Updates to Middle School Math Program

San Mateo- Foster City School District March 25, 2021

What do we want for our students in math?

Combat messages in society about math

"Reading with your child"

"Do math with your child"

Math: Just keep working. There is no rush. If you **math** with them, they will grow.

What do we want out of our K-8 math program?

Math: Just keep working. There is no rush. If you **math** with them, they will grow.

Mathematics Team Mission and Vision

SMFC students become enthusiastic and proficient learners of mathematics who are able to share their thinking, use multiple representations, and build on the ideas of others.

Increase meaningful mathematical discourse and sense-making to build fluency, flexibility, and strategic competence in all students.

What challenges are we facing right now?

Covid learning loss is greatest in math.

5th to 6th Math transition is always problematic, especially after year of distance learning.

Math placement steps interrupted by pandemic.

COVID Learning Loss

COVID-Related Learning Loss Will Hit Younger Students Differently

By Sarah D. Sparks — August 26, 2020 2 min read

Educators are bracing for students to return to school this fall with significant learning loss, after more than six months of disruption from the coronavirus pandemic. New research suggests schools will need to target interventions differently for students in different grades and subjects.

Researchers with the assessment group Illuminate Education analyzed more than 500,000 computer-adaptive test scores in reading and math from kindergarten through 5th grade students in reading and math between fall and spring tests in the 2018-19 and 2019-20 school years. The data were used to project the difference in growth between the two years and the extent of learning loss in each grade and subject.

They found students in all grades and subjects had learning loss during the pandemic school closures this spring, but they followed different patterns. Kindergartners and 1st graders lost the most ground in general reading growth, but rising 5th graders lost the most fluency in reading aloud. Across every grade, students lost more learning in math than in reading, losing two and a half to four and a half months of learning, compared to a month or two in reading.

Covid learning loss is projected to be greatest in Math

Projections from 500,000 computer-adaptive test scores in reading and math:

"Across every grade, students lost more learning in math than in reading, losing two and a half to four and a half months of learning, compared to a month or two in reading."

Ed Weekly Article August 2020

Figure 1. Mean *aReading* scores by cohort.

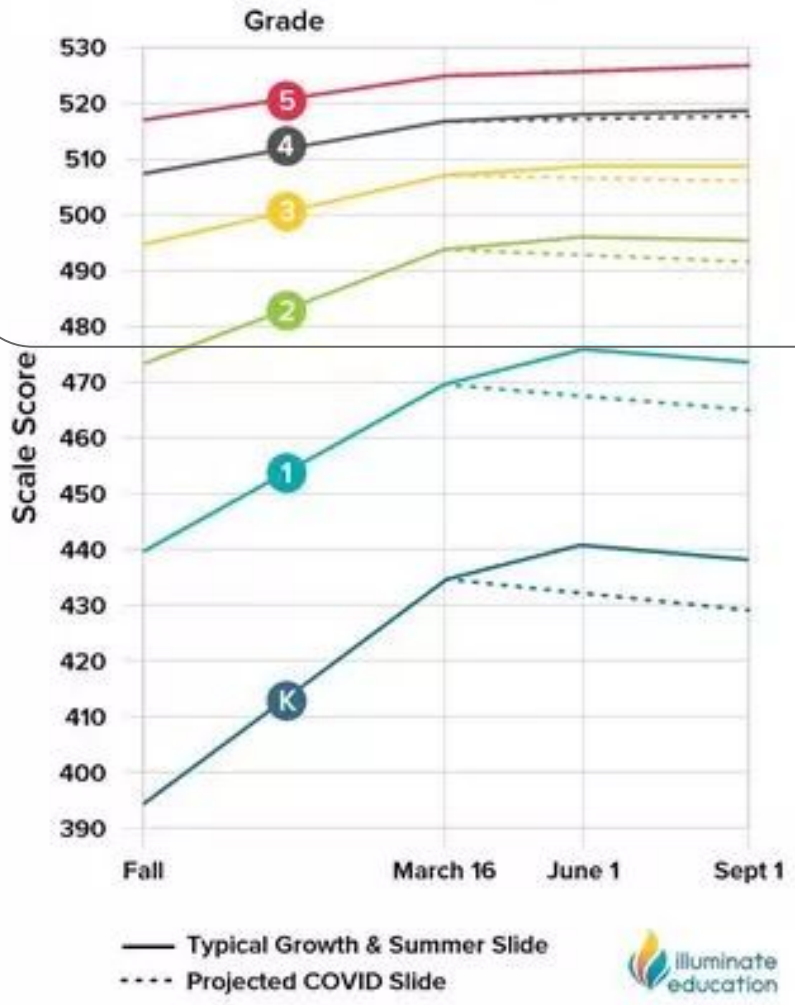


Figure 2. Mean *aMath* scores by cohort.

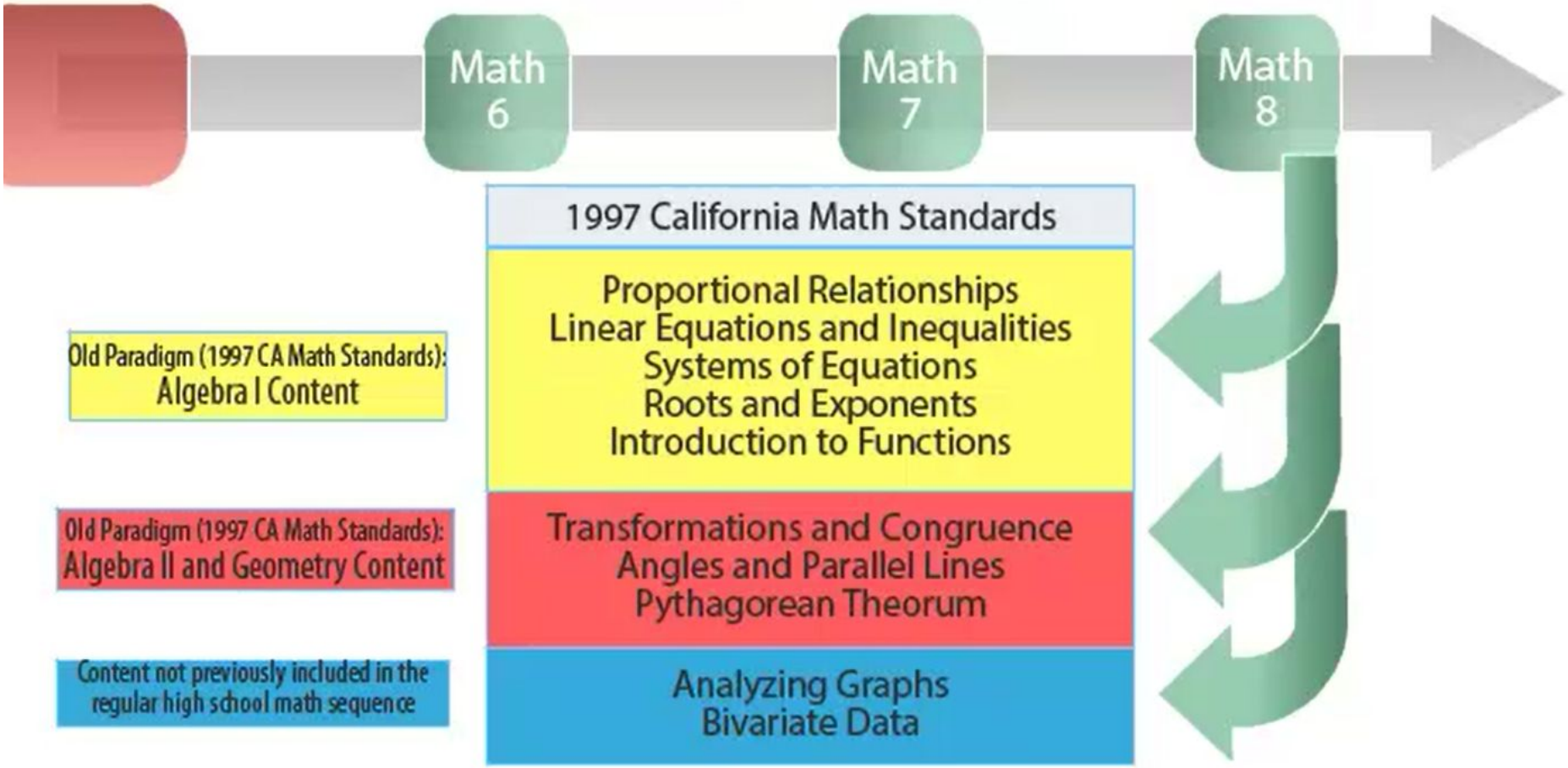
For Discussion …

What content occurs in what classes?

Are there Math 6 adjustments that can improve Math outcomes for all students?

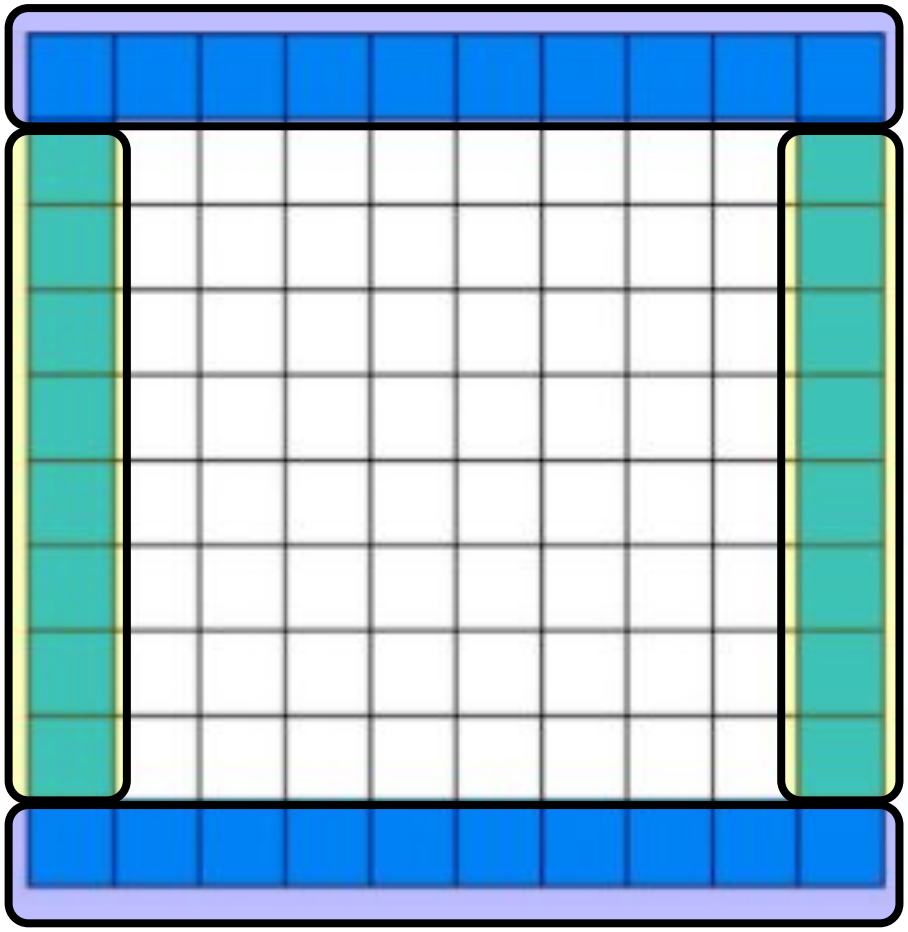
Should Math 6 adjustments be made, how will they not impact Advanced Math access?

