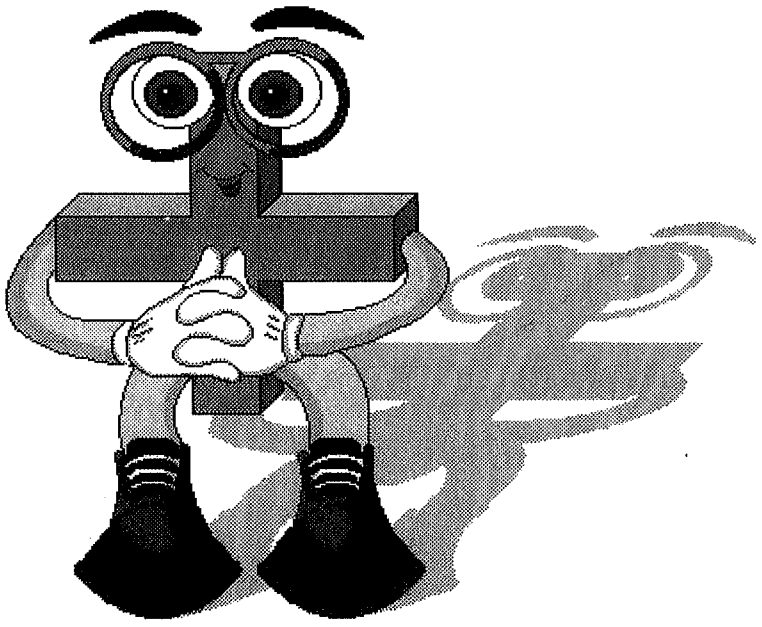
Addition Strategies and Algorithms



Strategy: Using a Number Grid

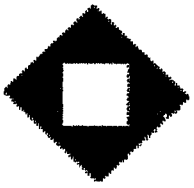
When do I use it?

- Use the number grid for finding sums of beginning addition problems and two-digit addition problems.

Description:

A number grid lends itself to many activities that reinforce understanding of numeration and place value. For example, by exploring the patterns in rows and columns, children discover that any number on the number grid is:

- 1 more than the number to its left
- 1 less than the number to its right
- 10 more than the number above it
- 10 less than the number below it



Example:

17 + 25 = ?

- Start at 17.
- Add 20.
  - Move down 2 rows to 37
- Add 5.
  - Count 5 more to 42.

17 + 25 = 42

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

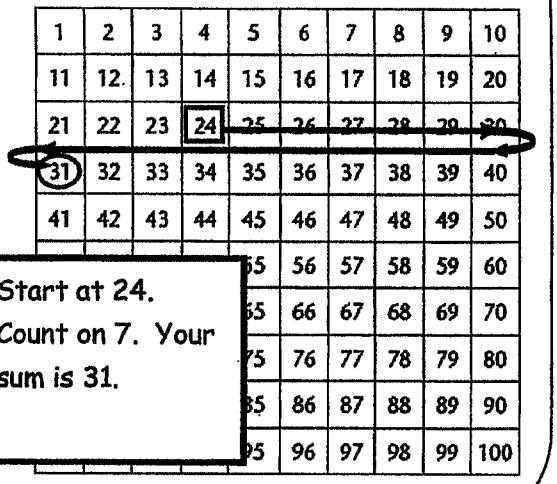
Milestones:

- When students begin adding 10s and 1s in their head (they no longer rely on the number grid) they are ready to move on to Partial Sums.

Example Answers: Using a Number Grid

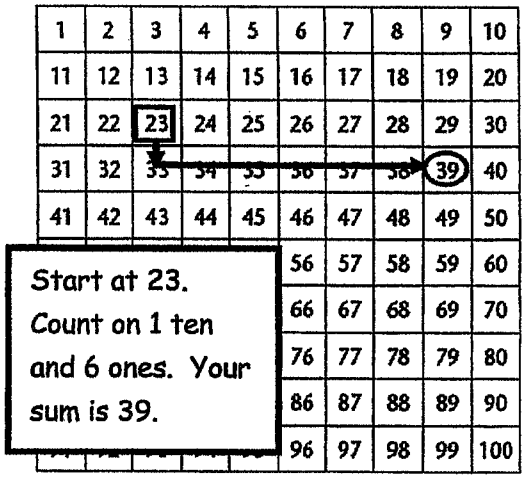
Use the number grids to solve the problems. Draw the path you used to arrive at your answer.

