

WHY WE SHOULD RECONSIDER (AND WHAT WE SHOULD BE DOING INSTEAD)

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GOALS

WHO AM I?

WHAT'S WRONG WITH WORKSHEETS?

WHAT SHOULD WE BE DOING INSTEAD?

HOW DO WE DO IT IN OUR CLASSROOMS?

WHERE DO WE GET MORE PROBLEMS?

WHAT COMES NEXT?





EDUCATION WEEK



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Algebra 1

Name _____

One-Step Equations

Date _____ Period _____

Solve each equation.

1) $26 = 8 + v$

2) $3 + p = 8$

3) $15 + b = 23$

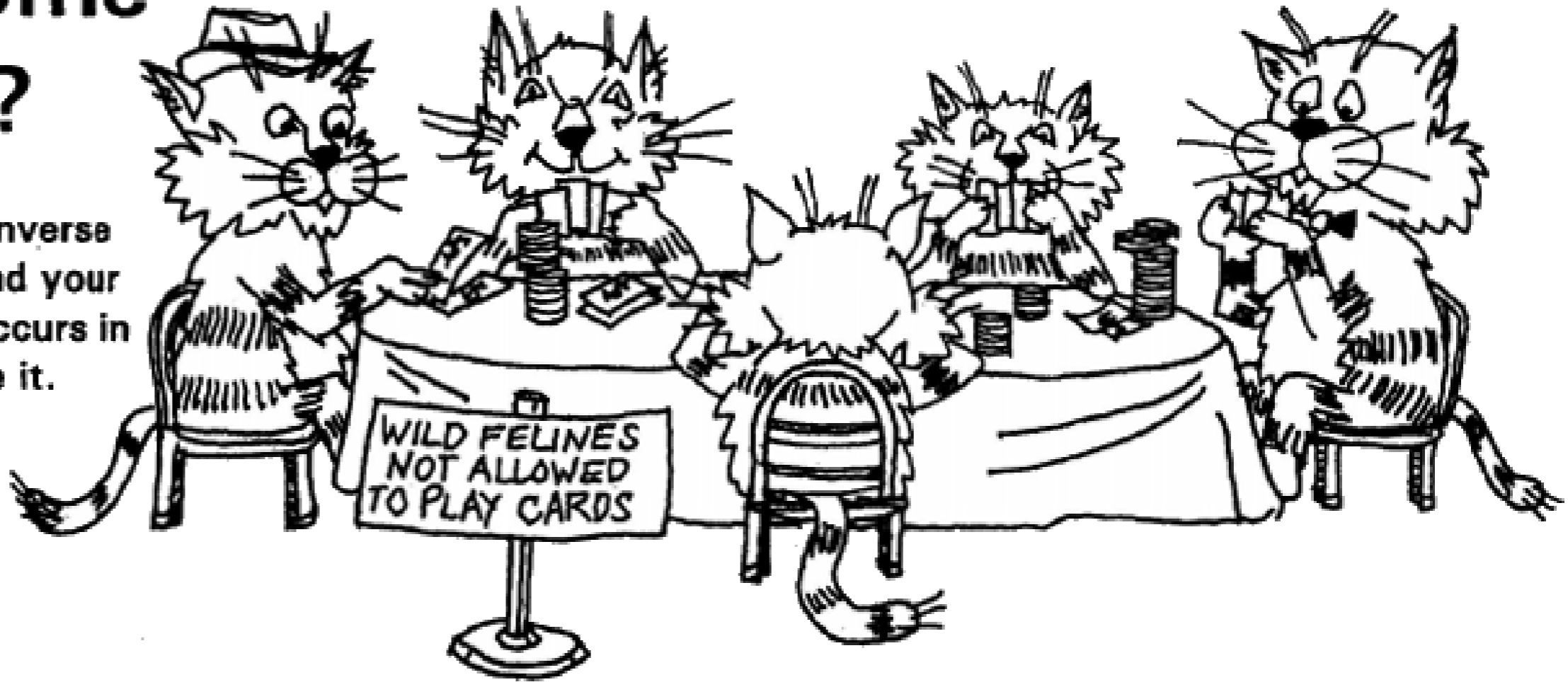
4) $-15 + n = -9$

5) $m + 4 = -12$

6) $x - 7 = 13$

Why shouldn't some cats play cards?

DIRECTIONS: Solve each equation by using the inverse operation. Use a calculator where necessary. Find your answer in the decoder. Each time your answer occurs in the decoder, write the letter of the problem above it.