What content occurs in what classes



Common Core Mathematics

Math 6 | Math 7 | Math 8 | Alg | Geo | Alg 2



$2(10) + 2(8)$

Common Core Mathematics

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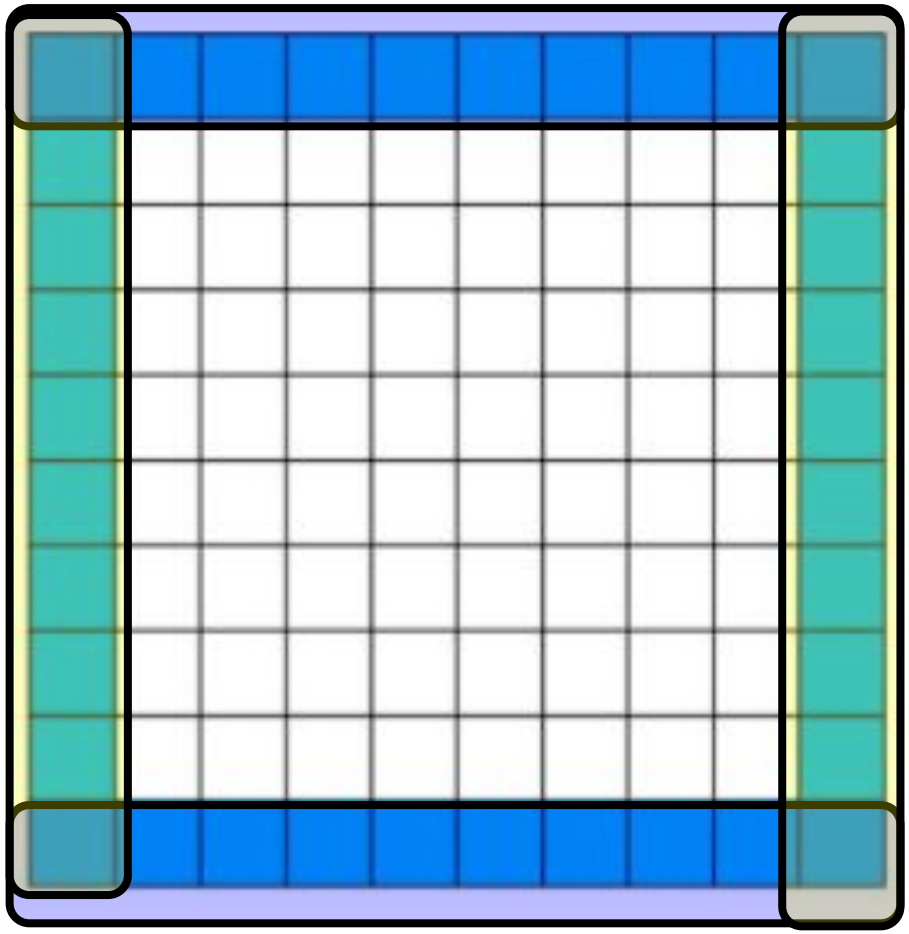

$2(10) + 2(8)$

$4(10) - 4$

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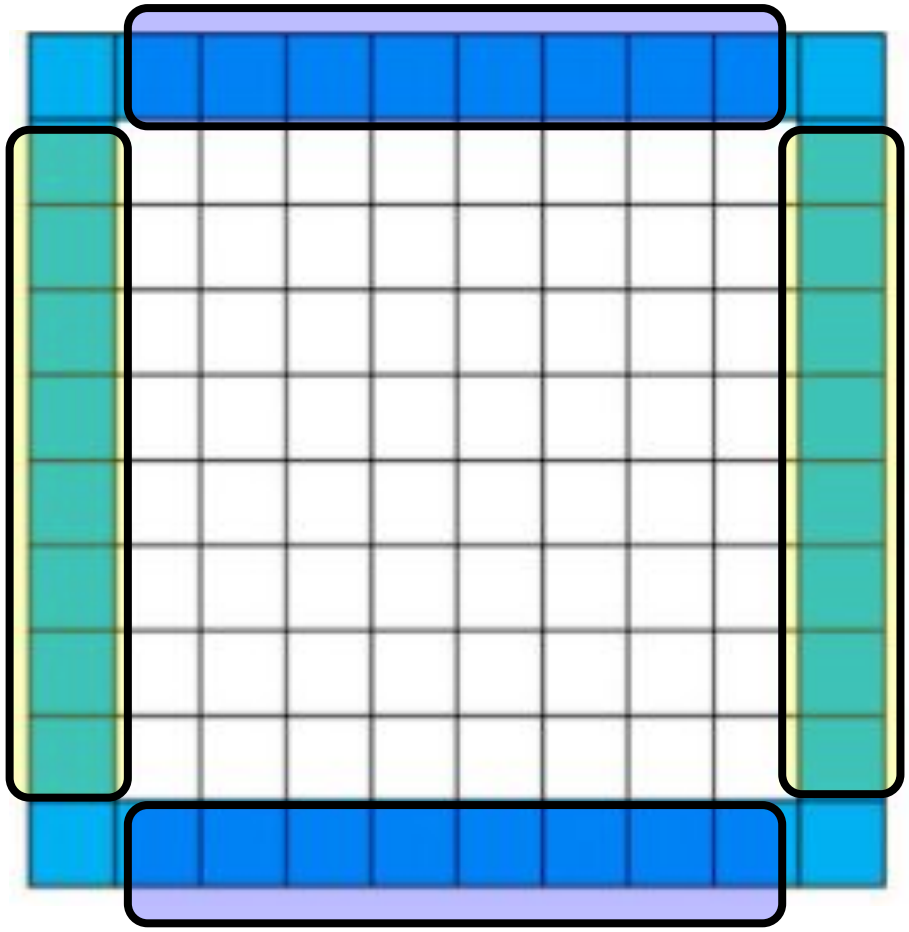

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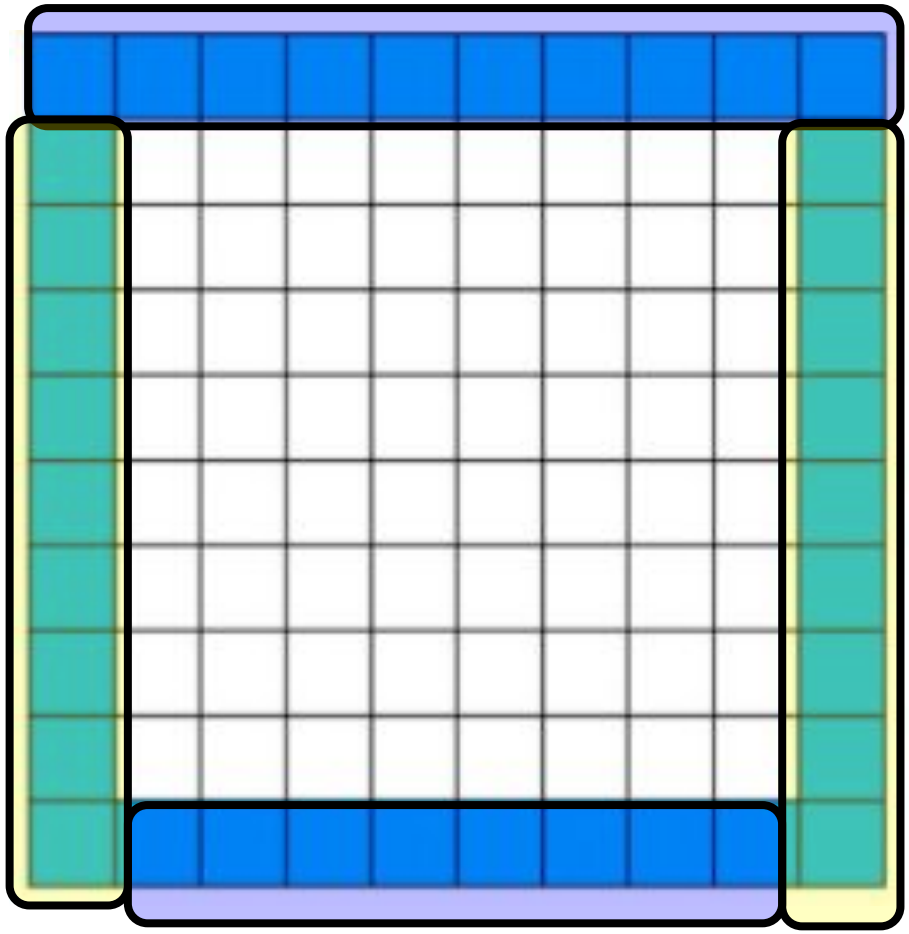

