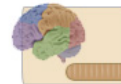




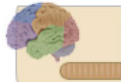
Math Strategies: *Instructional Strategies Informed by Cognitive Neuroscience*

SAIS Learning Support Conference
February 2023

Carraway Center for Teaching & Learning, LLC
Kimberly B. Carraway, Ed.M.
Kimberly@CarrawayCenter.com

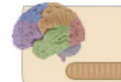


When Math is Hard

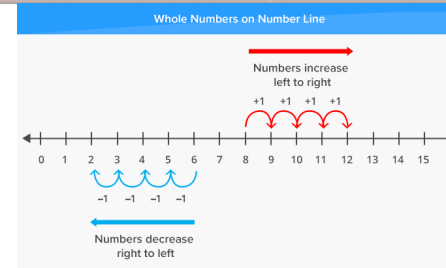


When Math is Hard

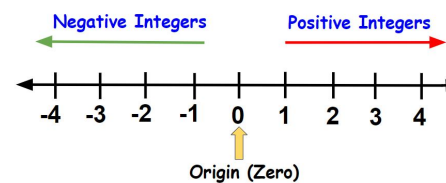
- Directionality
- Mental Math
- Remembering Order of Steps
- Attention to Detail
- Automated Facts
- Comparing Quantities
- Fact Fluency
- Errors: omissions, substitutions, miscalculations
- Transposing numbers/copying incorrectly
- Sustaining Attention
- Remembering the final goal - not getting lost along the way
- Mathematical cognitive flexibility
- Executive functioning
- And.....and.....and.....



Use the Number Line

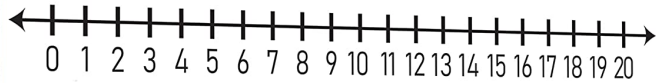


Integers on a Number Line

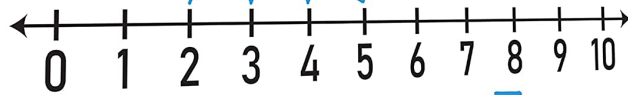




Engage in Number Talks



$$\square = \square$$



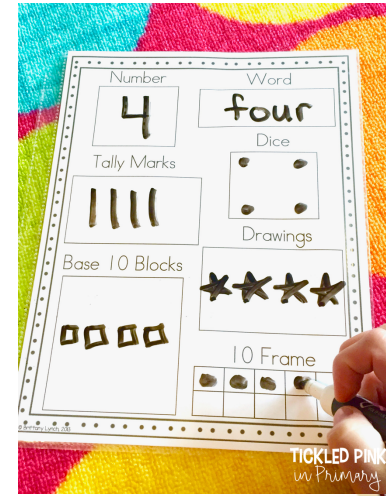
$$2 + 3 = 5$$



Develop Number Sense



NUMBER SENSE
math stations K-2nd



TICKLED PINK
in Primary



Use A LOT of Manipulatives



- Friction
- Touch
- Movement
- Individual Pieces
- Part / Whole
- Large Arm Movements