1. $3 + g = 13$ ($g =$ _____)

2. $34 = a \cdot 2$ ($a =$ _____)

3. $\frac{h}{15} = 10$ ($h =$ _____)

4. $15 = d - 18$ ($d =$ _____)

5. $132 = m \times 11$ ($m =$ _____)

6. $15o = 210$ ($o =$ _____)

7. $\frac{i}{2.3} = 6.7$ ($i =$ _____)

8. $2.5e = 40$ ($e =$ _____)

9. $180 = t - 35$ ($t =$ _____)

10. $90 = 3l$ ($l =$ _____)

11. $7.2 = 0.36n$ ($n =$ _____)

12. $\frac{b}{5} = 31$ ($b =$ _____)

13. $4c = 60$ ($c =$ _____)

WORKSHEET CONCERNS

- ~~OFTEN FEELS LIKE BUSY WORK~~
- ~~DON'T REALLY BUILD SENSE MAKING~~
- ~~RARELY LEAD TO GREAT CONVERSATIONS~~
- ~~DON'T GIVE US RICH INFORMATION~~

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PROBLEM ONE

Solve for x .

$$21 + x = 70$$

PROBLEM TWO

Using the digits 1 to 9 at most one time each, fill in the boxes to create two equations: one where x has a positive value and one where x has a negative value. You may reuse digits for each equation.

$$\boxed{5} \boxed{6} + x = \boxed{8} \boxed{4}$$

PROBLEM THREE

Using the digits 1 to 9 at most one time each, fill in the boxes to create an equation where x has the greatest possible value.

$$\boxed{1} \boxed{2} + x = \boxed{9} \boxed{8}$$



Robert Kaplinsky

@robertkaplinsky

MS & HS #MTBoS Ts, please ask your Ss these 3 ?s and put the % who answered correctly here:

[docs.google.com/forms/d/e/1FAI](https://docs.google.com/forms/d/e/1FAI...) Answers at top of form.

PROBLEM ONE
Solve for x.
 $21 + x = 7$

PROBLEM TWO
Using the digits 1 to 9, at most one time each, create two equations: one where x has a positive value and one where x has a negative value.
[][] + x = [][]

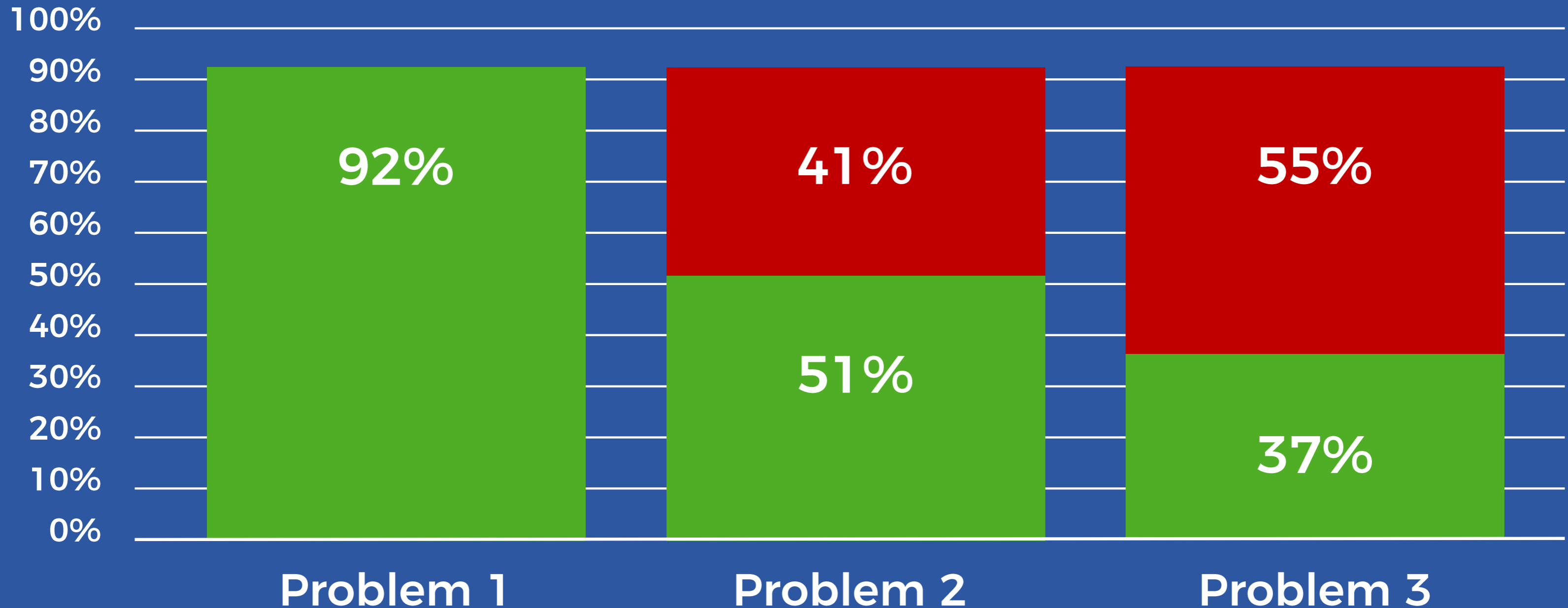
PROBLEM THREE
Using the digits 1 to 9, at most one time each, create an equation where x has the greatest possible value.
[][] + x = [][]