$2(10) + 2(8)$

$4(10) - 4$

$4(8) + 4$

$10 + 8 + 2(9)$

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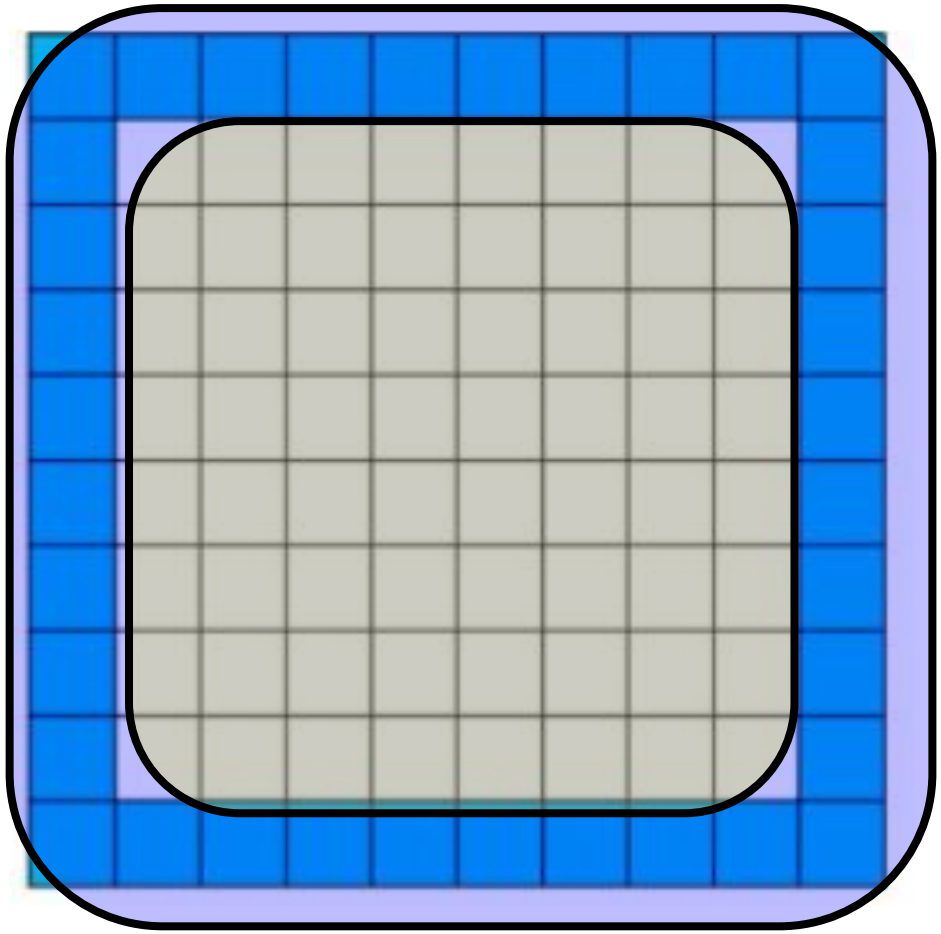

$2(10) + 2(8)$

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$10^2 - 8^2$

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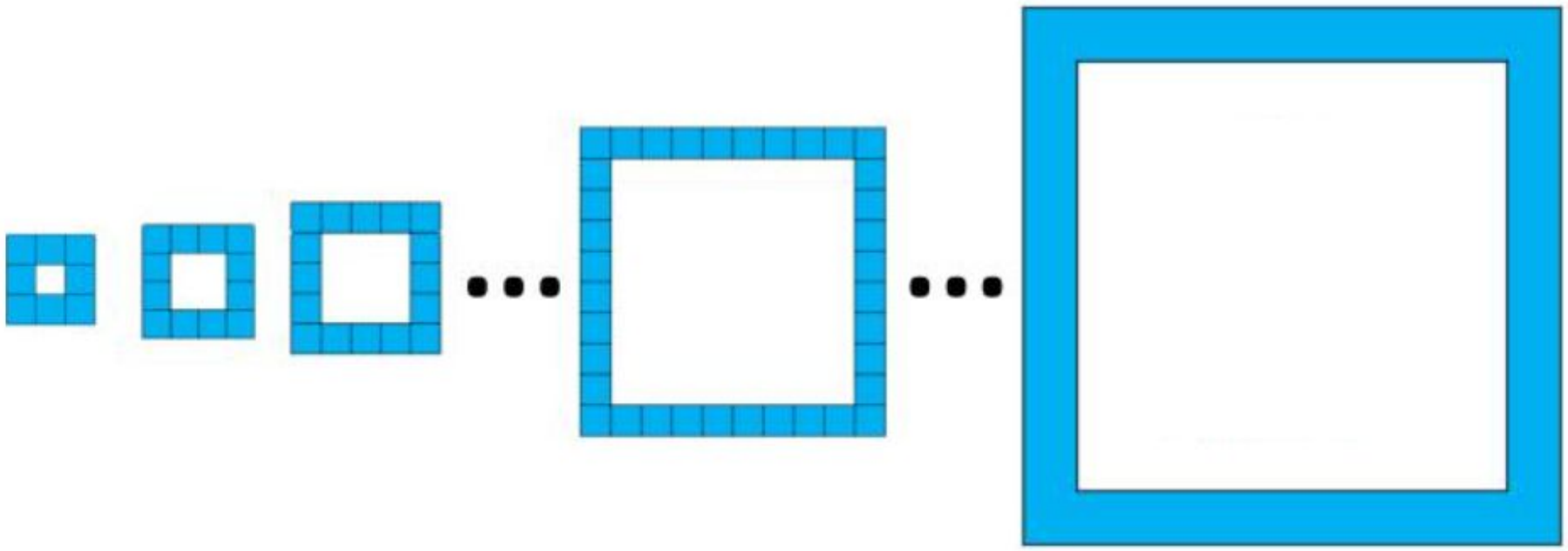

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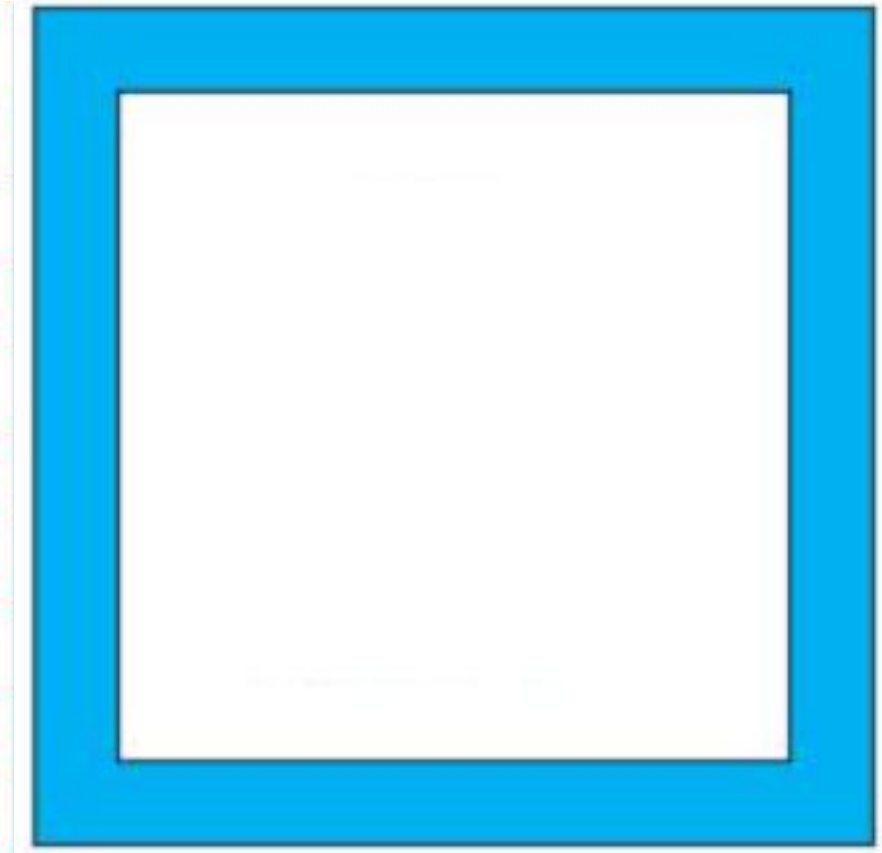

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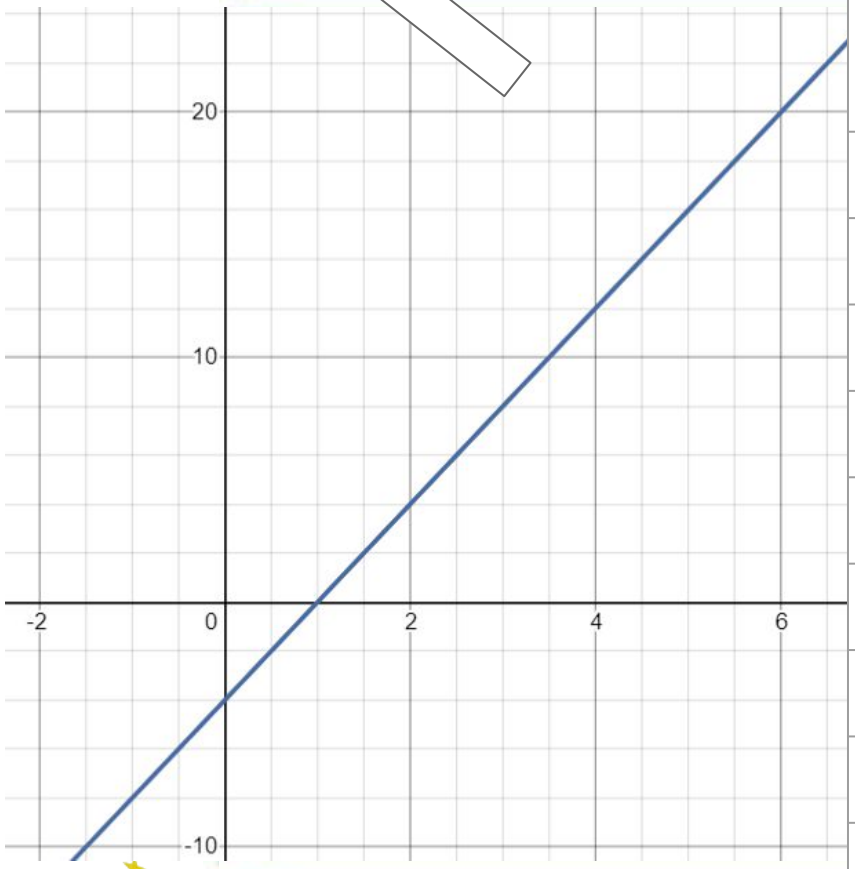


Figure (x)	Tiles (y)
0	-4
1	0
2	4
3	8
4	12
5	16
6	20
7	24

$2(x) + 2(x-2)$

$4(x) - 4$

$4(x-2) + 4$

$x + (x-2) + 2(x-1)$

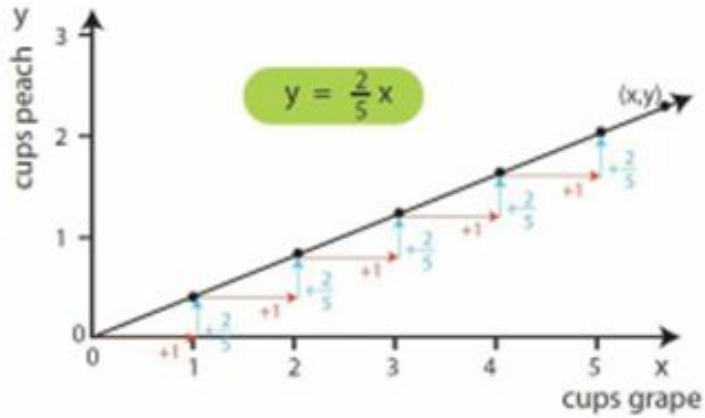
$x^2 - (x-2)^2$

Common Core Mathematics

Math 6 | Math 7 | Math 8 | Alg | Geo | Alg 2

For every 5 cups grape juice, mix in 2 cups peach juice.

