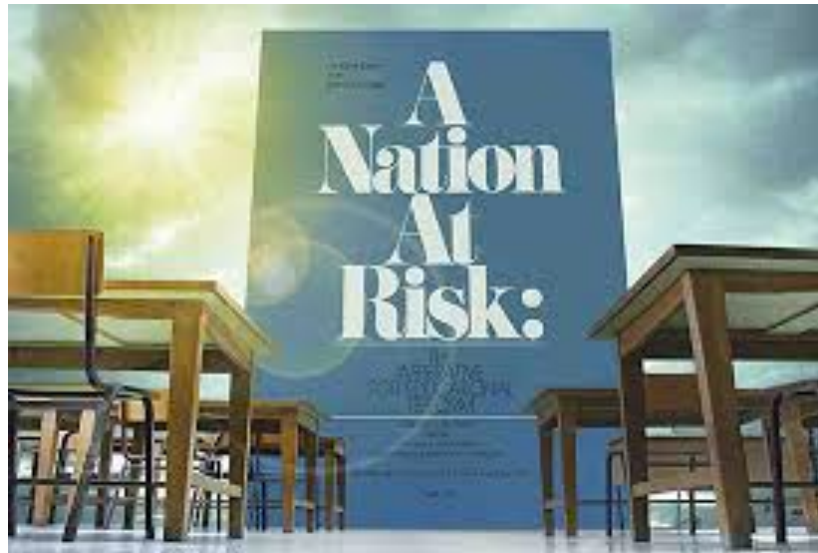
NRC Math Proficiency Strands



Common Core Standards for Mathematical Practice

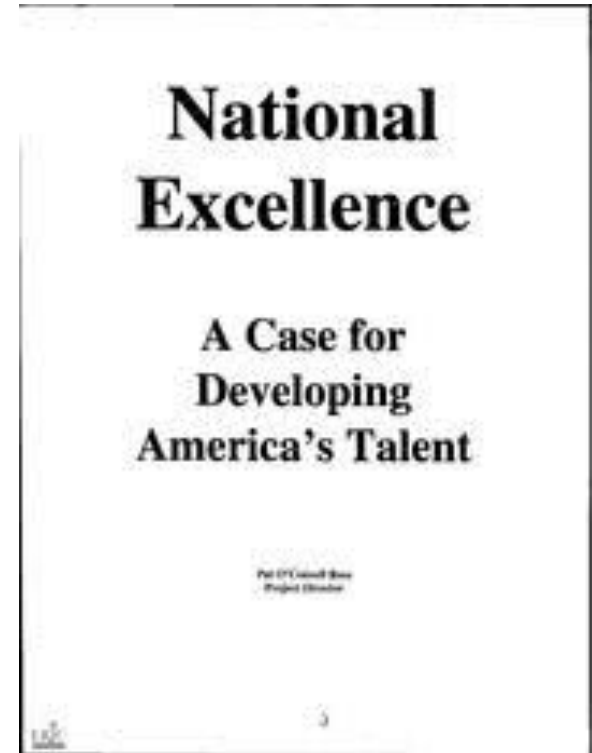
1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

The key component is the accelerated curriculum. Sometimes talented students are taught in a separate class, but they're not accelerated...If the talented students were given the same curriculum as the regular class, the effect on their academic performance was zero.



What gifted students want is flexibility: to be allowed to go at their own pace, to satisfy course requirements as quickly as possible, and to move on to new areas of learning.

Ernest L Boyer
high school student



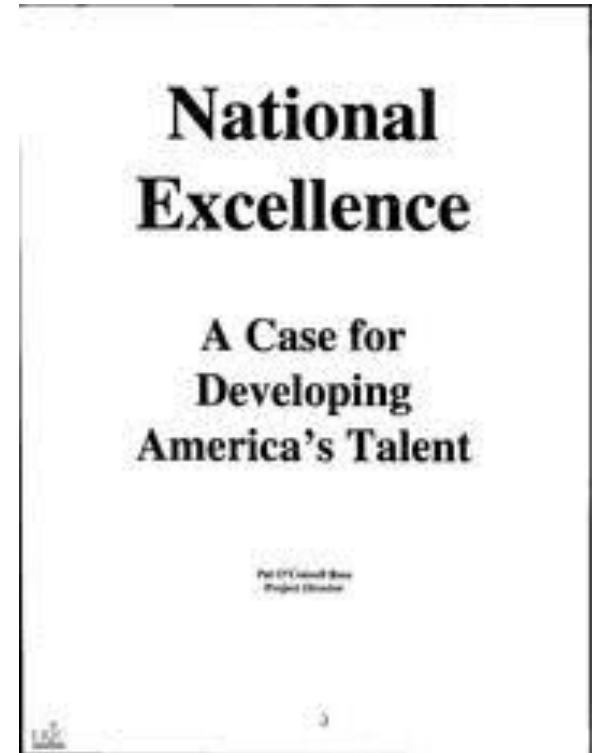
October 1993

A Vision for Excellent Schools

excerpts

All children progress through challenging material at their own pace. Students are grouped and regrouped based on their interests and needs. Achieving success for all students is not equated with achieving the same results for all students.

Students gain in self-esteem and self-confidence by mastering work that initially seemed slightly beyond their grasp.



October 1993

Most types of acceleration show significant positive academic effects for identified gifted learners as measured by:

- standardized achievement scores
- teacher developed test scores
- grade averages
- teacher ratings of student performance
- attitude toward learning



Dr. Karen Rogers
Professor Emeritus
Special Education and Gifted Education
University of St. Thomas
Minnesota

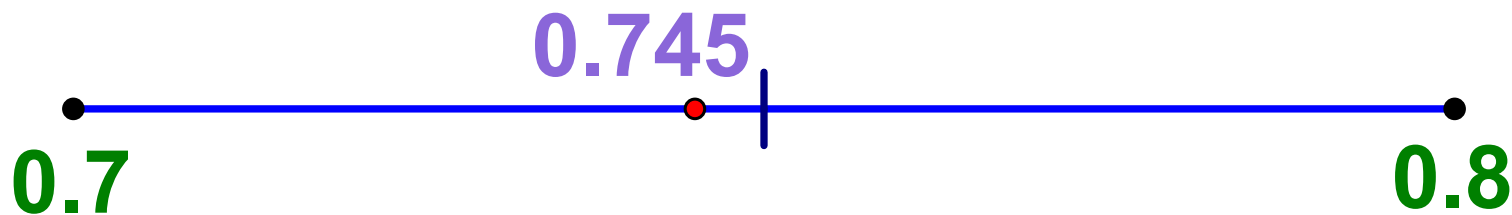
A best-evidence synthesis of research on acceleration options for gifted students, 1993