RETWEETS
36

LIKES
54



PROBLEM RESULTS



Depth of Knowledge Matrix - Elementary Math

Topic	Adding 1-Digit Numbers (< 5)	Equality	Interpreting Data	Money
CCSS Stand.	<ul style="list-style-type: none"> K.OA.5 	<ul style="list-style-type: none"> 1.OA.7 	<ul style="list-style-type: none"> 1.MD.4 	<ul style="list-style-type: none"> 2.MD.8
DOK 1 Example	Solve. $3 + 1 =$	Determine whether the number sentence is true or false. $4 + 1 = 5 - 2$	How many people were surveyed? <p>A bar graph with the y-axis labeled from 1 to 3 and the x-axis labeled 'Favorite Color' with categories Blue, Red, and Yellow. The bars show 3 for Blue, 1 for Red, and 2 for Yellow.</p>	If you have 1 quarter, 4 dimes, 2 nickels, and 3 pennies, how many cents do you have?
DOK 2 Example	Using the digits 1 to 5 at most one time each, fill in the boxes to create two true number sentences. $\square + \square = \square$	Using the digits 1 to 9 at most one time each, fill in the boxes to create two true number sentences. $\square + \square = \square - \square$	Make a graph that shows a possible result of 7 students' favorite color. <p>A blank bar graph with the y-axis labeled from 1 to 3 and the x-axis labeled 'Favorite Color' with categories Blue, Red, and Yellow.</p>	Make 72¢ in two different ways with either quarters, dimes, nickels, or pennies.
DOK 3 Example	Using the digits 1 to 5 at most one time each, fill in the boxes to create a true number sentence with the greatest possible sum. $\square + \square = \square$	Using the digits 1 to 9 at most one time each, fill in the boxes to create a true number sentence with the greatest possible value. $\square + \square = \square - \square$	Make a graph that shows a possible result of 7 students' favorite color with red being the most popular color. <p>A blank bar graph with the y-axis labeled from 1 to 3 and the x-axis labeled 'Favorite Color' with categories Blue, Red, and Yellow.</p>	Make 72¢ using exactly 9 coins that are either quarters, dimes, nickels, or pennies.

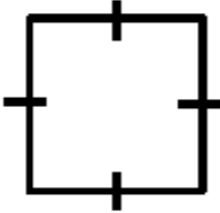
Depth of Knowledge Matrix - Elementary Math

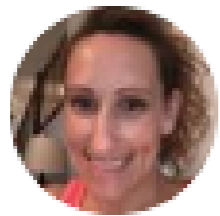
Topic	Subtracting 3-Digit Numbers	Operations with Time	Comparing Fractions	Multiplying Decimals
CCSS Stand.	<ul style="list-style-type: none"> 3.NBT.2 	<ul style="list-style-type: none"> 3.MD.1 	<ul style="list-style-type: none"> 4.NF.2 	<ul style="list-style-type: none"> 5.NBT.7
DOK 1 Example	Solve. $821 - 357 =$	What time will it be 14 minutes after 1:27 pm?	Place a < or > between the two fractions to make a true number sentence. $\frac{4}{7}$ $\frac{3}{5}$	Solve. $3.4 \times 2.5 =$
DOK 2 Example	Using the digits 1 to 9 at most one time each, fill in the boxes to make two different pairs of three-digit numbers that form a true number sentence. $\square\square\square - 291 = \square\square\square$	Using the digits 1 to 9 at most one time each, fill in the boxes to make a time that is 4:37 pm. $\square\square$ minutes after $\square:\square\square$ pm	Using the digits 1 to 9 at most one time each, fill in the boxes to create two different fractions: one that is less than one half and one that is more than one half. $\frac{\square}{\square} < \frac{1}{2}$ and $\frac{\square}{\square} > \frac{1}{2}$	Using the digits 1 to 9 at most one time each, fill in the boxes to make a true number sentence. $\square.\square \times 3.2 = \square.\square$
DOK 3 Example	Using the digits 1 to 9 at most one time each, fill in the boxes to make a difference that is as close to 329 as possible. $\square\square\square - \square\square\square =$	Using the digits 1 to 9 at most one time each, fill in the boxes to make the latest possible time. $\square\square$ minutes after $\square:\square\square$ pm	Using the digits 1 to 9 at most one time each, fill in the boxes to create a fraction that is as close to 5/11 as possible. $\frac{\square}{\square}$	Using the digits 1 to 9 at most one time each, fill in the boxes so that the product is as close to 50 as possible. $\square.\square \times \square.\square =$