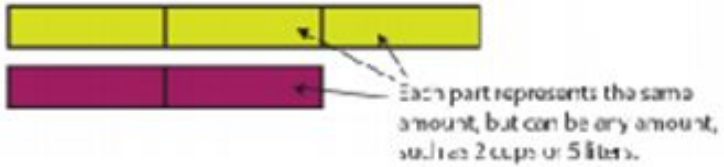
x cups grape	y cups peach
(0)	(0)
5	2
1	$\frac{2}{5}$
2	$2 \cdot \frac{2}{5}$
3	$3 \cdot \frac{2}{5}$
4	$4 \cdot \frac{2}{5}$
x	$x \cdot \frac{2}{5}$



# cups apple juice	3	6	9	12	3/2	1
# cups grape juice	2	4	6	8	1	2/3

made of 2 composed units

made of 1/2 of a composed unit



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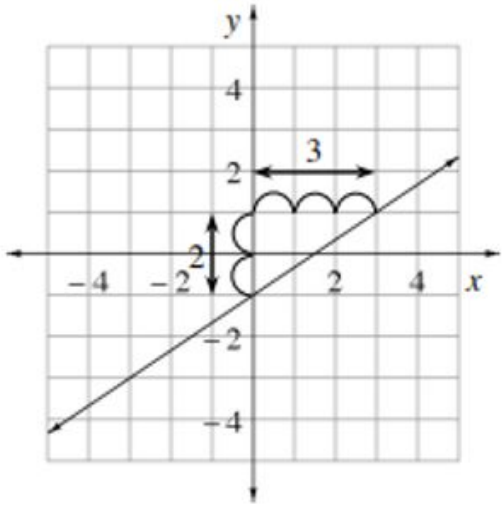
Solve: $-2x + 1 - (-3x + 3) = -4 + (-x - 2)$

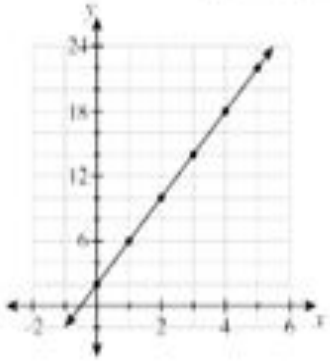
$$-2x + 1 - (-3x + 3) = -4 + (-x - 2)$$
$$-2x + 1 + 3x - 3 = -4 - x - 2$$
$$x - 2 = -x - 6$$
$$2x = -4$$
$$x = -2$$

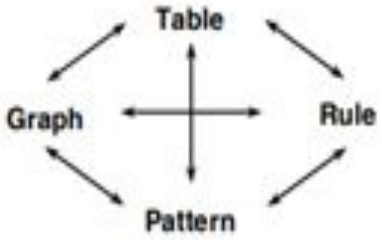


Use the table below to determine the rule in $y = mx + b$ form that describes the pattern.

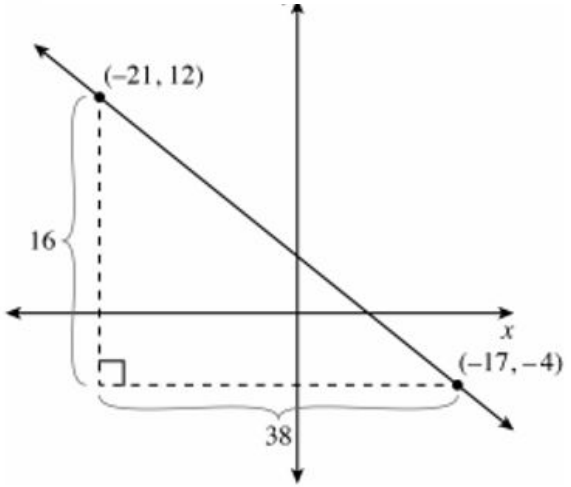
input (x)	−2	−1	0	1	2	3	4	5	x
output (y)	−8	−5	−2	1	4	7	10	13	

+3 +3 +3 +3 +3 +3 +3





$y = 3x - 2.$



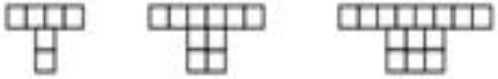


Fig. 1 Fig. 2 Fig. 3

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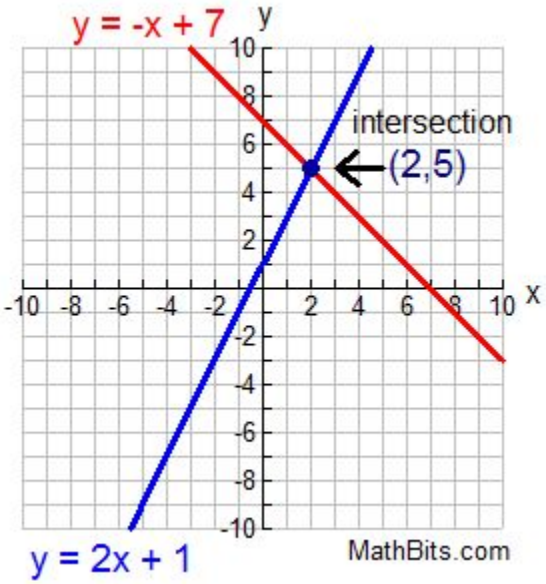

Graphing

$$\begin{cases} y = 2/5x - 2 \\ y = -3x + 15 \end{cases}$$

Substitution

$$\begin{cases} 4x - 3y = 6 \\ y = -3x + 15 \end{cases}$$

Elimination

$$\begin{cases} 5x + 3y = 3 \\ 2x - y = 6 \end{cases}$$

Properties of Integer Exponents

For any nonzero rational numbers a and b and integers n and m:

1. $a^n a^m = a^{n+m}$
2. $(a^n)^m = a^{nm}$
3. $a^n b^n = (ab)^n$
4. $a^0 = 1$
5. $a^{-n} = 1/a^n$

$$\frac{x^6 y^2 z^3}{x^{-2} y^3 z^{-1}}$$

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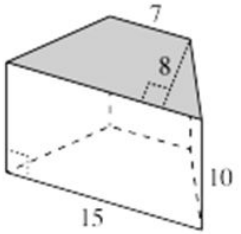
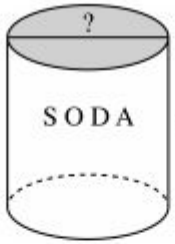


Volume
$= B(h)$
$= 88(10)$
$= 880 \text{ units}^3$

The base is a trapezoid with area $\frac{1}{2}(7 + 15) \cdot 8 = 88 \text{ units}^2$.



The soda can above has a volume of 355 cm^3 and a height of 12 cm. What is its diameter? Use a calculator for the value of π.

$\text{Volume} = r^2\pi h$

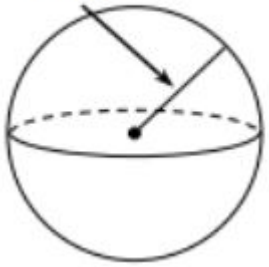
$355 = r^2\pi(12)$

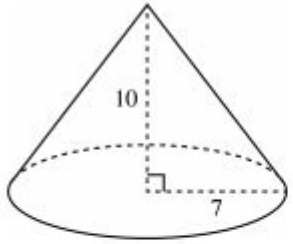
$\frac{355}{12\pi} = r^2$

$9.42 \approx r^2$

$r \approx 3.07$

$\text{diameter} = 2r \approx 2(3.07) \approx 6.14 \text{ cm}$

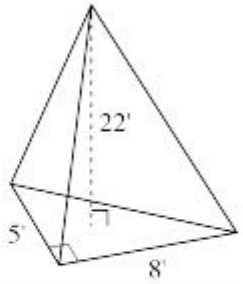




$\text{Volume} = \frac{1}{3}(7)^2\pi \cdot 10$

$= \frac{490\pi}{3}$

$\approx 513.13 \text{ units}^3$



Base is a right triangle

$B = \frac{1}{2} \cdot 5 \cdot 8 = 20$

$\text{Volume} = \frac{1}{3} \cdot 20 \cdot 22$

$\approx 146.67 \text{ ft}^3$

Common Core Mathematics

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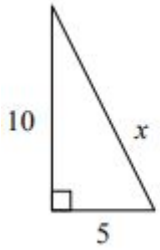
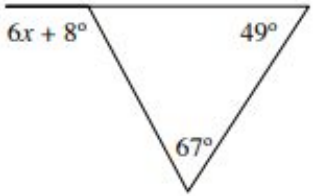


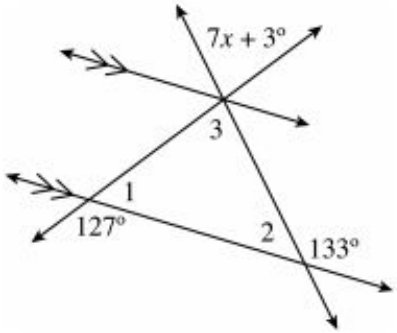
$x^2 = 10^2 + 5^2$

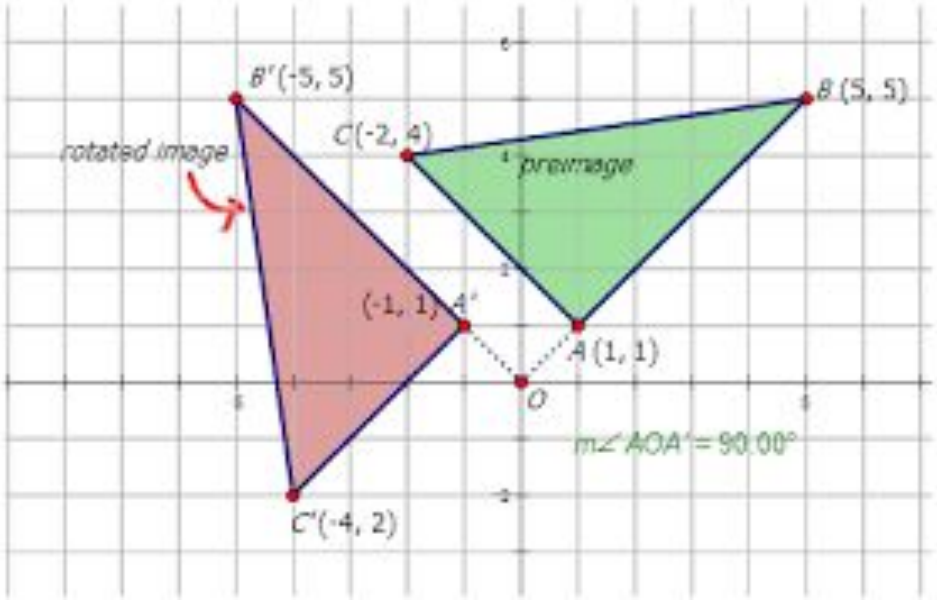
$x^2 = 100 + 25$

$x^2 = 125$

$x = \sqrt{125} \approx 11.18$ cm







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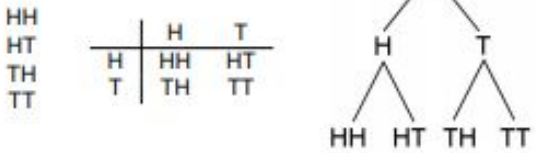