rounding 0.745 to the nearest tenth

1. 0.745 rounds to 0.75

2. 0.75 rounds to 0.8

3. Conclusion: 0.745 rounds to 0.8 (?)



Using “long division”
to find half of 40.5

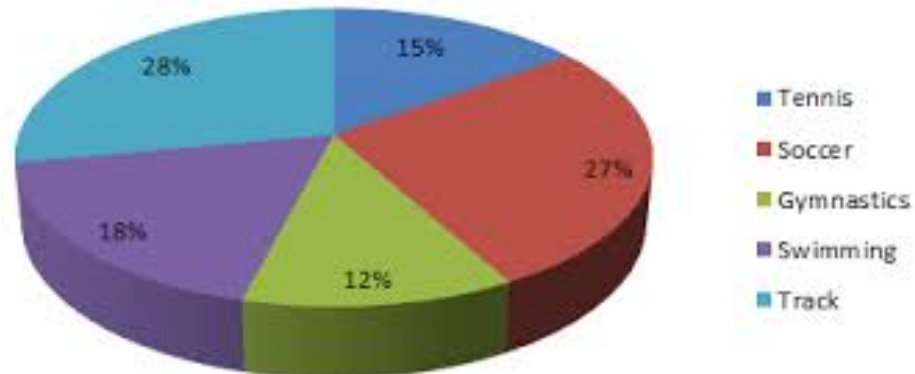
$$2 \overline{)40.5}$$

$$10.9 = R \div 3.7$$

$$? = R \div 0.37$$

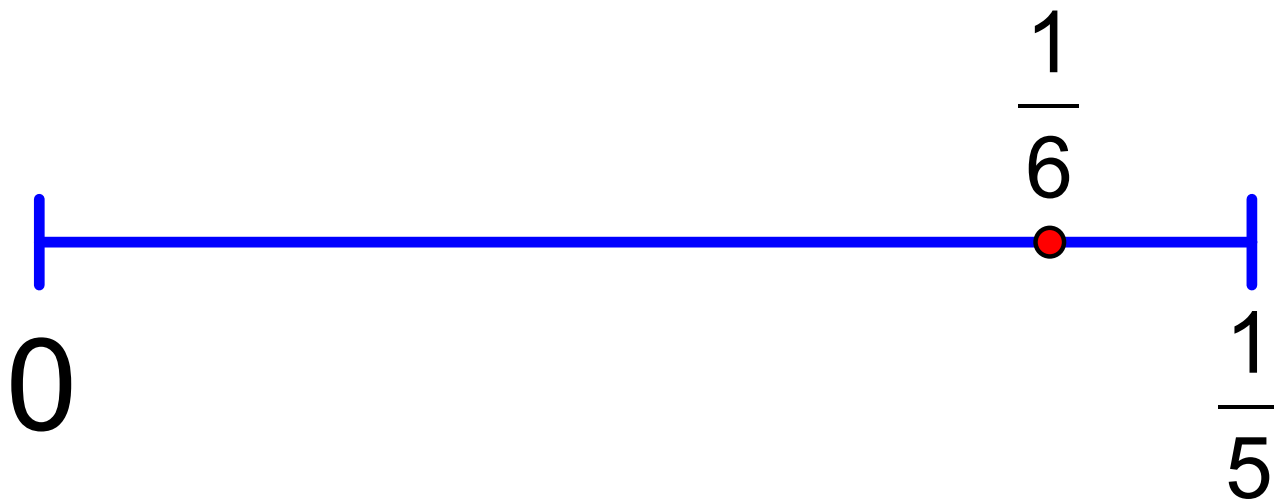


“forgetting” percentage calculations for a circle graph



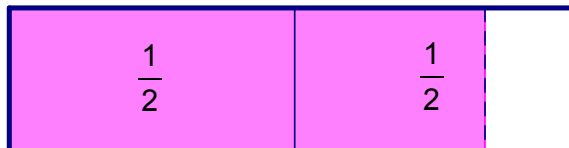
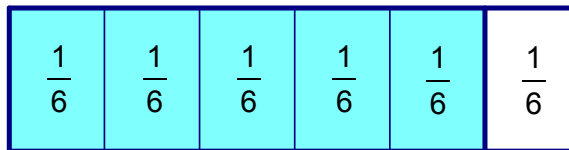
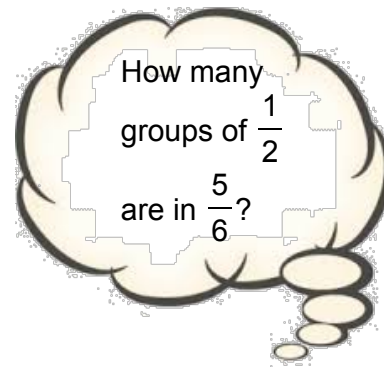
Can a equal 6?

$$\frac{1}{a} + \frac{\boxed{}}{\boxed{}} = \frac{1}{5}$$

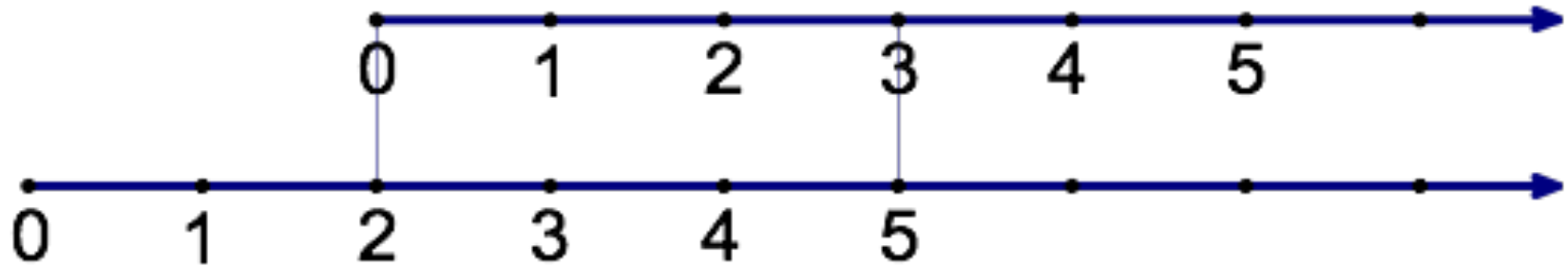


creating stories and pictures
that show the meaning
of fraction
multiplication and division

$$\frac{5}{6} \div \frac{1}{2}$$

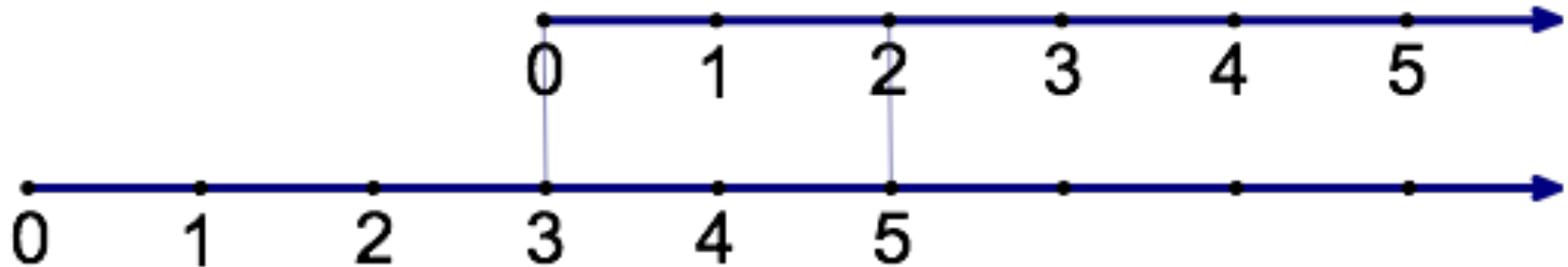


Show this with your rulers.