Depth of Knowledge Matrix - Secondary Math

Topic	Dividing Fractions	Solving Two-Step Equations	Exponents	Solving Equations with Variables on Both Sides
CCSS Standard(s)	<ul style="list-style-type: none"> 6.NS.1 	<ul style="list-style-type: none"> 7.EE.4a 	<ul style="list-style-type: none"> 8.EE.1 	<ul style="list-style-type: none"> 8.EE.8 A-REI.3
DOK 1 Example	Evaluate. $\frac{4}{9} \div \frac{2}{5}$	Solve for x . $2x + 3 = 9$	Evaluate. 3^4	Solve for x . $3x + 2 = -2x + 4$
DOK 2 Example	Using the digits 1 to 9 at most one time each, fill in the boxes to make two different pairs of fractions that have a quotient of $\frac{2}{3}$. $\frac{\square}{\square} \div \frac{\square}{\square} = \frac{2}{3}$	Using the digits 1 to 9 at most one time each, fill in the boxes to create two equations: one where x has a positive value and one where x has a negative value. $\square x + \square = \square$	Using the digits 1 to 9 at most one time each, fill in the boxes to make two true number sentences. $\square^{\square} = 64$	Using the digits 1 to 9 at most <u>two</u> times each, fill in the boxes to make an equation with no solutions. $\square x + \square = \square x + \square$
DOK 3 Example	Using the digits 1 to 9 at most one time each, fill in the boxes to make two fractions that have a quotient that is as close to $\frac{4}{11}$ as possible. $\frac{\square}{\square} \div \frac{\square}{\square}$	Using the digits 1 to 9 at most one time each, fill in the boxes to create an equation where x has the greatest possible value. $\square x + \square = \square$	Using the digits 1 to 9 at most one time each, fill in the boxes to make a result that has the greatest value possible. $\square^{\square} = \square\square\square$	Using the digits 1 to 9 at most one time each, fill in the boxes so that the solution is closest to zero. $\square x + \square = \square x + \square$

Depth of Knowledge Matrix - Secondary Math

Topic	Geometric Proofs	Complex Numbers	Trigonometric Functions	Definite Integrals
CCSS Standard(s)	<ul style="list-style-type: none"> G-CO.11 	<ul style="list-style-type: none"> N-CN.2 	<ul style="list-style-type: none"> F-TF.3 	<ul style="list-style-type: none"> N/A
DOK 1 Example	Add one geometric marking to demonstrate the quadrilateral is a square. 	Multiply the binomials. $(3 + 4i)(2 + 3i)$	Evaluate. $\sin \frac{\pi}{3}$	Solve. $\int_2^6 x^3 dx$
DOK 2 Example	Use exactly five geometric markings to show that a quadrilateral is a square.	Using the integers -9 to 9 at most one time each, fill in the boxes twice: once to make a positive real number product and once to make a negative real number product. $(\square + \square i)(\square + \square i)$	Using the digits 1 to 9 at most one time each, fill in the boxes to make two true number sentences. $\sin \frac{\square \pi}{\square} = 1$	Using the digits 1 to 9 at most one time each, fill in the boxes to make a positive and a negative solution. $\int_{\square}^{\square} x^{\square} dx$
DOK 3 Example	What is the least number of geometric markings needed to demonstrate that a quadrilateral is a square?	Using the integers -9 to 9 at most one time each, fill in the boxes to make a real number product with the greatest value. $(\square + \square i)(\square + \square i)$	Using the digits 1 to 9 at most one time each, fill in the boxes to find the function's greatest possible value. $\sin \frac{\square \pi}{\square} = \frac{\sqrt{\square}}{\square}$	Using the digits 1 to 9 at most one time each, fill in the boxes to make a solution that is as close to 100 as possible. $\int_{\square}^{\square} x^{\square} dx$



Chrissy Day

@ChrissyDay1974



I LOVE Open Middle [@robertkaplinsky](#) second graders were working on ____ - ____ Make the smallest difference possible using the digits 1-9 once only. The conversation and perseverance was something I had never seen from these kids!