Base 10 Blocks

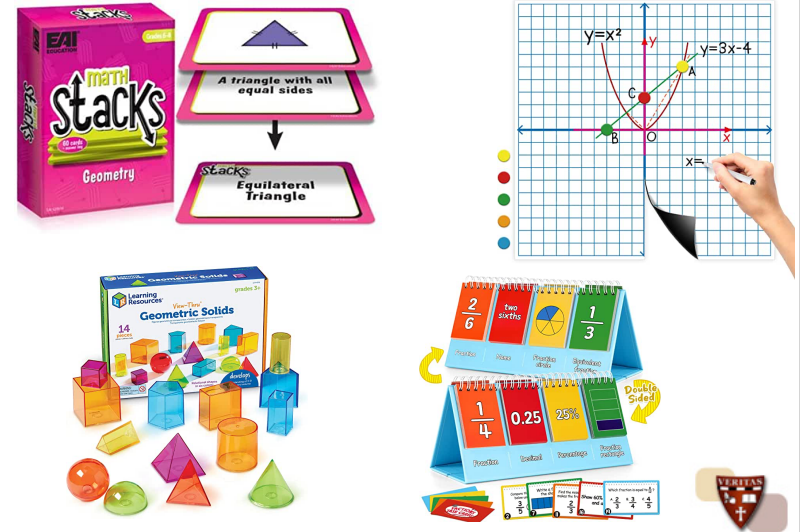




10 and 20 Frame Sets

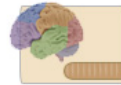


Engage in Number Talks

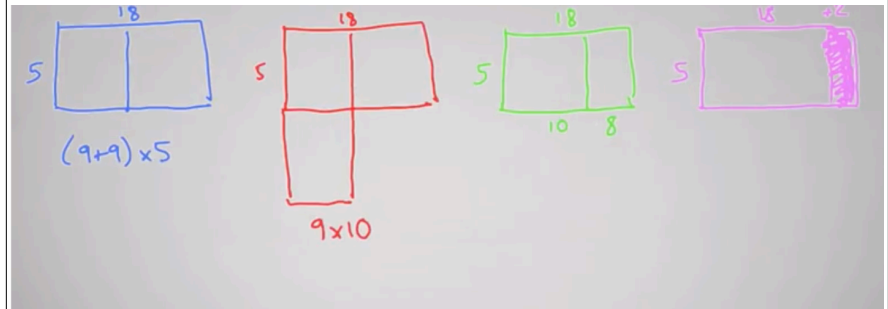


Engage in Number Talks

$$18 \times 5 = ?$$



Number Talks Examples





Automate Math Facts



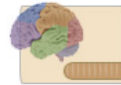
Dry Erase Sheets - Multiplication



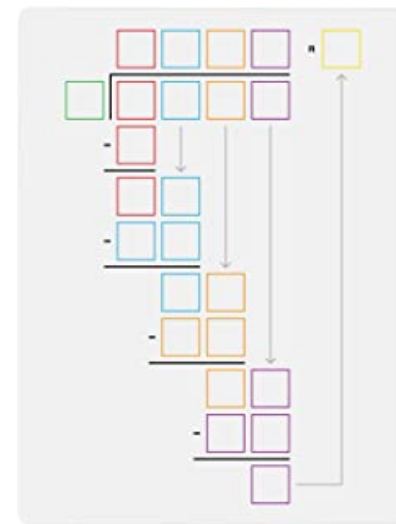
Provide Reference Charts

HUNDRED BOARD									
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

Multiplication Chart												
×	1	2	3	4	5	6	7	8	9	10	11	12
1	1	2	3	4	5	6	7	8	9	10	11	12
2	2	4	6	8	10	12	14	16	18	20	22	24
3	3	6	9	12	15	18	21	24	27	30	33	36
4	4	8	12	16	20	24	28	32	36	40	44	48
5	5	10	15	20	25	30	35	40	45	50	55	60
6	6	12	18	24	30	36	42	48	54	60	66	72
7	7	14	21	28	35	42	49	56	63	70	77	84
8	8	16	24	32	40	48	56	64	72	80	88	96
9	9	18	27	36	45	54	63	72	81	90	99	108
10	10	20	30	40	50	60	70	80	90	100	110	120
11	11	22	33	44	55	66	77	88	99	110	121	132
12	12	24	36	48	60	72	84	96	108	120	132	144



Provide scaffolded memory support

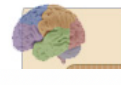




Notebook Paper for Math



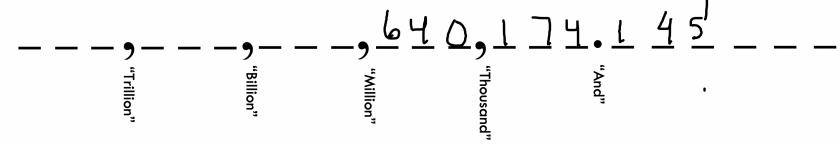
		2	.	4			
	+	3	.	2	5		
		5	.	6	5		



Use Color Coding in Teaching Math

Place Value Chart

Trillions			Billions			Millions			Thousands			Ones			Decimal Place (part of a whole)					
Hundred Trillions	Ten trillions	Trillions	Hundred Billions	Ten billions	Billions	Hundred Millions	Ten Millions	Millions	Hundred Thousands	Ten Thousands	Thousands	Hundreds	Tens	Ones	Tenths	Hundredths	Thousandths	Ten-thousandths	Hundred-thousandths	Millionths

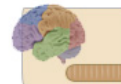


Use color coding to show steps

$(x+5)(x+2)$

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

$x^2 + 10x + 10$



Math Notes & How To Pages

THE COMPLETE MIDDLE SCHOOL STUDY GUIDE

EVERYTHING YOU NEED TO ACE MATH IN ONE BIG FAT NOTEBOOK

Notes borrowed from the **SMARTEST KID IN CLASS** (double-checked by an **AWARD-WINNING** teacher)

We **COLLECT LIKE TERMS** (also called **COMBINING LIKE TERMS**) to simplify an expression—meaning, we rewrite the expression so that it contains fewer numbers, variables, and operations. Basically, you make it look more “simple.”