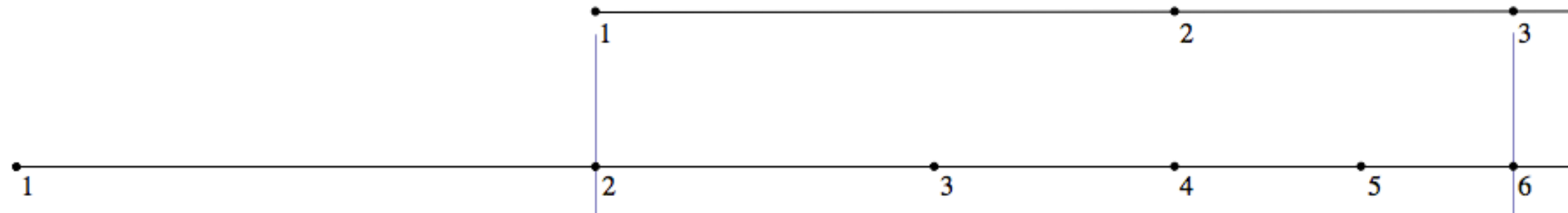


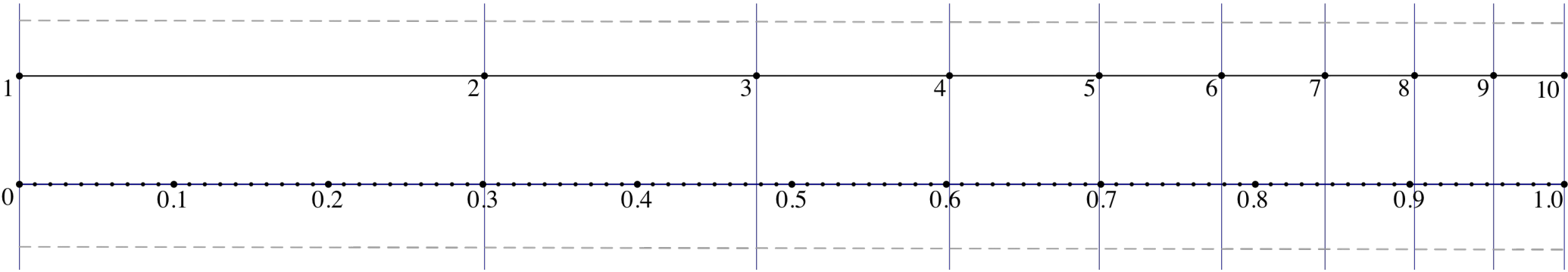
What do you notice?

What do you wonder?

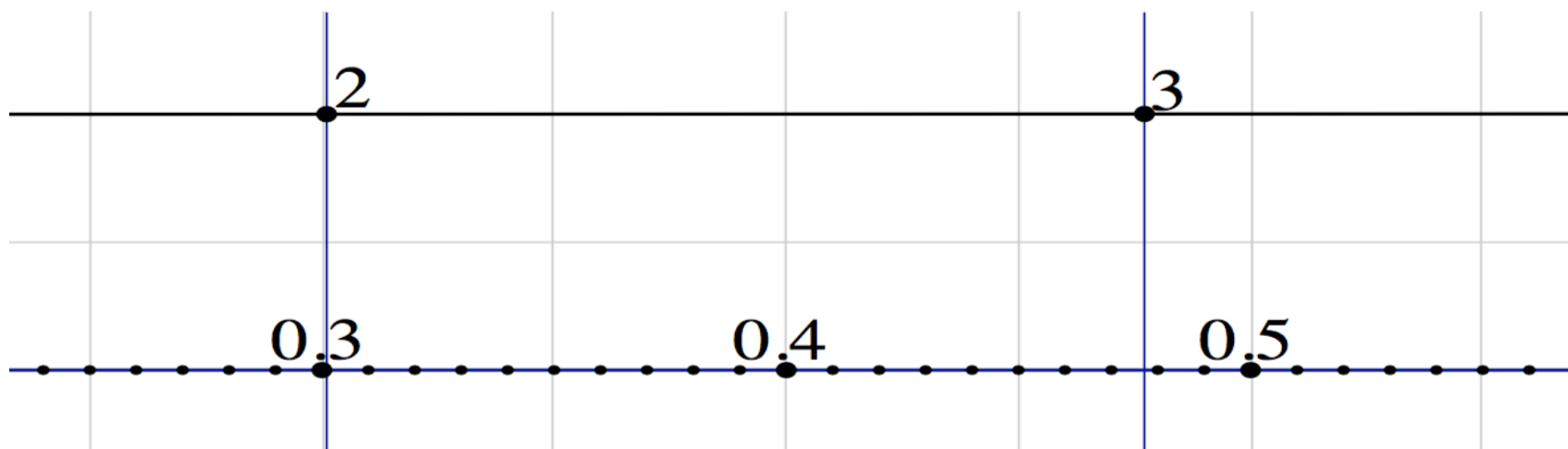


How does this work?





A magnified view



What is the measurement for the number 2?

What is the measurement for the number 3?

What is the measurement for the number 2.5?

potential growth

for students who know procedures

- Notice when answers are/not reasonable.
- Think of the *magnitude* of numbers.
- Find a way forward when you forget a rule.
- See and use concepts behind procedures.
- Make connections.
- Search for efficient or elegant approaches.
- Persevere in the face of complexity.