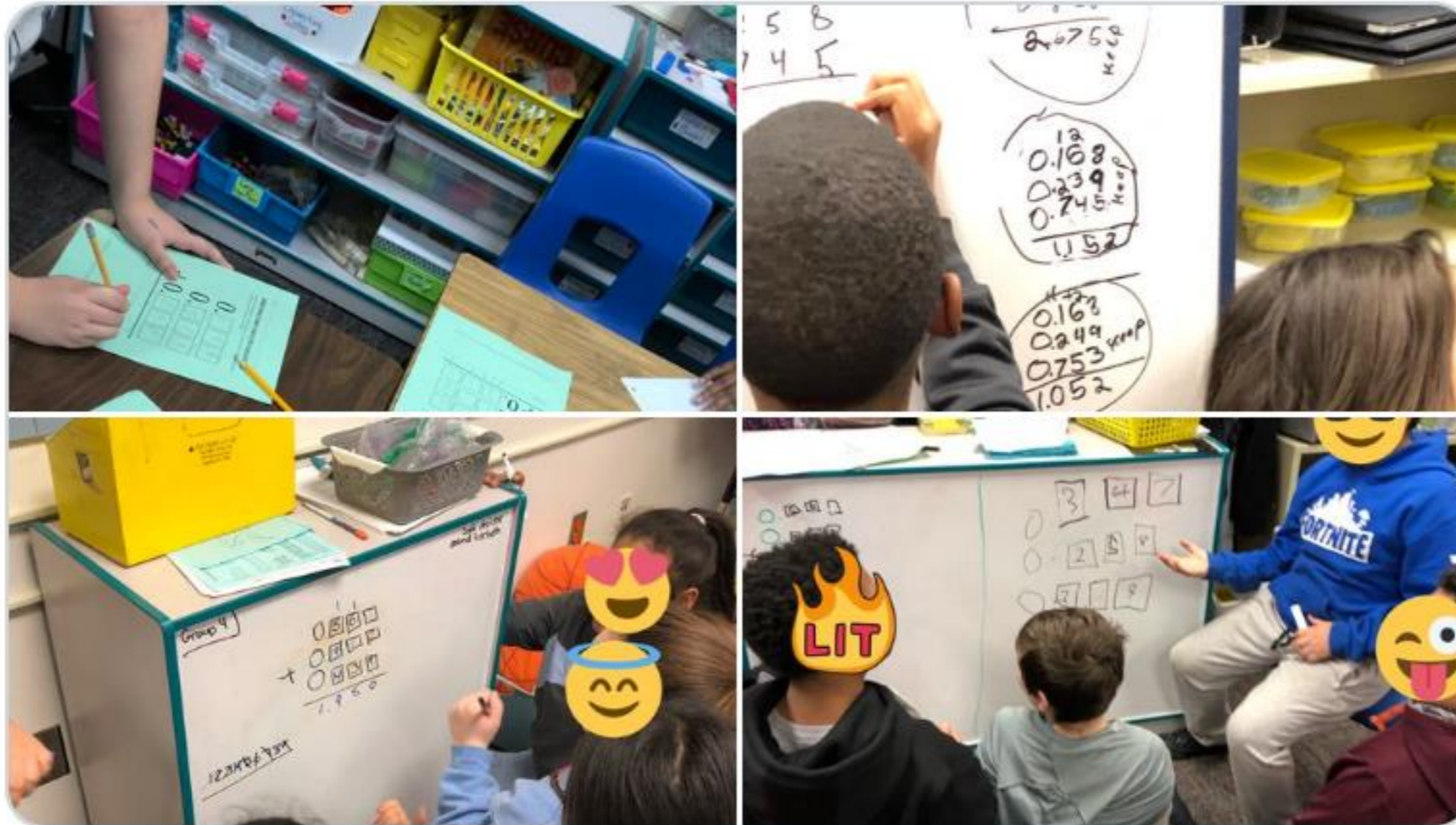
5:20 PM · Mar 9, 2019 · [Twitter for iPhone](#)

6 Retweets **62** Likes



DeLaina Ellis @dellis5th · Jan 11

It was an @openmiddle showdown in 5th grade! They could NOT stop! One student even asked me for his paper during recess so he could try to get even closer! #wearegrandview #iteachmath #mtbos #productivestruggle