EXAMPLE: Denise has 6 apples in her basket. Let's call each apple “ x .”

We could express this as $x + x + x + x + x + x$, but it would be much simpler to write $6x$. When we put $x + x + x + x + x + x$ together to get $6x$, we are collecting like terms. (Each term is the variable x , so we can combine them with the coefficient of 6, which tells us how many x 's we have.)

When combining terms with the same variable, add the coefficients.

EXAMPLE: Denise now has 6 apples in her pink basket, 1 apple in her purple basket, and 7 apples in her white basket.

We could express this as $6x + 1x + 7x$, but it would be much simpler to write $14x$.

EXAMPLE: $4x - 3x + 5x$
(When there is a “-” sign in front of the term, we have to subtract.)
 $4x - 3x + 5x = 1x$

If two terms do NOT have the exact same variable, they cannot be combined.

EXAMPLE: $7m + 3y - 2m + y + 8$
(The $7m$ and $-2m$ combine to make $5m$, the $3y$ and y combine to make $4y$, and the constant 8 does not combine with anything.)
 $7m + 3y - 2m + y + 8 = 5m + 4y + 8$

REMEMBER: A term with a variable cannot be combined with a constant.

REMEMBER: A variable without a coefficient actually has a coefficient of 1. So “ $4x$ ” really means “ $4x$ ” and “ $3x$ ” really means “ $3x$.” (Remember the identity property of multiplication.)

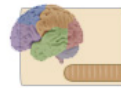
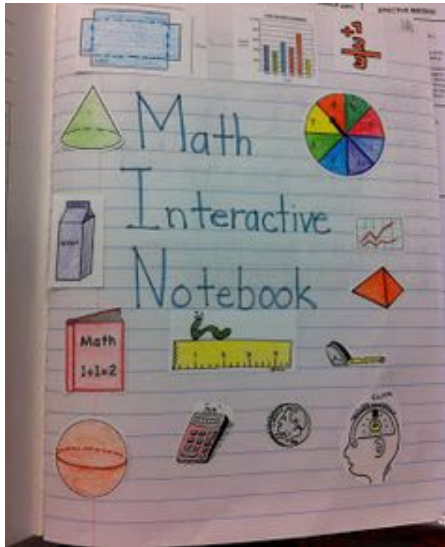
REMEMBER: $3ab$ can combine with $10ab$ because the commutative property of multiplication tells us that ab and ba are equivalent.

184





Create Math "How To" Pages



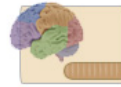
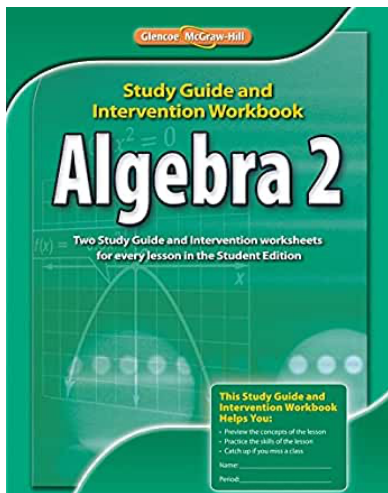
Give step by step "how to" cue cards

How To Solve Word Problems

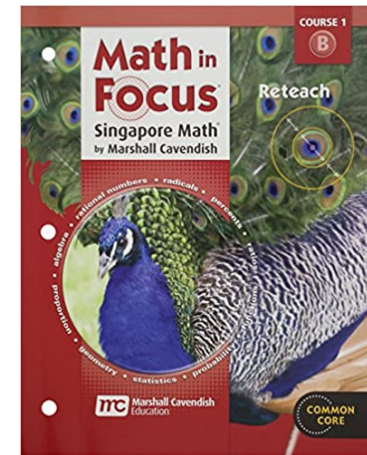
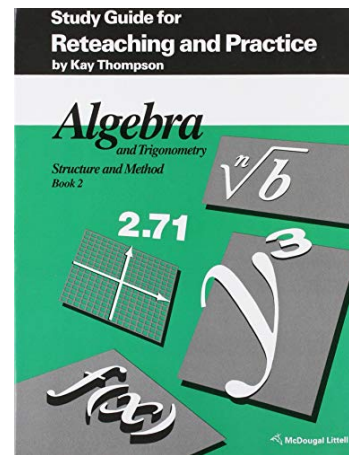
- Shhh
1. Read question silently.
 2. Read question out loud (make sure it sounds right)
 3. Reword the question in a shorter (right-brained) way.
 4. Draw pictures
 5. Figure out what they want... what are they asking for?
 6. Solve
 7. See if your answer makes sense
↳ reread using/including your answer.