1. 24 + 7 =



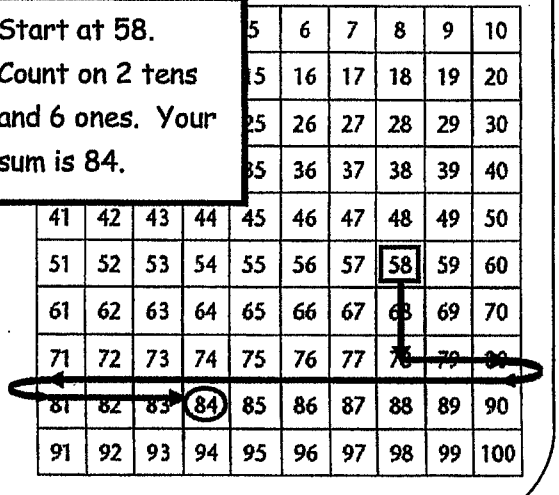
Start at 24. Count on 7. Your sum is 31.

1. 23 + 16 =



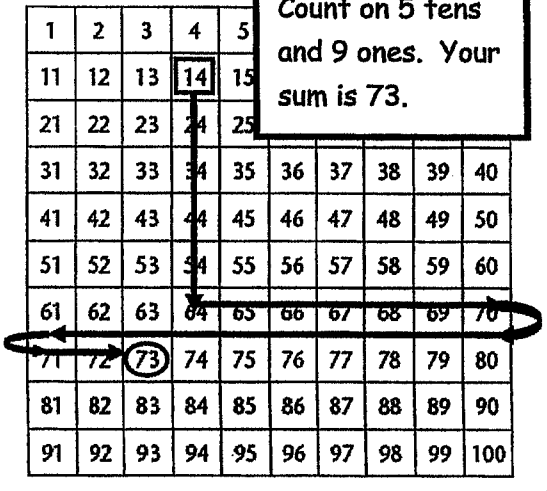
Start at 23. Count on 1 ten and 6 ones. Your sum is 39.

1. 58 + 26 =



Start at 58. Count on 2 tens and 6 ones. Your sum is 84.

1. 14 + 59 =



Start at 14. Count on 5 tens and 9 ones. Your sum is 73.

Examples: Partial Sums

Use partial sums to solve the problems below.

1. 45 + 7 =

2. 37 + 62 =

3. 802 + 489 =

4. 4,158 + 726 =

5.
$$\begin{array}{r} 415 \\ +\ 377 \\ \hline \end{array}$$

6.
$$\begin{array}{r} 9{,}257 \\ +\ 2{,}789 \\ \hline \end{array}$$

Algorithm: Partial-Partial Sums

When do I use it?

- Students will use this strategy when adding two or more two- or three-digit numbers.

Description:

- This algorithm is an extension of the Partial Sums Algorithm. However, students are now breaking apart only one of the addends.

Example:

- 17 + 25 = ?
  - Add the 20 to 17. 17 + 20 = 37
  - Add the 5 ones to the previous partial sum 37 + 5 = 42

So, 17 + 25 = 42

As children grow in their flexibility with numbers, you may begin to see them using the "Make 10" Strategy with Partial Sums.

- 37 + 8 = ?

  3 + 5
  - 37 + 3 = 40
  - 40 + 5 = 45

Milestones:

- Some students will be doing this concurrently with column addition. (The Partial-Partial Sums algorithm is more of a mental math strategy.)

Example Answers: Partial-Partial Sums

Use partial-partial sums to solve the problems below.

Please Note: we are using the same examples to show you how children's thinking may look different.

1. 45 + 7 =

   5 + 2

   45 + 5 = 50

   50 + 2 + 52

2. 37 + 62 =

   60 + 2

   37 + 60 = 97

   97 + 2 = 99

3. 802 + 489 =

   800 + 2

   2 + 489 = 491

   800 + 489 = 1,291

4. 4,158 + 726 =

   700 + 20 + 6

   4,158 + 700 = 4,858

   4,858 + 20 = 4,878

   4,878 + 6 = 4,884

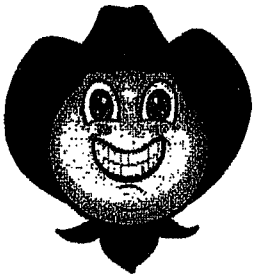
5. 415 → 400 + 10 + 5
   + 377

   400 + 377 = 777
   10 + 777 = 787
   5 + 787 = 792

6. 9,257 → 9,000 + 200 + 50 + 7
   + 2,789

   9,000 + 2,789 = 11,789
   200 + 11,789 = 11,989
   50 + 11,989 = 12,039
   7 + 12,039 = 12,046

Examples: Column Addition



Add.

1.

	Tens	Ones
	5	2
+	1	9

2.