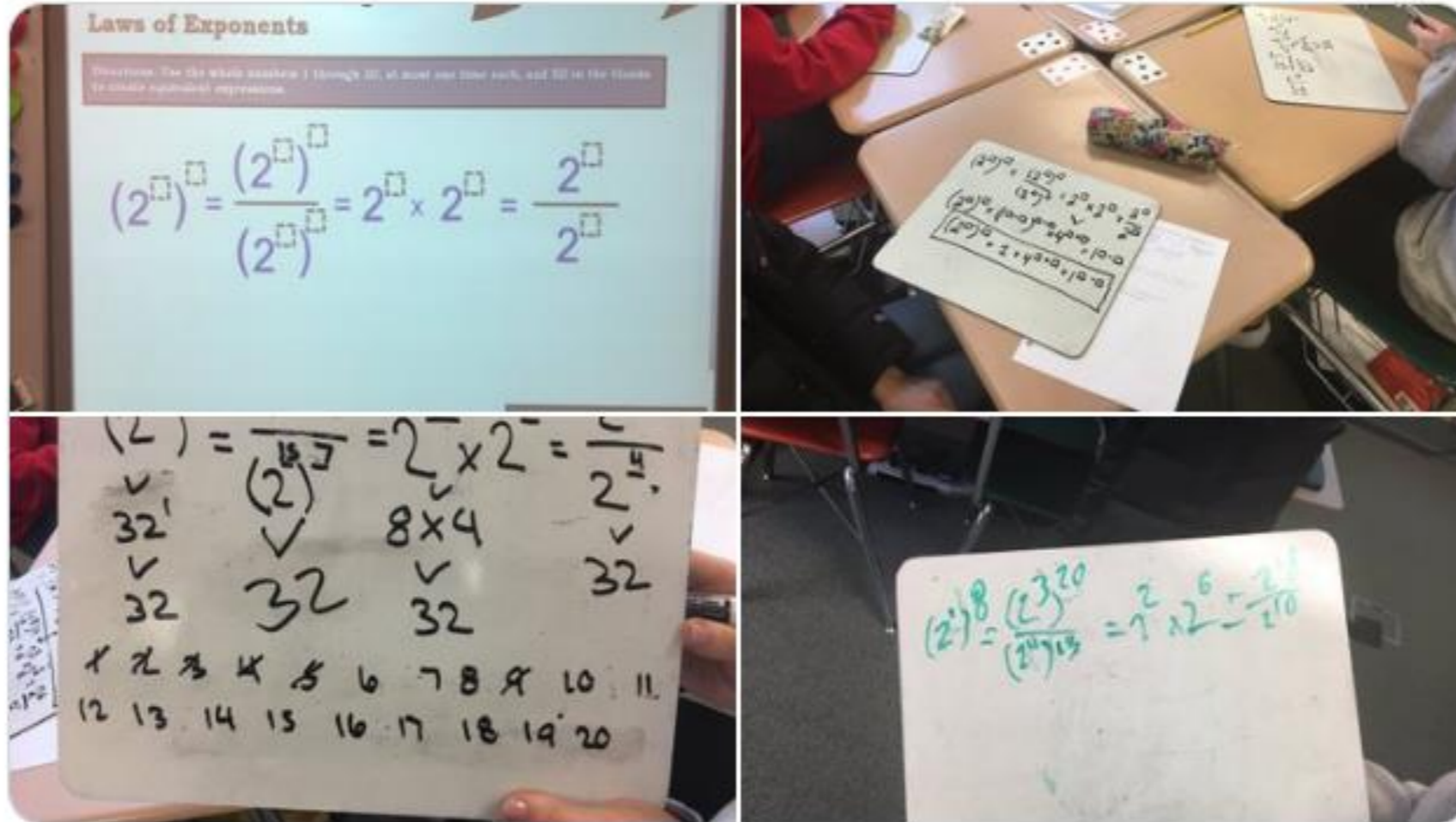


Wendy Kozina

@wkozina

Kids begging for more time and yelling, "No" when I asked if they wanted a hint! Amazing activity