benefits

of providing sufficient depth

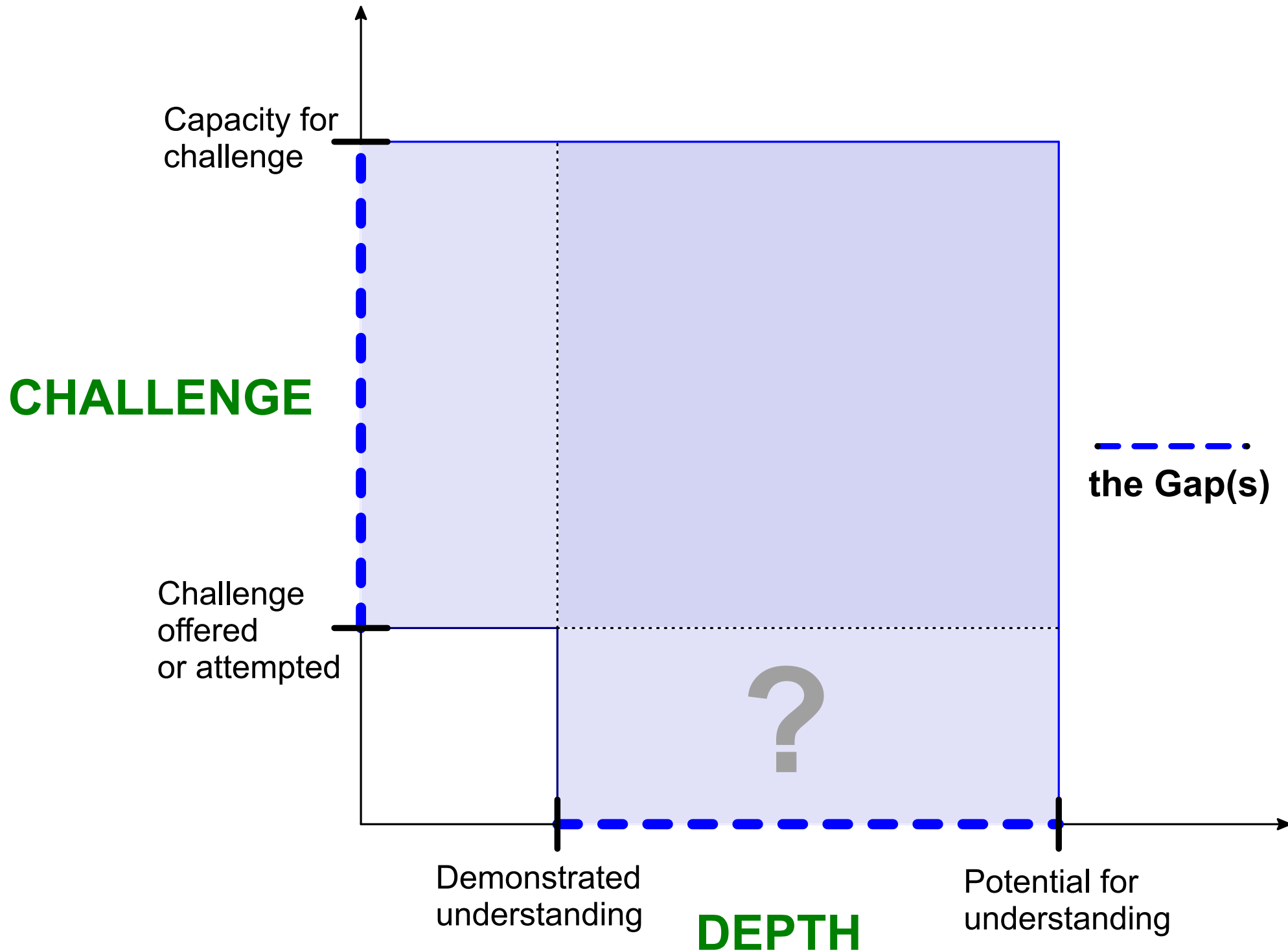
- Develop students' full potential.
- Create a positive “snowball effect” on learning.
- Manage the “I use to be good...” syndrome.
- Retain students in upper level math courses.
- Reinforce realistic, productive beliefs about math.
- Identify students' needs more effectively.

Imagine change.

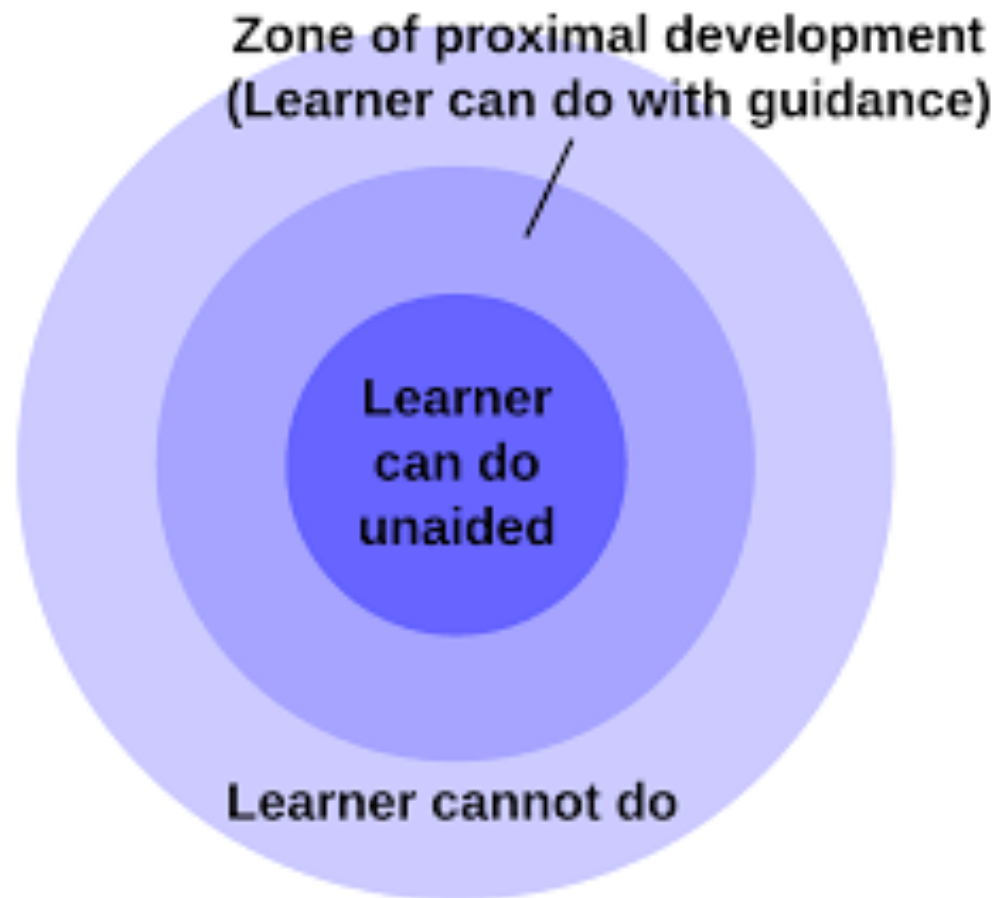
Ten Plus One

5280 Math Resources >> Ten Plus One

1. Write a story.
2. Draw a picture.
3. Explain why.
4. Find another way.
5. Compare and contrast.
6. Start with the answer.
7. Remove information.
8. Solve to learn.
9. Build a pattern.
10. Ask “What if...?”



$$\begin{array}{r}
 9 \square 8, 7 \square 7 \\
 - \square 2 \square, 5 3 \square \\
 \hline
 2 8 8, \square 9 4
 \end{array}$$



Zone of Proximal Development

Vygotsky

productive struggle

The mind that is not baffled
is not employed.

The impeded stream is
the one that sings.

Wendell Barry



productive struggle

and Mindset



Carol Dweck

“If parents want to give their children a gift, the best thing they can do is to teach their children to love challenges, be intrigued by mistakes, enjoy effort, and keep on learning. That way, children don’t have to be slaves of praise.”

The labeling of students as gifted hurts not only the students who are deemed as having no gifts but also the students who are given the gifted label, as it sets them on a fixed mindset pathway...

Mathematical Mindsets

Jo Boaler, 2015

...the U.S. education system focuses on “gifted” students who are given different opportunities, not because they show great tenacity and persistence but often because they are fast with math facts.

Mathematical Mindsets

Jo Boaler, 2015

Every child deserves
an equal opportunity
to struggle.

Mary Slade



Imagine change.

Try this mathematical experiment!

Step 1: Choose two whole numbers.

Step 2: Subtract the smaller number from the larger number.

Step 3: Subtract the difference and the subtrahend (larger – smaller).

Step 4: Repeat Step 3 until the answer is 0 or 1.

Find a way to predict which numbers will stop at 1 instead of 0.