Math Notes & How To Pages



Use the Reteach Workbooks



Write simple step by step directions

1 write formula
 $A = \frac{b \times h}{2}$

2 plug in numbers
 $50 = \frac{x \cdot 10}{2}$

3 do simple math & rewrite
 $\frac{50}{5} = \frac{x \cdot 5}{5} \quad | \quad 5x = 50$
 $10 = x$

Area = 50

Teach specific vocabulary

Chapter 9 quotient (answer)

Dividend

Divisor

Quotient

Different ways to represent

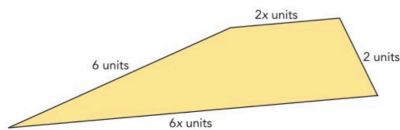
How you read the problem

Explicit Instruction

Guided Practice

Complete.

- 27 The figure shows a quadrilateral. Find the perimeter of the quadrilateral.



$$6x + 6 + 2x + 2 = 6x + 2x + 6 + 2$$

$$= ? + ?$$

The perimeter of the quadrilateral is ? units.

Simplify each expression.

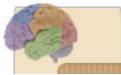
- | | |
|-----------------------|------------------------|
| 28 $4x - 3 + 3x$ | 29 $5y + 4 - 2y$ |
| 30 $8y - 7 - 4y$ | 31 $7z + 9 - 2z - 2$ |
| 32 $5 + 11z - 4 + 6z$ | 33 $8g + 10 - 3g + 7$ |
| 34 $12 + 6g - 5 - 4g$ | 35 $27 + 3r - 9 + 15r$ |

Circle Key Words in Directions & Questions

One saw and 4 hammers cost \$72. Two saws and 6 hammers cost \$114. How much is each?

Classify the following shapes.





33. Aurelio is purchasing carpet tiles to cover an **area** of his living room floor that is **$8\frac{1}{3}$ feet** wide by **10 feet** long. Each carpet tile is a square **20 inches** wide by **20 inches** long. What is the **minimum** number of carpet tiles that Aurelio must purchase to cover this area of his living room floor?

- A. 5
- B. 11
- C. 21
- D. 30
- E. 84



Executive Function Errors in Math

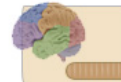
$$\begin{array}{r} 143 \\ + 27 \\ \hline \end{array} \rightarrow \begin{array}{r} 134 \\ + 27 \\ \hline \end{array}$$

$$\begin{array}{r} 37 \\ + 15 \\ \hline \end{array} \rightarrow \begin{array}{r} 37 \\ - 15 \\ \hline \end{array}$$



Checking Your Work - Tapping

$$\begin{array}{r} 485 \times 25 = \\ 485 \\ \times 25 \\ \hline 2325 \end{array}$$



Checking Strategies

X What is the difference between speed and velocity?
 7. Is velocity a vector or scalar quantity and why?
 Vector, because velocity is $\frac{\text{Position}}{\text{Time}}$ direction magnitude
 8. Members of the Fairview Track Club are running a 1.5 km race. What is the distance of the race in millimeters?
 $1500 \text{ m} \times 1000 = 1,500,000 \text{ mm}$
 X Which has the greater speed? A duck that travels 600 m in 60 seconds, or a goose that travels 60 m in 5 seconds?
 The duck $\frac{600}{60} = 10 \text{ m/s}$ vs $\frac{60}{5} = 12 \text{ m/s}$
 10. Complete the motion map:
 $\frac{3}{6} \cdot 5$

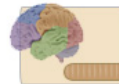
Is it Finished? Finished?
 Write it down! All of it. (slope = $\frac{\text{rise}}{\text{run}}$)
 Units - don't forget me!
 Touch math
 ✓ off your numbers - $\frac{600}{60}$
 did you copy right
 Over label (position)
 + or - slope





Math Checklist

1. Is it finished or finished finished?
2. Circle key words in the question.
3. Box what the key question is or write an empty box for the answer.
4. Use touch math - tap and touch
5. Put a checkmark above your numbers to see if you copied them correctly
6. Circle the signs (+ -)
7. Sub-vocalize - read the problem out loud
8. OVER label - write more than you think you need
9. Show every step. Write it down. ALL of it!
10. Units - don't forget about these guys :)
11. REDUCE, reduce and reduce again!