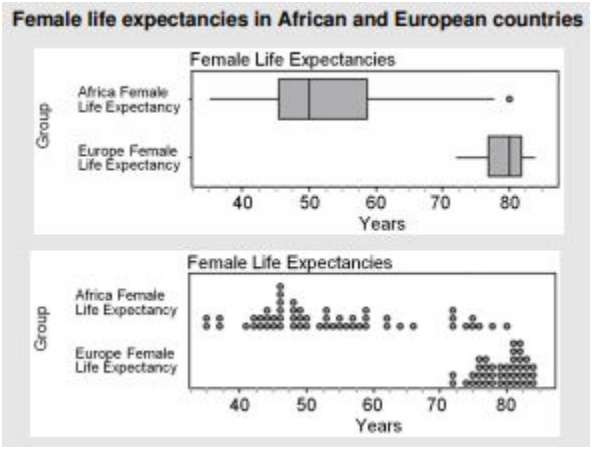

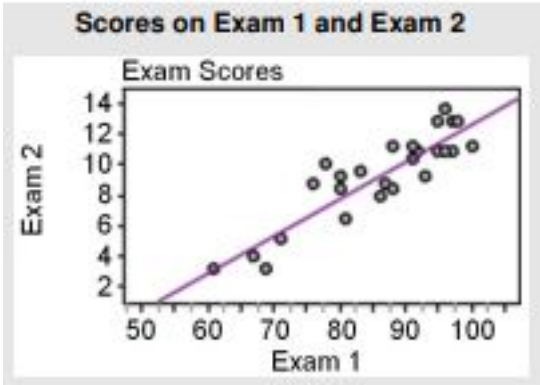

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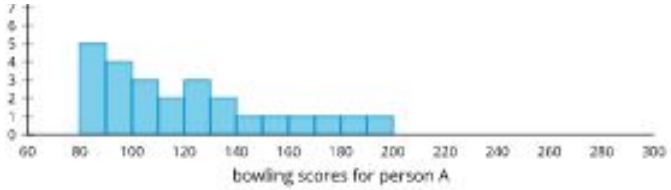

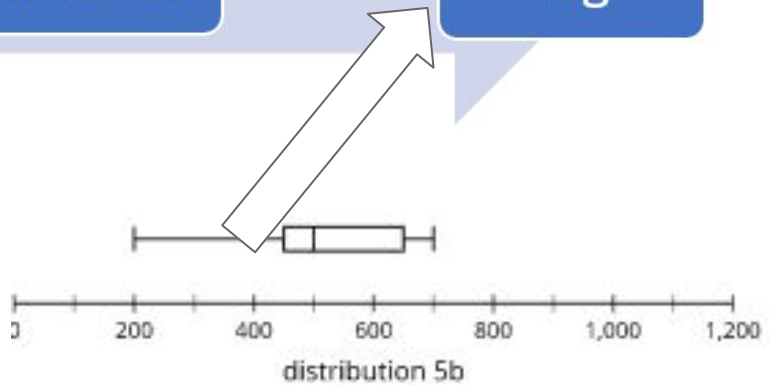

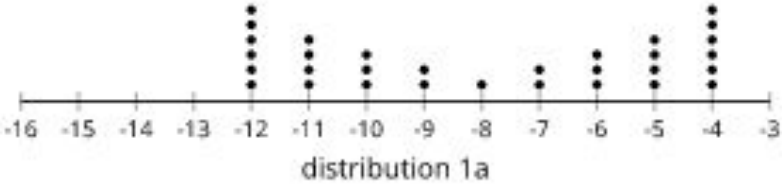

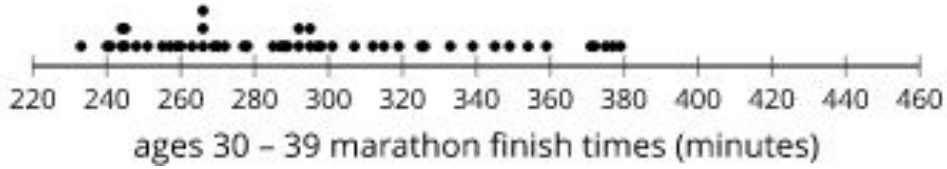

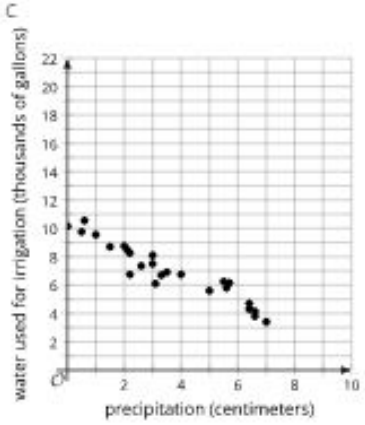

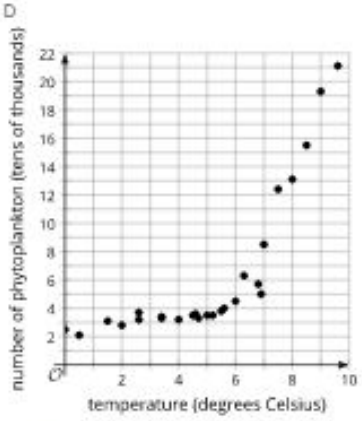

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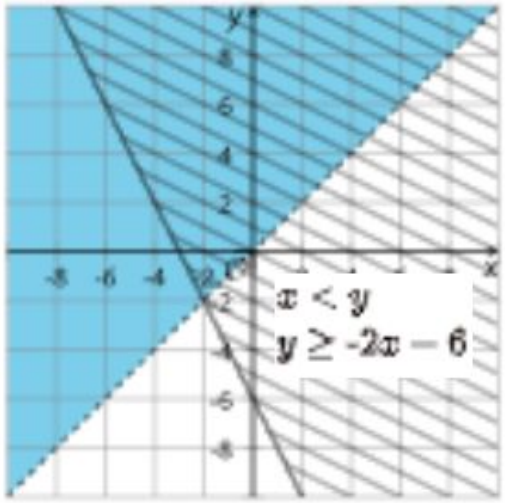

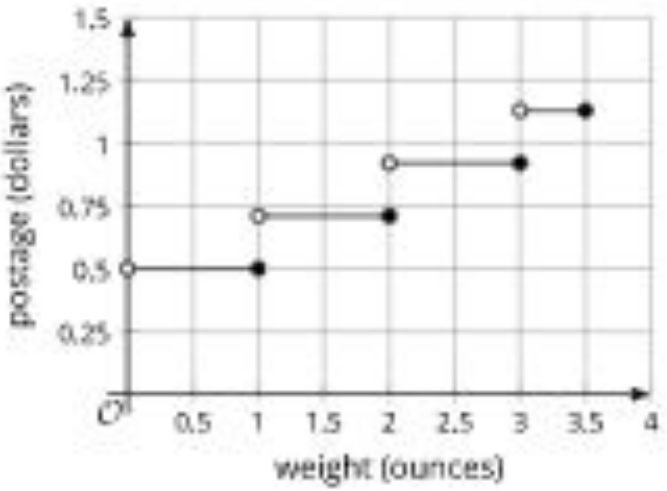

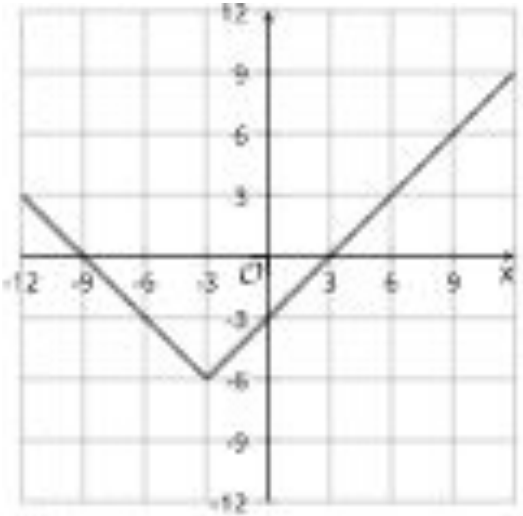

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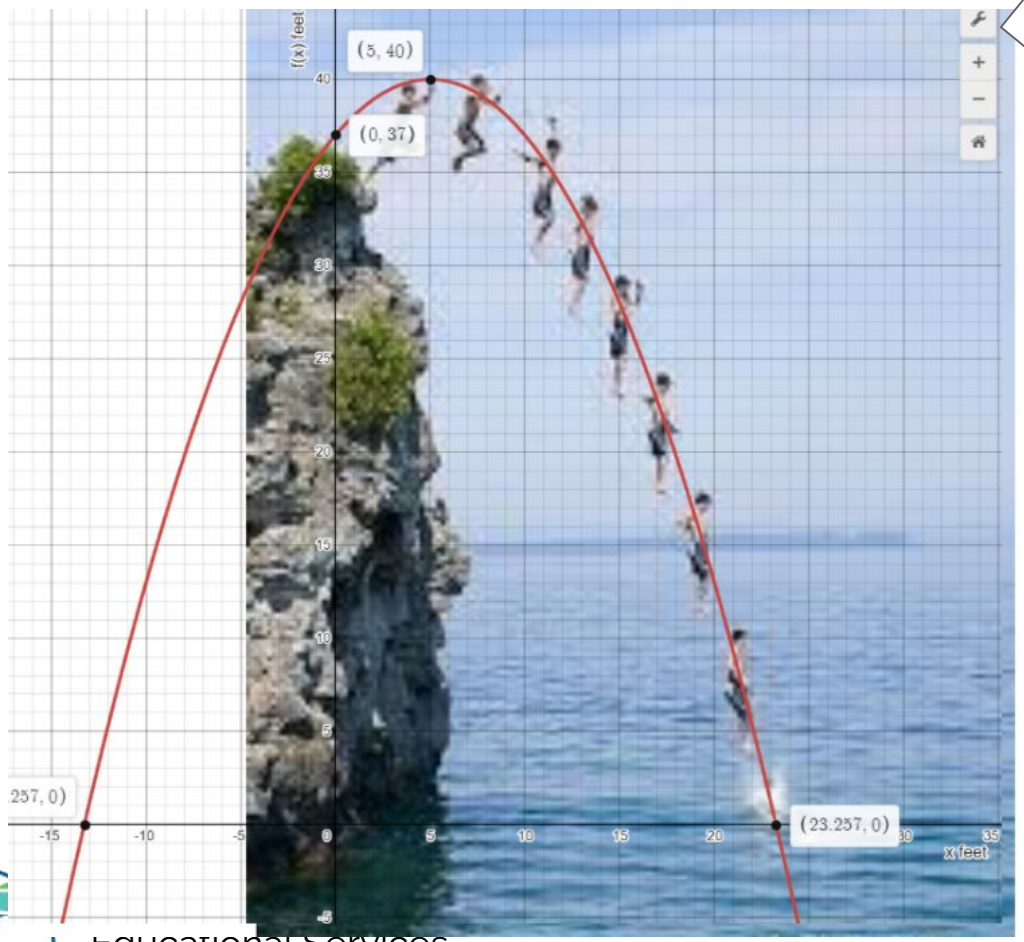