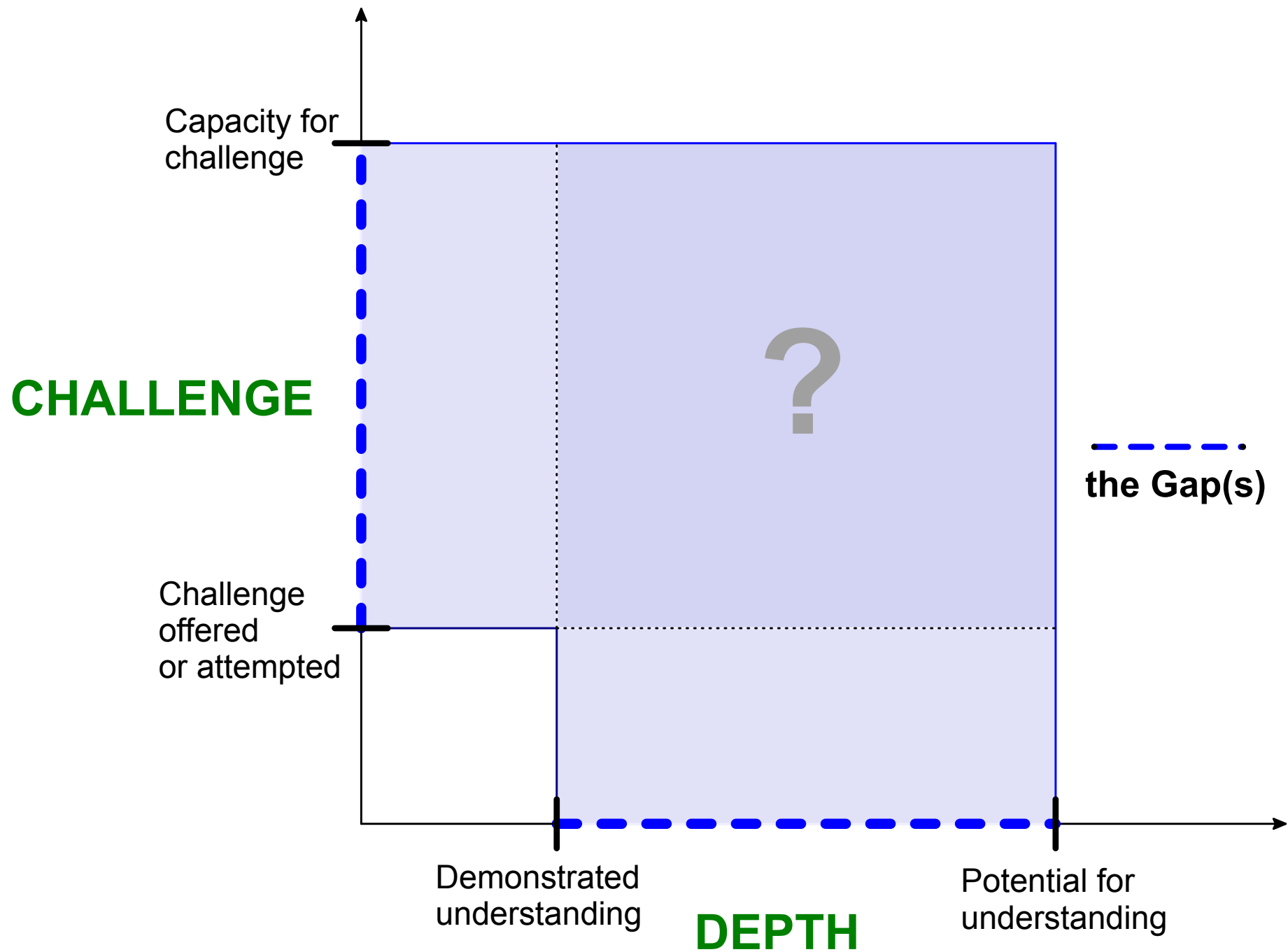
Intrepid Math 1-2

Jerry Burkhart, 2017

benefits

of providing greater challenge

- Develop students' full potential.
- Learn growth mindset.
- Reinforce realistic, productive beliefs about math.
- Manage “elitism.”
- Identify students' needs more effectively.



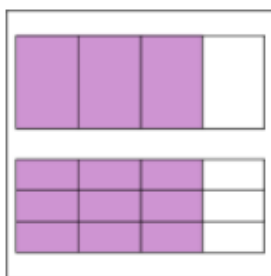
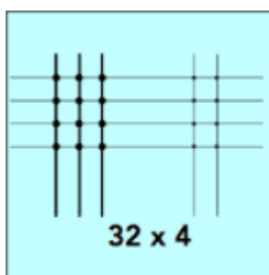
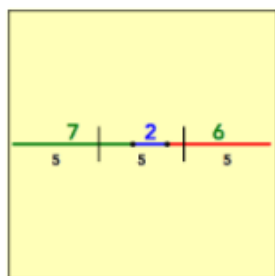
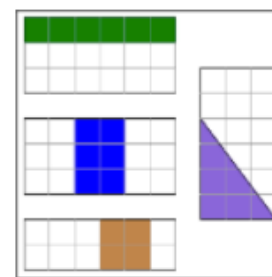
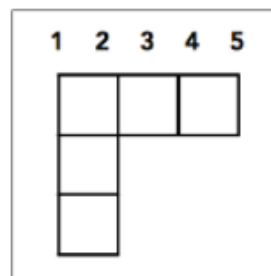
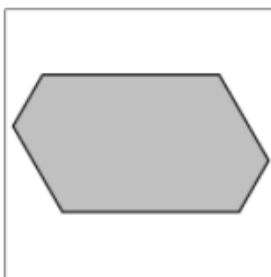
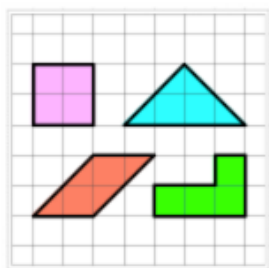
noticing and wondering prompts

5280 Math Resources >> Noticing and Wondering

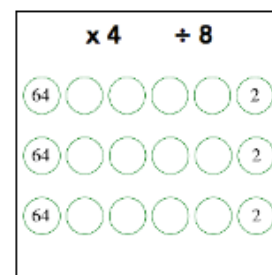
EARLY GRADES (K-4)

What do you notice? What do you wonder?

$$\begin{aligned} 0 &= 4 - 4 \\ 1 &= 4 - 3 \\ 2 &= 4 - 2 \\ 3 &= 4 - 1 \end{aligned}$$



$$\begin{aligned} 11 \times 19 &= 209 \\ 11 \times 28 &= 308 \\ 11 \times 37 &= 407 \\ 11 \times 46 &= 506 \end{aligned}$$



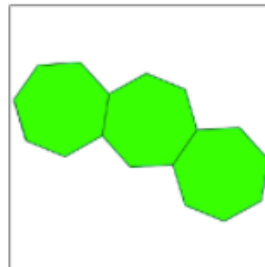
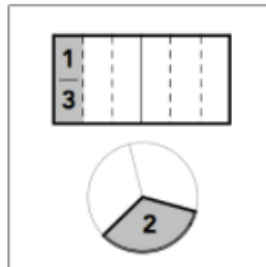
	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	10
2	2	4	6	8	10	12	14	16	18	20
3	3	6	9	12	15	18	21	24	27	30
4	4	8	12	16	20	24	28	32	36	40
5	5	10	15	20	25	30	35	40	45	50
6	6	12	18	24	30	36	42	48	54	60
7	7	14	21	28	35	42	49	56	63	70
8	8	16	24	32	40	48	56	64	72	80
9	9	18	27	36	45	54	63	72	81	90
10	10	20	30	40	50	60	70	80	90	100

noticing and wondering prompts

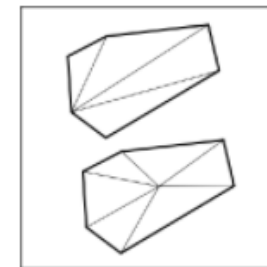
5280 Math Resources >> Noticing and Wondering

MIDDLE GRADES (5–8)

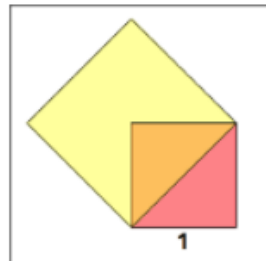
What do you notice? What do you wonder?