	Tens	Ones
	3	7
+	5	4

3.

	Tens	Ones
	1	6
+	3	8

Final Answer

Tens	Ones

Tens	Ones

Tens	Ones

4.

	Tens	Ones
	5	6
+	2	1

5.

	Tens	Ones
	3	4
+	4	9

6.

	Tens	Ones
	2	3
+	5	7

Final Answer

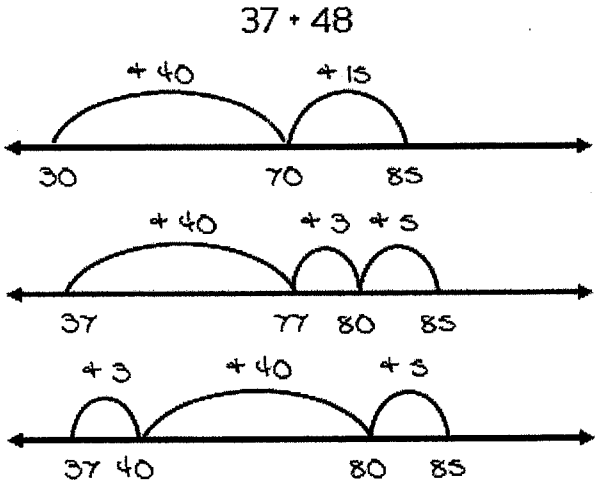
Tens	Ones

Tens	Ones

Tens	Ones

Open Number Line Addition

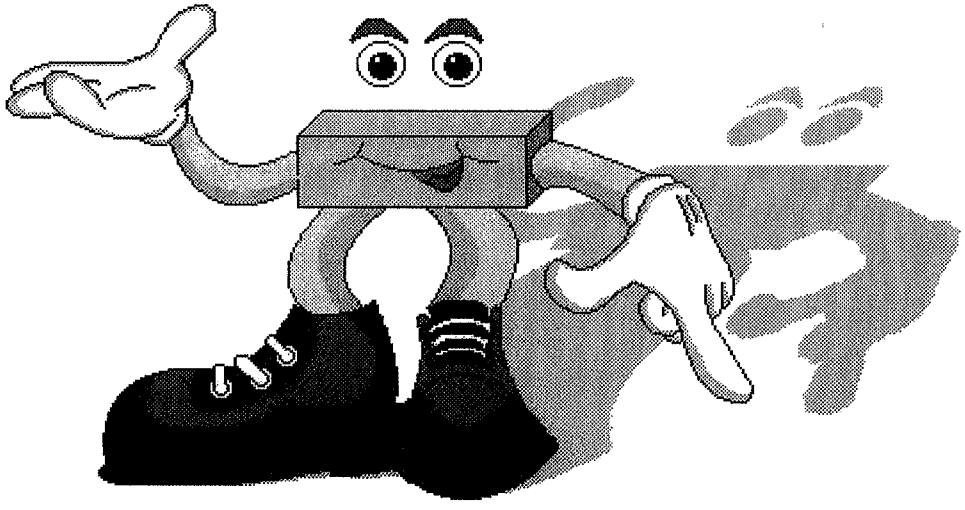
I love vacation, but it's GREAT to be back home! So, somewhere on a trail in the mountains of Georgia, I got to thinking about open number lines. That's a math buzz word you hear a lot these days, but what exactly *is* an open number line? Well, it's a number line with no numbers or tick marks. Open number lines are great models for working with place value or, in the case below, addition. In previous posts I've talked about mental strategies for addition. The number line is a fantastic way to record the different strategies used by students. The three number lines below all show strategies for adding 37 + 48. Look at each one and see if you can explain how the addition was done in each case.



1. Number Line 1: This student added the tens (30 + 40) and then the ones (7 + 8). The number line starts at 30 (the tens from the first number) and adds on the 4 tens from the second number, landing on 70. The student then added 7 + 8 to get 15 and added that to the 70 to get 85.
2. Number Line 2: This student left 37 whole and added on the 4 tens from the second number. He then broke the 8 ones into 3 + 5 and used the 3 ones to make 80. Finally, he added on the remaining 5 ones.
3. Number Line 3: This student took 3 of the 8 ones from the second number to get make a ten out of the 37 (37 + 3 = 40). Then, she jumped on the 4 tens to get to 80. Last, she added the remaining 5 ones.

Notice the number sense required for this type of math. Students have to be able to think flexibly about numbers, understand place value, and decompose numbers. This might be out of your comfort zone! If so, try some problems on your own. When you do this with your class, it is a good idea to anticipate the strategies students might use, so you'll be ready to draw them. Here's a little freebie you can use with your class.