Initial Value?
F(0) = 37 feet *(output)*

Increasing interval?
{ x | 0 ≤ x < 5 }
{ x | -∞ < x < 5 }

Decreasing interval?
{ x | 5 < x ≤ 23.257 }
{ x | 5 < x < ∞ }

Local Maximum or Minimum?
(5, 40) *maximum*

Vertical Intercept(s)?
(0, 37) y-intercept

Horizontal Intercept(s)?
(-13.257, 0) & (23.257, 0) y-intercepts

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Math 6 → Math 7 → Math 8 → Alg → Geo → Alg 2

Big Ideas of Quadratics

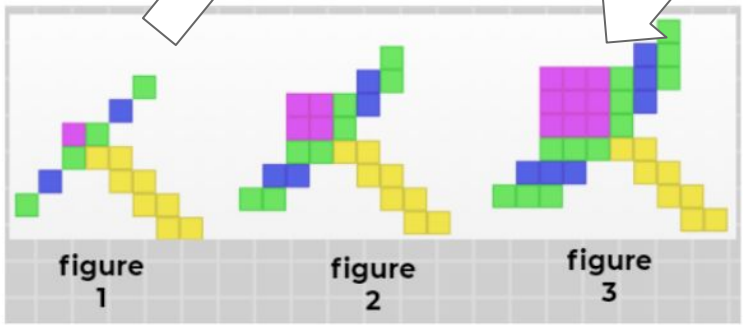
$a = 9,\ b = -2,\ c = -1$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

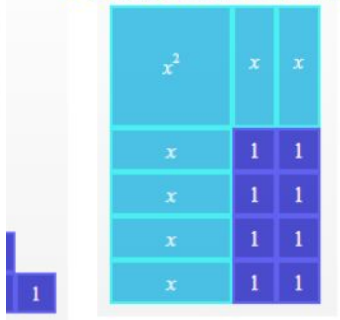
$$x = \frac{2 \pm \sqrt{(-2)^2 - 4(9)(-1)}}{2}$$

$$x = \frac{2 \pm \sqrt{4 + 36}}{2}$$

$$x = \frac{2 \pm \sqrt{40}}{2}$$

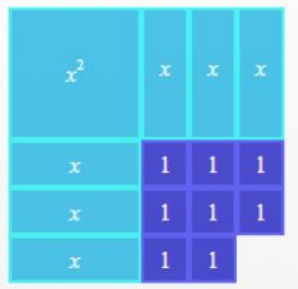


Factored Form



f(x) = (x + 2)(x + 4)

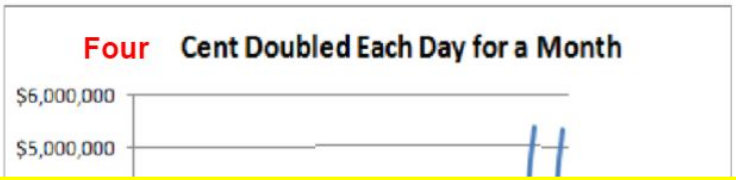
Vertex Form



f(x) = $(x + 3)^2 - 1$

Common Core Mathematics

Math 6 | Math 7 | Math 8 | Alg | Geo | Alg 2

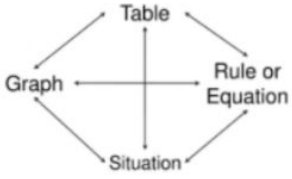


Day 1	$.04	Day 16	$1,310.72
Day 2	$.08	Day 17	$2,621.44
Day 3	$.16	Day 18	$5,242.88
Day 4	$.32	Day 19	$10,485.76
Day 5	$.64	Day 20	$20,971.52

n^{th} term in a geometric sequence $a_n = a_1 r^{n-1}$ ($a_1 =$ first term, $r =$ common ratio)

Day 14	$327.68	Day 29	$10,737,418.20
Day 15	$655.36	Day 30	$21,474,836,40

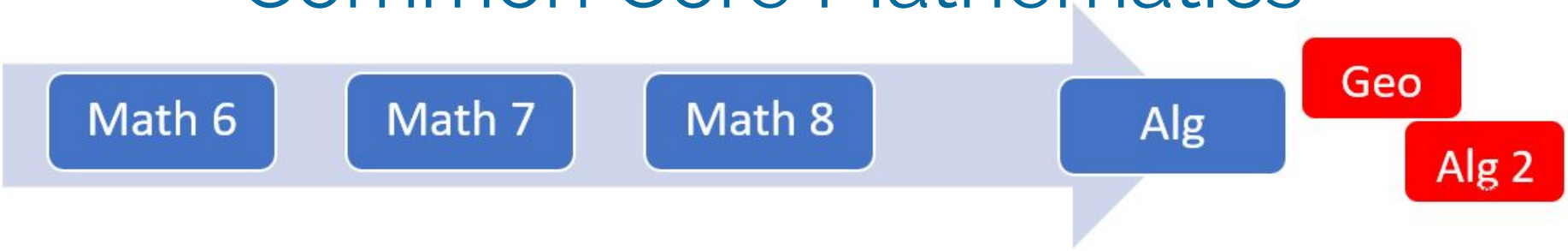
$y = 0.04(2)^{x-1}$



$y = 0.01(2)^{x+1}$

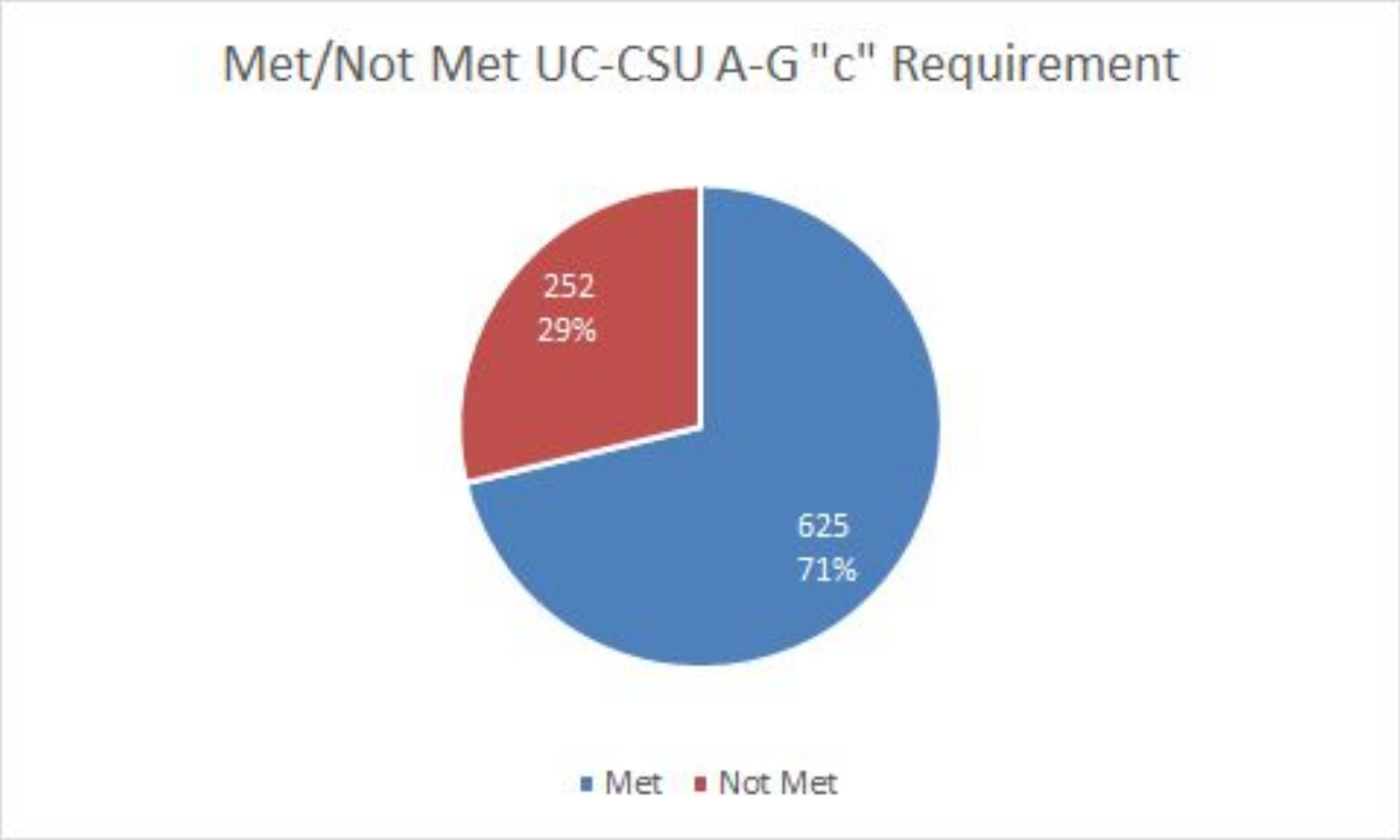
Start with 4 pennies and double your money every day.