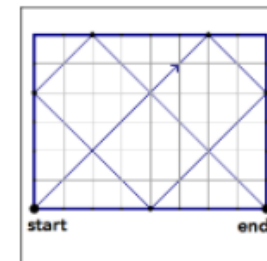
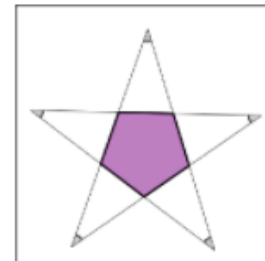
	0	1	2	3	4
0	0	0	0	0	0
1	0	1	2	3	4
2	0	2	4	6	8
3	0	3	6	9	12
4	0	4	8	12	16



0	none	8	3
1	0	9	20
2	1	10	101
3	10	11	10000
4	2	12	12
5	100	13	100000
6	11	14	1001
7	1000	15	110



$$\begin{array}{l} \frac{1}{2} - \frac{1}{3} = \frac{1}{6} \\ \frac{1}{3} - \frac{1}{4} = \frac{1}{12} \\ \frac{1}{4} - \frac{1}{5} = \frac{1}{20} \end{array} \quad \begin{array}{l} \frac{1}{2} - \frac{1}{4} = \frac{1}{4} \\ \frac{1}{3} - \frac{1}{5} = \frac{2}{15} \\ \frac{1}{4} - \frac{1}{6} = \frac{1}{12} \end{array}$$

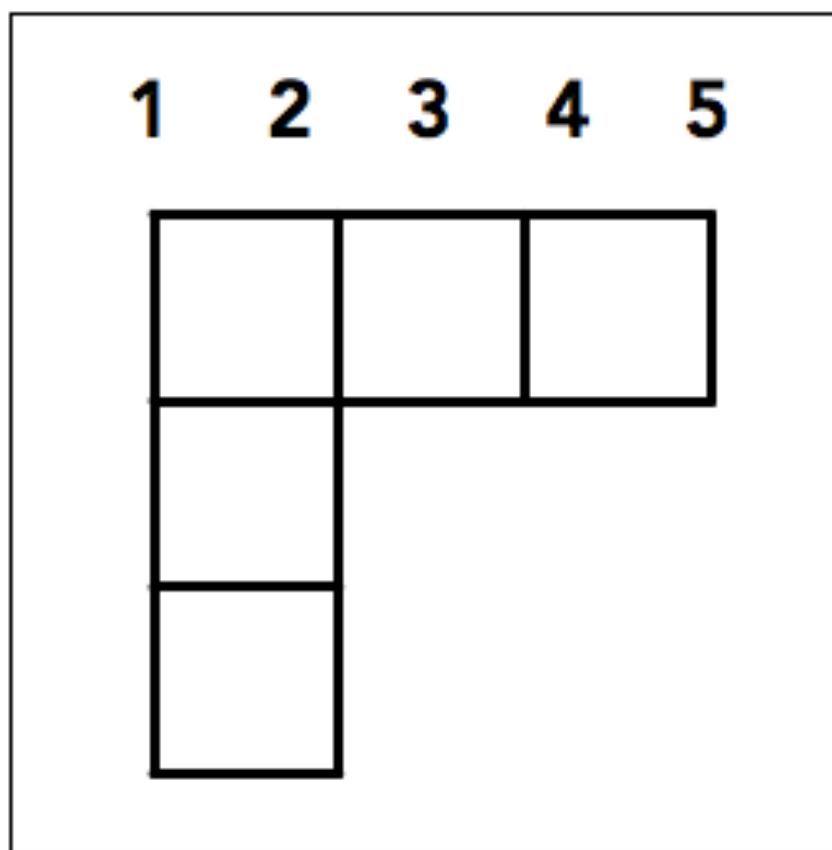


Mountain Heights Middle School:
51,600 square feet of floor space
470 students
North Star Middle School:
118,300 square feet of floor space
725 students

Used by permission: Advanced Common Core Math Explorations: Ratios, Proportions, and Similarity. Prufrock Press, 2016.

problems that never end

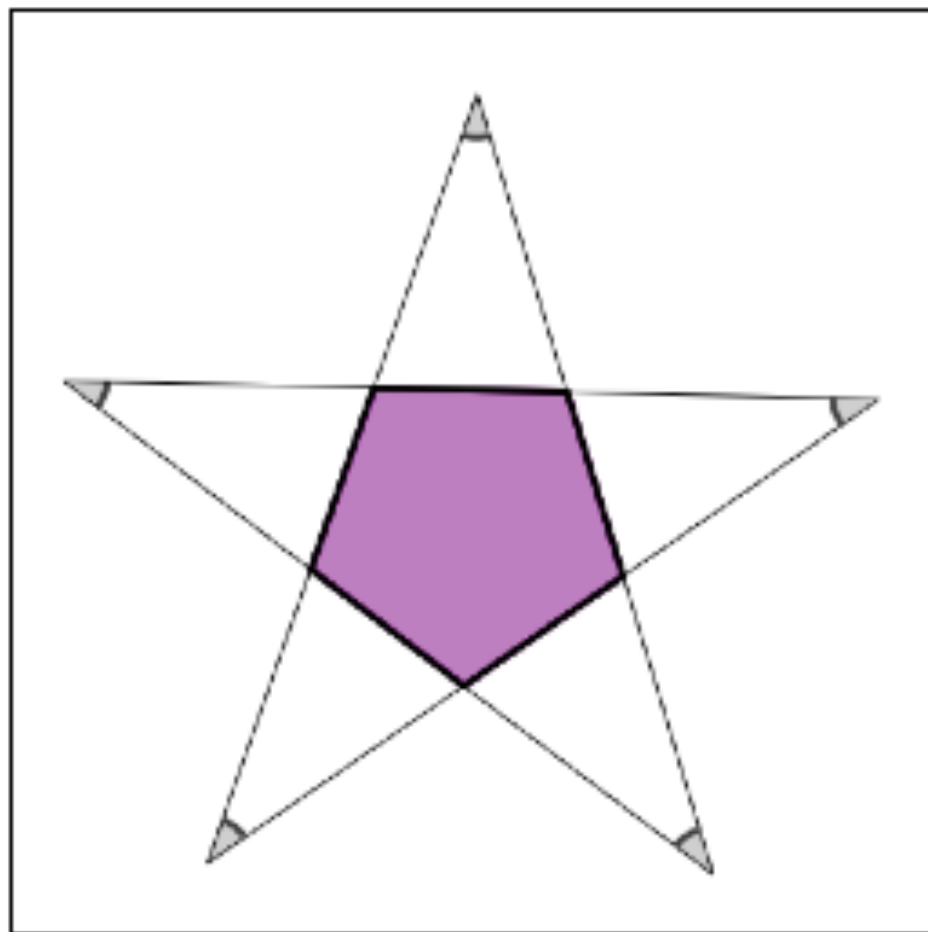
5280 Math Resources >> Problems That Never End