@robertkaplinsky @openmiddle



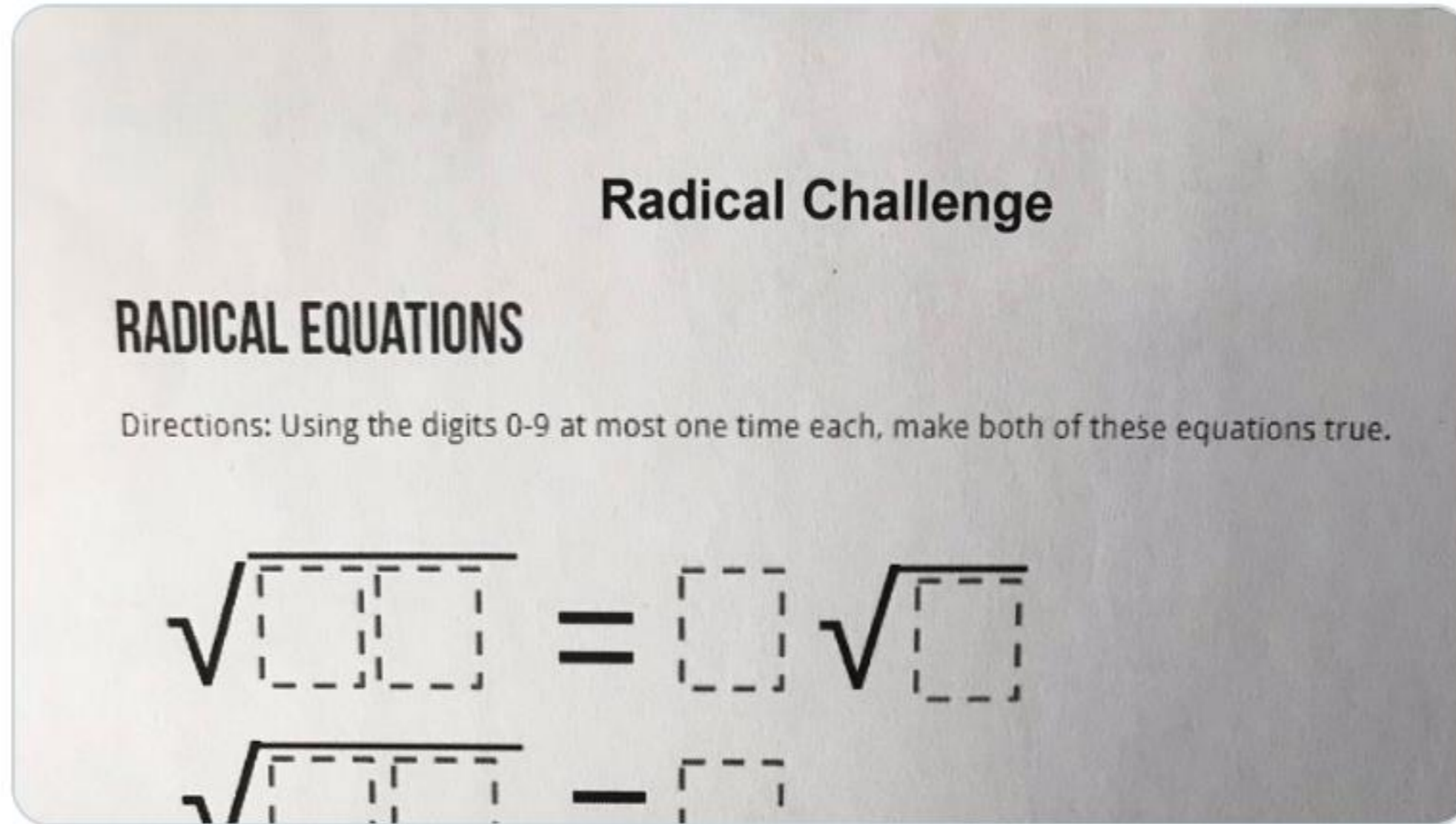
1:30 PM · Mar 8, 2019 · Twitter for iPhone

14 Retweets 98 Likes



Marguerite Spriggs @mspriggs30 · Nov 16, 2018

My **first time trying** an **@openmiddle** problem with my students today. Wasn't sure how it would go or if they'd solve it. After a few minutes going at it (and coming up with more than one solution) they asked "can we do another one?" "That was fun - we should do it more!"