Common Core Mathematics

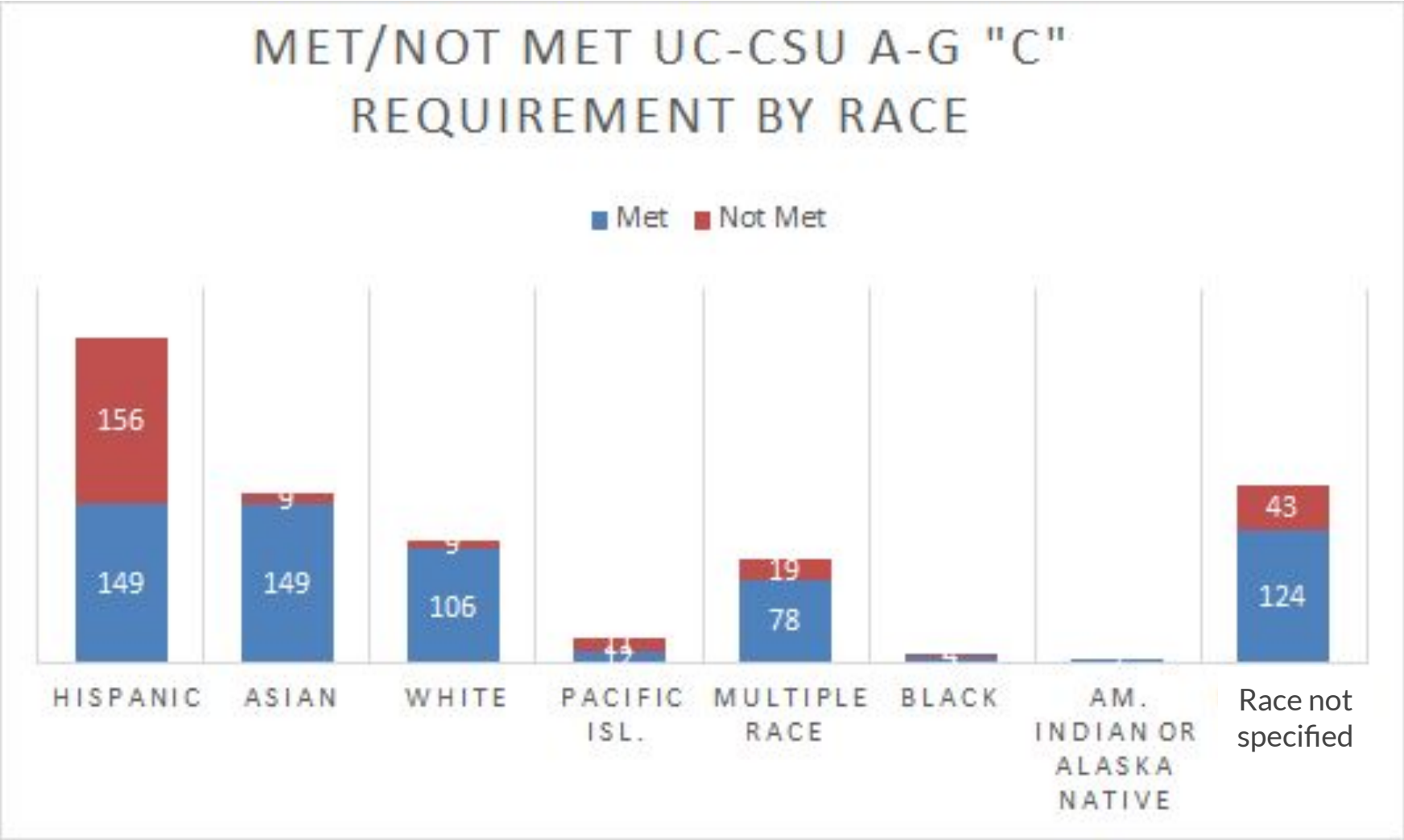


Our students need the time to become rich deep thinkers in these big idea.

Are there Math 6 adjustments that can improve Math outcomes for all students?



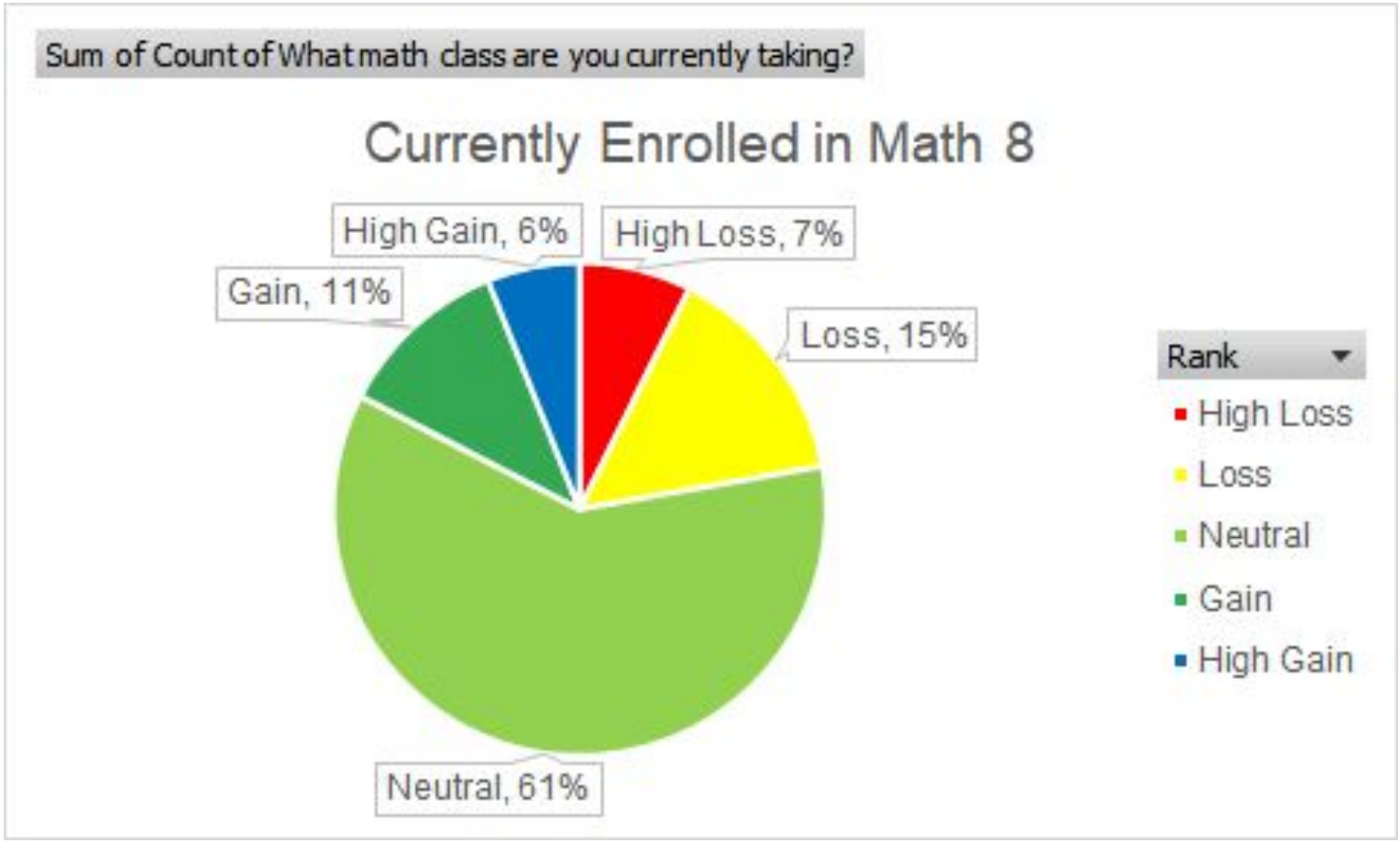
SMFCSD Math Program Results



SMFCSD Math Program Results

Recent survey of over 840 SMFCSD 8th Graders ask about...

Math confidence in grades 4 & 5 compared to grades 6 & 7 (Scale 1 - 5)*



*grade 8 confidence (Distance Learning) is not included in this data.

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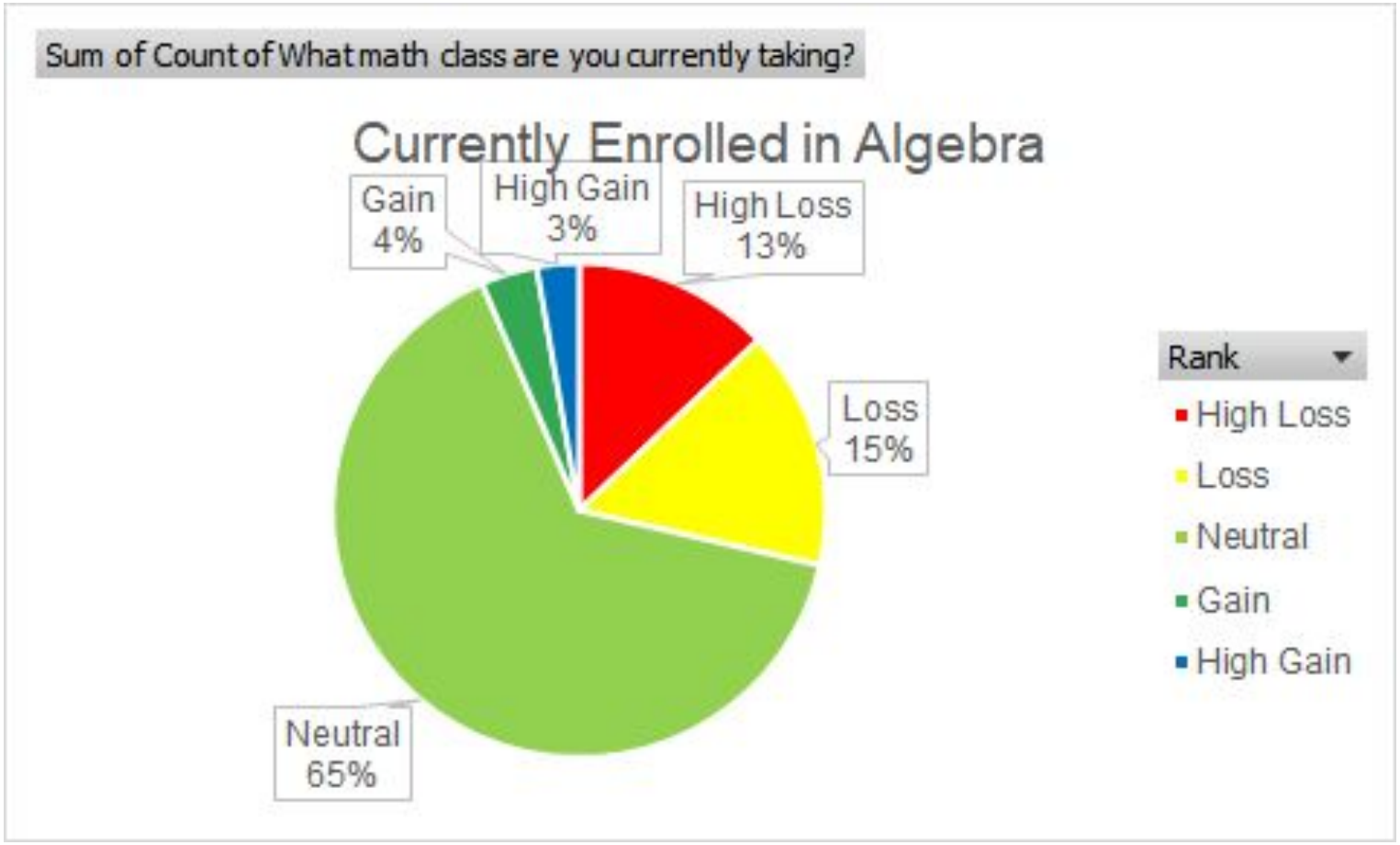

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Will a heterogenous grade 6 help all students achieve at higher rates?