Extending the Challenge in Mathematics: Developing Mathematical Promise in K-8 Students
Linda Jensen Sheffield. Corwin Press, 2003

problems that never end

5280 Math Resources >> Problems That Never End



Advanced Common Core Math Explorations: Measurement and Polygons ("Starstruck").
by Jerry Burkhardt. Prufrock Press, 2016.

projects that never end

5280 Math Resources >> Projects That Never End

.	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	10
2	2	4	6	8	10	12	14	16	18	20
3	3	6	9	12	15	18	21	24	27	30
4	4	8	12	16	20	24	28	32	36	40
5	5	10	15	20	25	30	35	40	45	50
6	6	12	18	24	30	36	42	48	54	60
7	7	14	21	28	35	42	49	56	63	70
8	8	16	24	32	40	48	56	64	72	80
9	9	18	27	36	45	54	63	72	81	90
10	10	20	30	40	50	60	70	80	90	100

projects that never end

5280 Math Resources >> Projects That Never End

.	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	10
2	2	4	6	8	10	12	14	16	18	20
3	3	6	9	12	15	18	21	24	27	30
4	4	8	12	16	20	24	28	32	36	40
5	5	10	15	20	25	30	35	40	45	50
6	6	12	18	24	30	36	42	48	54	60
7	7	14	21	28	35	42	49	56	63	70
8	8	16	24	32	40	48	56	64	72	80
9	9	18	27	36	45	54	63	72	81	90
10	10	20	30	40	50	60	70	80	90	100

Multiplication Table Patterns. Jerry Burkhart. 5280math.com

projects that never end

5280 Math Resources >> Projects That Never End

.	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	10
2	2	4	6	8	10	12	14	16	18	20
3	3	6	9	12	15	18	21	24	27	30
4	4	8	12	16	20	24	28	32	36	40
5	5	10	15	20	25	30	35	40	45	50
6	6	12	18	24	30	36	42	48	54	60
7	7	14	21	28	35	42	49	56	63	70
8	8	16	24	32	40	48	56	64	72	80
9	9	18	27	36	45	54	63	72	81	90
10	10	20	30	40	50	60	70	80	90	100

projects that never end

ACCME Books >> Ratios Proportions, and Similarity
Ramps, Paints, and Hot-Air Balloons

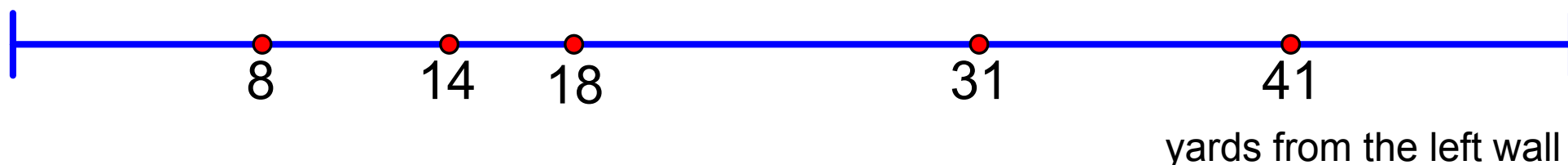
Temperature and Volume of Air (at constant pressure)

Temperature (°K)	266	273	301	320	345	355
Volume (mL)	4.5	4.6	5.1	5.4	5.8	6.0

Advanced Common Core Math Explorations: Ratios, Proportions, and Similarity.
by Jerry Burkhart. Prufrock Press, 2016.

projects that never end

5280 Math Resources >> Projects That Never End



Items are sent from each machine
to a new machine for final processing.
Where should the new machine be located?