Provide room to show your work

Multiply. Find the product. **Count decimal places**

1) 1.082×4.5 a) 0.4868 b) 0.4869 c) 4.868 d) 4.869

2) 3.46×7.1 a) 2.768 b) 24.566 c) 27.750 d) 245.66

Choose the correct answer for each. Divide until the remainder is zero. Check work.

3) $7 \overline{) 55.42}$ a) 5.06 b) 56 c) 56 d) not given

4) $8.4 \overline{) 5.27}$ a) 0.15 b) 1.5 c) 0.155 d) 1.55

Find the quotient by dividing. *Then round the quotient to the nearest dollar. (no cents)*

5) $8 \overline{) 25.33}$ check here x 8

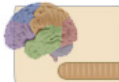
6) $81 \overline{) 701.00}$ check x 81

7) Do the same as #16. Round to nearest dollar.

8) $22 \overline{) 22.2}$ a) \$4 b) \$3.3 c) \$4.3 d) \$3

9) Tickets for the DA raffle cost \$0.75 each. How many tickets can you buy for \$48.00? a) 37 tickets b) 44 tickets c) 64 tickets d) 64 tickets

10) Marcie has \$1.45 in quarters and dimes. She has 10 coins in all. How many dimes does she have? a) 3 b) 7 c) 10 d) 20



Provide room to show your work

6 Chapter Test



Find the radius of the circle with the given diameter.

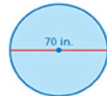
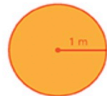
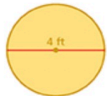
1. 10 inches
2. 5 yards

Find the diameter of the circle with the given radius.

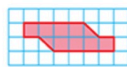
3. 34 feet
4. 19 meters

Find the circumference and area of the circle. Use 3.14 or $\frac{22}{7}$ for π .

5. diameter of 4 feet
6. radius of 1 meter
7. diameter of 70 inches

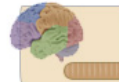


8. Each square on the grid is 1 square inch. Estimate the perimeter of the figure. Then find the area.



Find the perimeter and area of the figure. Use 3.14 or $\frac{22}{7}$ for π .

- 9.
- 10.
- 11.



Additional Recommendations

1. Have students reference their notes so not to use as much working memory for procedural memory
2. Allow use of calculator or multiplication table so students can practice problem solving
3. Write down what you DO know and see if that helps you have a visual "aha" moment
4. When you get stuck, step back and skip the problem, come back to it and see if there is a new method to use to solve it.
5. Draw pictures
6. Write down ALL formulas on the math test or worksheet before beginning.
7. Know which units go with which amounts
8. Have a vocabulary sheet with key words for functions such as sum, product, divisor, integer, etc.
9. Improve self monitoring





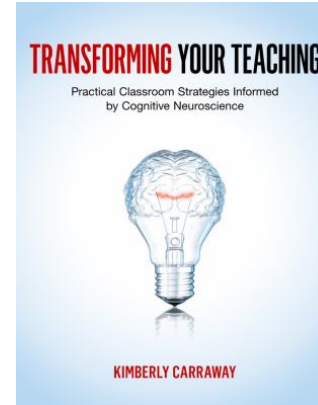
Common Errors Checklist

Common Errors

Specific Error	Test 8.1-8.4	Test 8.1-8.8	Test coordinate plane	Test perimeter & Area	Test congruence	Test 13.1-13.5	Test 13.1-13.7	Average	percentage
	8.1-8.4							42.4	41.8
wrote down wrong number									
wrote answer in wrong form									
copied the problem wrong (wrong sign)									
read the problem wrong									
didn't write down full answer									
put down the wrong word									
too specific answer									
did not check answer									
thought it was right, but wasn't actually									



Transforming Your Teaching



The Carraway Center for Teaching & Learning

Kimberly@carrawaycenter.com

615-586-1144

www.carrawaycenter.com

Book available on amazon.com or you can order in bulk from Kimberly Carraway