Researchers from Columbia University found the probability of completing advanced math courses and math achievement increased in all groups when middle school students were enrolled in mixed-ability math courses.[1]

Figure 1: **Increase in % of students participating in de-tracked middle school math courses that took courses beyond Algebra 2 in high school**

Average achievers	81%	91%
High achievers	89%	99%
Low socioeconomic status	32%	67%
Black and Latino students	38%	58%

From: Burris, Heubert, and Levin (2006)

More high achieving middle school students in these mixed ability courses took the AP calculus exam and scored higher than students in tracked courses.

This study of six middle school math classes in New York found that students' probability of completing advanced math courses beyond Algebra 2 in high school increased across all groups, including high achieving students. Also, the average scores on achievement tests for high achieving students who learned in math courses without tracks, i.e. heterogeneously grouped, were not significantly different than high achieving students' scores in tracked math courses.

Will a heterogenous grade 6 help all students achieve at higher rates?

Researchers from Stanford University and Kings College in London found all middle school students performed below their potential when in tracked math courses, both in high tracks and low tracks.[2]

This study of over 1000 students in London schools examined students' perceptions of going from mixed ability to tracked math courses during middle school. The results suggest that all students were negatively affected by the tracked math courses whether they were in the low track or high tracks.

Students in higher tracks in math were disadvantaged by fast paced lessons and pressure to succeed.

[1] Burris, C.C., Heubert, J.P, and Levin, H.M (2006). Accelerating Mathematics Achievement Using Heterogeneous Grouping. *American Educational Research Journal*. Vol. 43 No. 1, p. 137-154.
[2] Boaler, J., Wiliam, D. and Brown, M. (2000). Students experiences of ability grouping-disaffection, polarization, and construction of failure. *British Educational Research Journal*. Vol. 26, No. 5., p. 631-648.

[Link to Document]

SFUSD SAN FRANCISCO PUBLIC SCHOOLS

Quick Facts about Math & Tracking

Q: Will taking away tracks in math (e.g. honors track math courses) help all students achieve at higher rates?

A: *Studies demonstrate the positive impact of math coursework sequences that put all students through the same courses rather than tracking students based on their perceived ability.*

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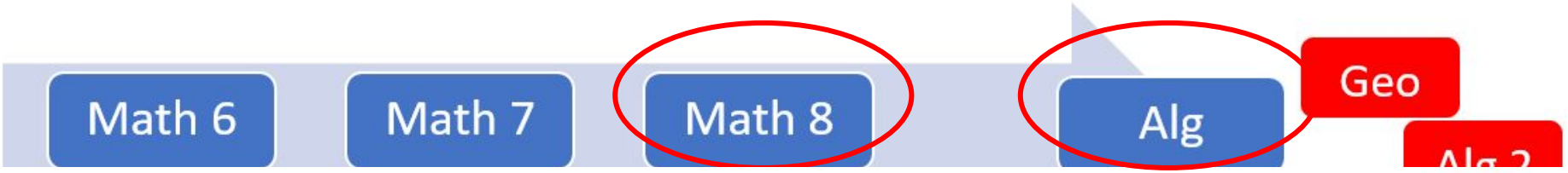
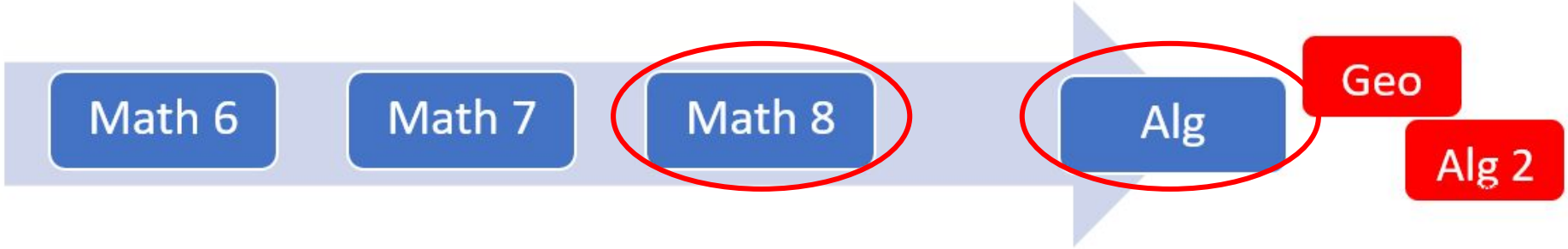
Should Math 6 adjustments be made, how will they not impact Advanced Math access?



Aragon High School

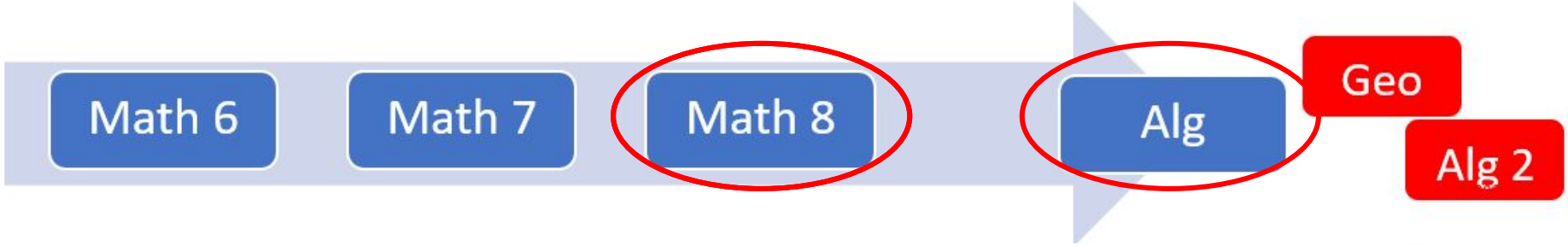
9th	10th	11th	12th
Algebra 1	Geometry *Compressed Math 1	Algebra II Integrated II **Compressed Math 2	Pre-Calculus AP Statistics AP Calculus AB/BC Finite Math Path to Statistics Algebra II



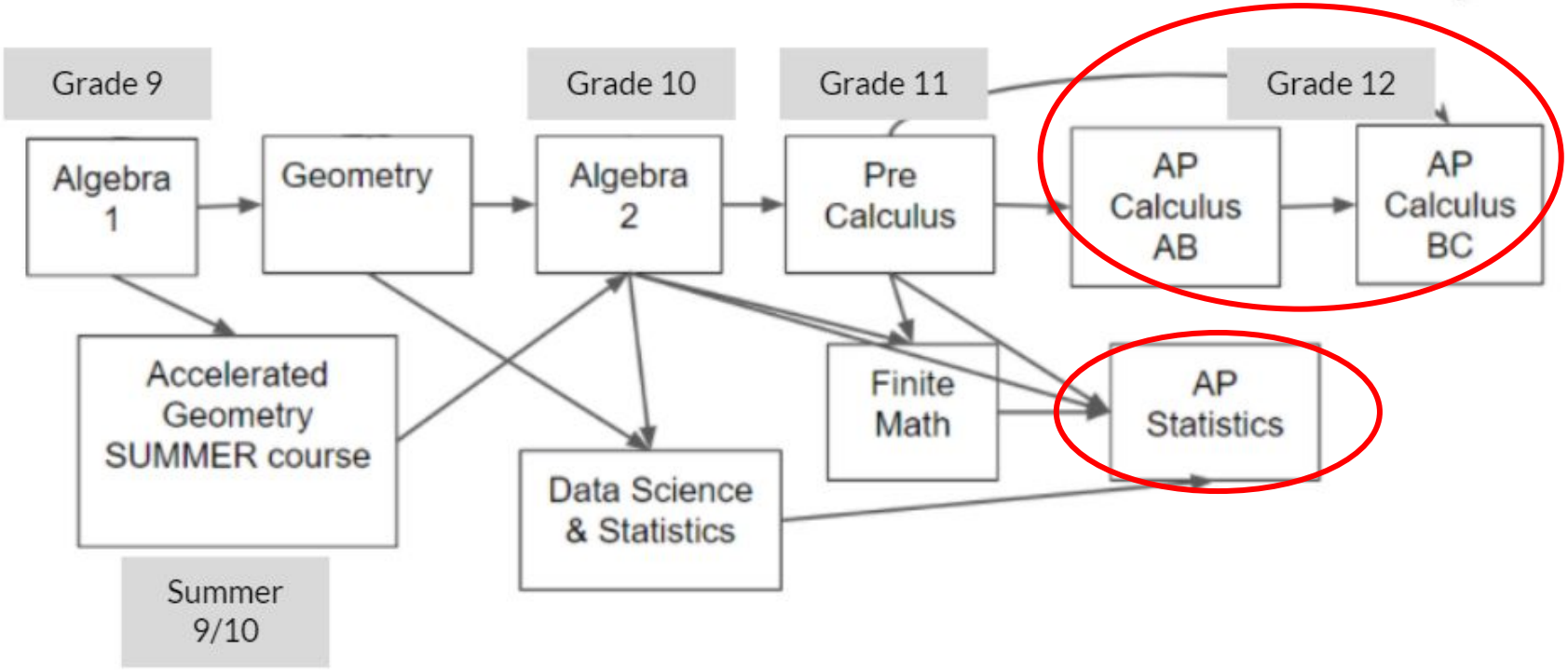
HILLSDALE HIGH SCHOOL

Math Pathways

9th Grade	Geometry			
10th Grade	Algebra 1		Algebra 2	
11th Grade	Data Science	Algebra 2	Data Science	Precalculus
12th Grade	Algebra 2 Finite Math AP Statistics	Data Science Precalculus Finite Math AP Statistics	AP Statistics Finite Math	AP Calculus AB/BC AP Statistics



San Mateo High School



For Board Decision (at next meeting)

Offer all students a heterogeneous Math 6 course next school year to include engagement with teachers, site leaders, and families to understand how we strengthen our 6-8 math program for all students.

Engagement started ….

- Ongoing meetings with Math Leads from each Middle School
- Site leader engagements
- Monthly meetings with SMUHSD Partner districts

Key Next Steps

Planning for a successful heterogeneous Grade 6 Math

- Curriculum Support
- Professional Learning for teachers focused on meeting the needs of a diverse range of math experiences
- Sustained coaching to support shifts in instruction
- Summer Bridge for rising 6th graders
- Family Engagements Fall 2021

Thank You

Questions