projects that never end

5280 Math Resources >> Projects That Never End

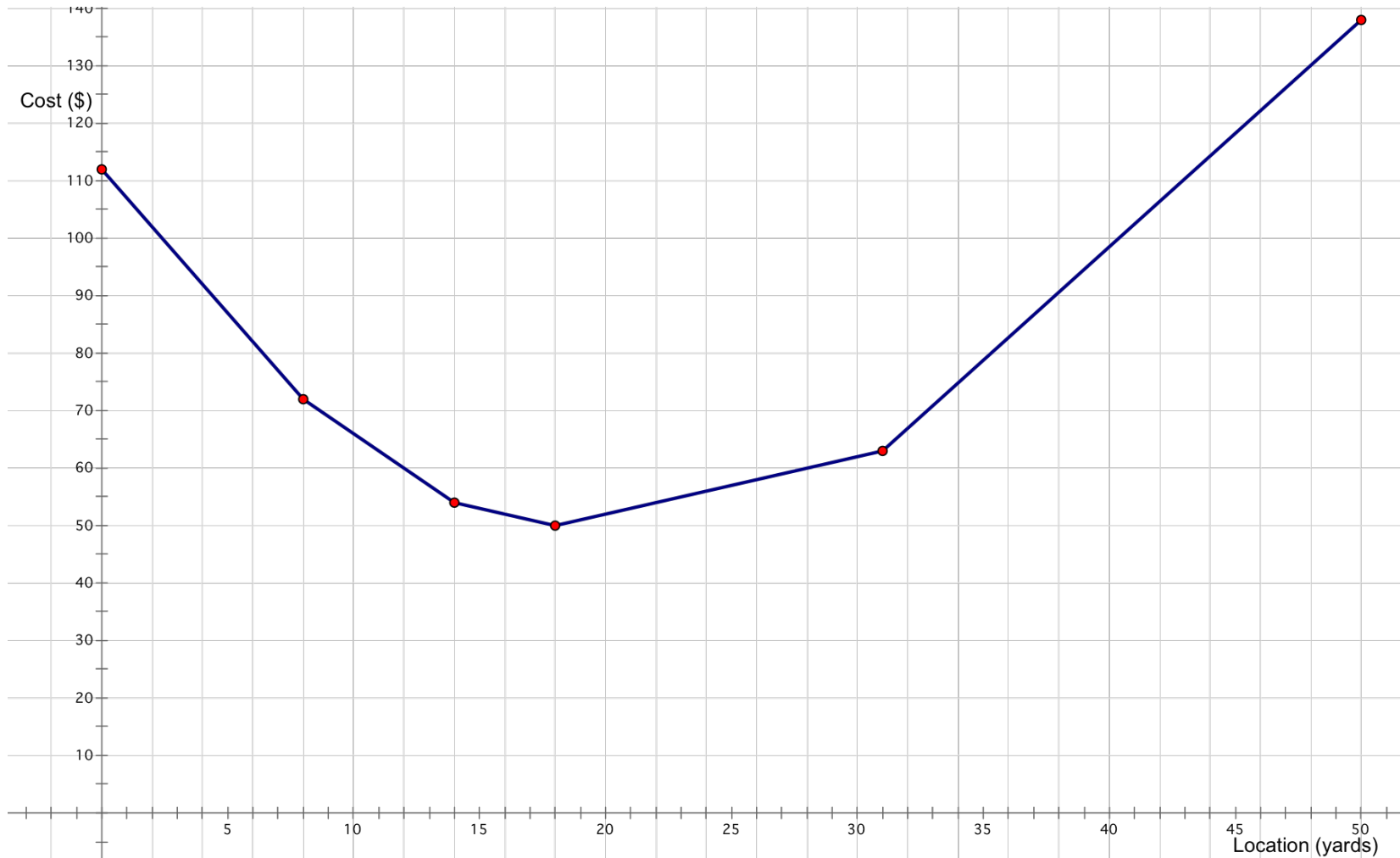
Cost for 5 Machines

Loc (yds)	Cost (\$)		Loc (yds)	Cost (\$)		Loc (yds)	Cost (\$)		Loc (yds)	Cost (\$)		Loc (yds)	Cost (\$)
0	112												
1	107		11	63		21	53		31	63		41	93
2	102		12	60		22	54		32	66		42	98
3	97		13	57		23	55		33	69		43	103
4	92		14	54		24	56		34	72		44	108
5	87		15	53		25	57		35	75		45	113
6	82		16	52		26	58		36	78		46	118
7	77		17	51		27	59		37	81		47	123
8	72		18	50		28	60		38	84		48	128
9	69		19	51		29	61		39	87		49	133
10	66		20	52		30	62		40	90		50	138

Best Location for a Machine. Jerry Burkhart. 5280math.com

projects that never end

5280 Math Resources >> Projects That Never End



Best Location for a Machine. Jerry Burkhart. 5280math.com

projects that never end

5280 Math Resources >> Projects That Never End

between 0 and 8 yards: $C = 112 - 5 \cdot x$
from $(8 - x) + (14 - x) + (18 - x) + (31 - x) + (41 - x)$

between 8 and 14 yards: $C = 96 - 3 \cdot x$
from $(x - 8) + (14 - x) + (18 - x) + (31 - x) + (41 - x)$

between 14 and 18 yards: $C = 68 - x$
from $(x - 8) + (x - 14) + (18 - x) + (31 - x) + (41 - x)$

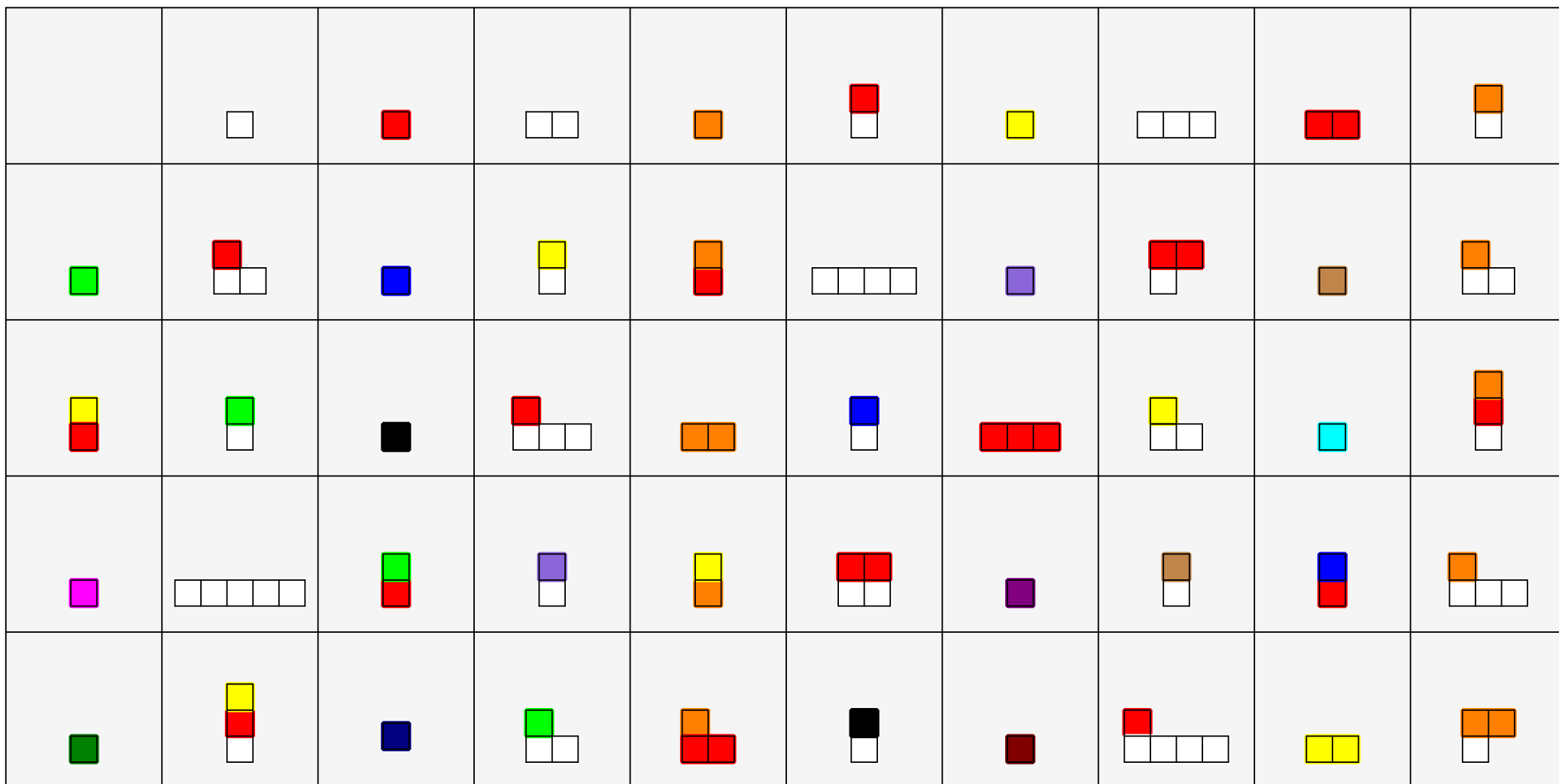
between 18 and 31 yards: $C = 32 + x$
from $(x - 8) + (x - 14) + (x - 18) + (31 - x) + (41 - x)$

between 31 and 41 yards: $C = -30 + 3 \cdot x$
from $(x - 8) + (x - 14) + (x - 18) + (x - 31) + (41 - x)$

between 41 and 50 yards: $C = -112 + 5 \cdot x$



projects that never end




5280 Math Resources >> Math Building Blocks












Advanced Common Core Math Explorations: Factors and Multiples.
by Jerry Burkhart. Prufrock Press, 2014.

1	2
	<input type="checkbox"/>

1	2	3
		

1	2	3	4
			

1	2	3	4	5
				

1	2	3	4	5	6
					

implications

for all learners

- Increased access to challenge
- Greater flexibility in meeting needs
- Higher expectations for all

other resources

[5280math.com >> Other Resources](#)

- >> Classroom resources
- >> Websites
- >> Books for Teachers
- >> Books for Students

Please share yours. I would love to include them!



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website: 5280math.com/contact

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jburkhart@5280math.com