Katherine MacKenzie

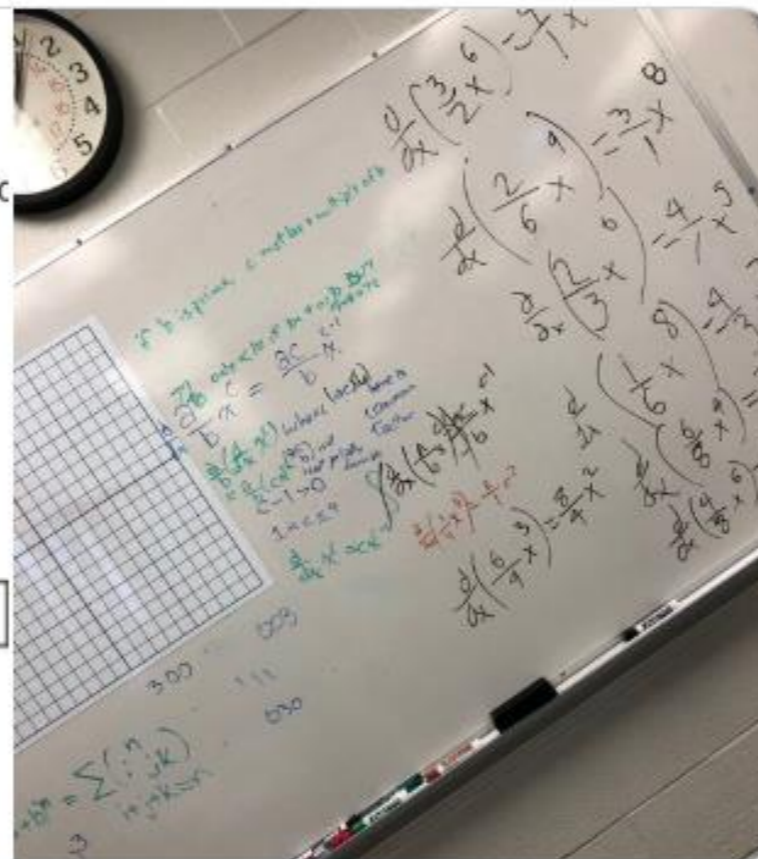
@kmackenzie7

Tried an [@openmiddle](#) problem (for the 1st time) with my calculus crew. Left it on the board went to grab a photocopy before class start. Came back and Ss were crowded around the board sharing ideas. It's was magical. I *must* bring these to all my classes [#MTBoS](#) [#iteachmath](#)

DERIVATIVE POWER RULE

Directions: Use the digits 1 to 9, at most one time each, to create a true derivative statement.

$$\frac{d}{dx} \left(\frac{\square}{\square} x^{\square} \right) = \frac{\square}{\square} x^{\square}$$



2:17 PM · Apr 18, 2019 · [Twitter for iPhone](#)

20 Retweets 156 Likes



MrsDill

@MrsDill2



Replying to [@robertkaplinsky](#) [@openmiddle](#) and [@And02B](#)

My students live for these! Nearly every day I'm asked, "You got anymore of those open problem things for us to solve?"

6:44 PM · Apr 17, 2019 · [Twitter for iPhone](#)

5 Likes

OPEN MIDDLE PROBLEM BENEFITS

- KIDS LOVE DOING THEM
- BUILD CONCEPTUAL UNDERSTANDING
- OFTEN LEAD TO GREAT CONVERSATIONS
- REVEAL HIDDEN MISCONCEPTIONS

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HOW DO WE DO IT?

- Open Middle Worksheet

Name: _____ Period: _____ Date: _____

First attempt:

Points: ____/2 attempt ____/2 explanation

What did you learn from this attempt? How will your strategy change on your next attempt?

Second attempt:

Points: ____/2 attempt ____/2 explanation

First attempt:

Points: ____/2 attempt ____/2 explanation

What did you learn from this attempt? How will your strategy change on your next attempt?

HOW DO WE DO IT?

- Open Middle Worksheet
- Classwork
- Homework
- Assessments

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NUMBER TILES

[Printable PDF with the digits 0 to 9](#)[Printable PDF with the integers -9 to 9](#)

BROWSE BY COMMON CORE STATE STANDARDS

[Kindergarten \(13\)](#)[Counting & Cardinality \(3\)](#)[Geometry \(3\)](#)[Number & Operations in Base Ten \(1\)](#)[Operations & Algebraic Thinking \(6\)](#)[Grade 1 \(21\)](#)[Geometry \(3\)](#)

Home > Grade 7 > Expressions & Equations > Two-Step Equations

TWO-STEP EQUATIONS

Directions: Using the digits 1 to 9 at most one time each, place a digit in each box to find the greatest (or least) possible values for x .

$$\boxed{}x + \boxed{} = \boxed{}$$

Hint

How does each constant's value affect the solution's value?
How does the coefficient's value affect the solution's value?

Answer

Assuming x can be a negative value, $1x + 9 = 2$ gives the least possible value of -7 . The greatest possible value would be, $1x + 2 = 9$

Source: [Audrey Mendivil](#), [Daniel Luevanos](#), and [Robert Kaplinsky](#).



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WHAT COMES NEXT?

Action	Do Now	Start Planning	Don't Do
Try Open Middle problems out with your students	✓		
Find more problems I can use on the Open Middle website.	✓		
Incorporate Open Middle problems on assessments.		✓	
Replace all traditional problems with Open Middle problems.			✓
Share these resources with colleagues to make them aware.	✓		



If you've heard of Open Middle problems and maybe used a few of them, but you're not satisfied with how things have gone and want consistently good results, then this mini workshop is for you. I want your students to love using Open Middle problems and have them be your favorite problems to use when getting observed.

We'll begin by discussing how Open Middle problems can help you and your students. Then we'll work through specific examples for grades K-1, 2-5, and 6-12. We'll use them to talk about how to prepare to use a problem as well as how to use them with students. We'll also address how you can use Open Middle problems when teaching students digitally. Then we'll talk about where you can find more Open Middle problems to use and when and where you want to use them in your units. Finally, there's a bonus lesson on

Mini

How To Use An Open Middle Problem

by Robert Kaplinsky

~~\$59.00~~ \$39.00

Subject: Mathematics

Grade Levels:

- Elementary School
- Middle School
- High School
- College
- Graduate

Registration is open

1

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- Open Middle

smarturl.it/openmiddle