Subtraction Strategies and Algorithms



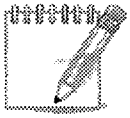
Strategy: Count Back on a Number Grid

When do I use it?

- Students use this strategy for subtracting two digit numbers.

Description:

- Students start at the biggest number and count back

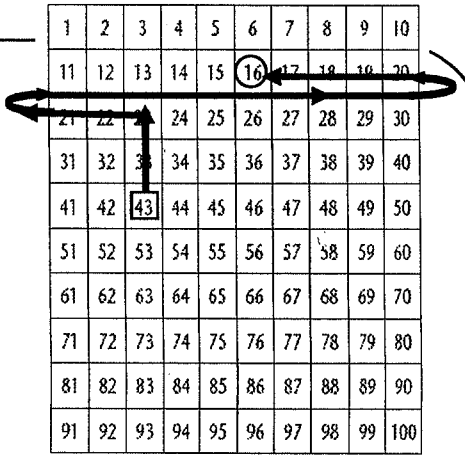


Example:

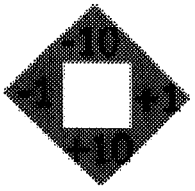
43 – 27 = ?

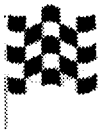
- Start at 43
- Subtract 20
  - move up 2 rows to 23
- Subtract 7
  - Count back 7 to 16

43 – 27 = 16



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





Milestones:

- Look for children to begin to do this process mentally without the aid of a number grid.

Examples: Using a Number Grid

Use the number grids to solve the problems. Draw the path you used to arrive at your answer

1. 49 – 16 =

Solve the problem by counting back.

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

Solve the problem by counting up.

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

2. 87 – 32 =

Solve the problem by counting back.

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

Solve the problem by counting up.

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

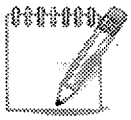
Algorithm: Counting-Up Subtraction Method

When do I use it?

- Students use this strategy when subtracting two digit (or larger) numbers.

Description:

- Starting at the smaller number, count up to make the nearest ten, count on by tens and hundreds, and then count up by ones. Finally, add all of the numbers you added on to find the difference.



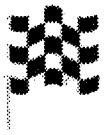
Example:

Subtract 89 from 347 by counting up.

Write the smaller number and count up to the larger number.
Each time you count up, circle that number.

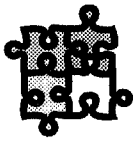
89	
+ (1)	Count up to the nearest 10.
90	
+ (10)	Count up to the nearest 100.
100	
+ (200)	Count up to the largest possible hundred.
300	
+ (47)	Count up to the larger number.
347	

Next, add the numbers you circled. 1 +10 +200 +47 = 258
You counted up 308. Therefore, 347-89 = 258



Milestones:

- Look for students to begin to do this mentally, and to cluster their addition into fewer groups.



Real-Life Connections:

- Counting-up is very useful when children are learning to count change or determine elapsed time.

Example Answers: Counting-Up Subtraction

Solve.

1. 50 – 19 =

19
+1
20
+30
50

1 + 30 = 31

50 – 19 = 31

2. 78 – 45 =

45
+ 5
50
+20
70
+ 8
78

5 + 20 + 8 = 33

78 – 45 = 33

3. 632 – 127 =

127
+ 3
130
+70
200
+400
600
+32
632

3 + 70 + 400 + 32 = 505

632 – 127 = 505

4. Carrie's party started at 3:55. It ended at 5:40. How long was Carrie's party?

3:55
+ :05
4:00
+1:00
5:00
+ :40
5:40

:05 + 1:00 + :40 = 1:45

5:40 – 3:55 = 1:45

The party was 1 hour and 45 minutes long.

Examples: Same-Change Rules

Solve.

1. 43 – 17 =

2. 300 – 186 =

3. 502 – 87 =

4. Sam went to the store and bought a pack of gum for $1.73. He paid the cashier with a $5 bill. How much change should Sam receive?

Algorithm: Trade-First Subtraction Method

When do I use it?

- Students use this algorithm for subtracting two digit (or larger) numbers.

Description:

- In this method the children look at all of the numbers first and determine if they need to trade before subtracting

Example:

Subtract 178 from 245 using the trade-first method.

Hundreds	Tens	Ones
2	4	5
− 1	7	8

Step 1:

Look at the 1s place. Can you subtract 8 ones from 5 ones?

Hundreds	Tens	Ones
	3	15
2	~~4~~	~~5~~
− 1	7	8

Step 2:

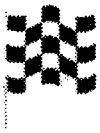
No, so trade 1 ten for 10 ones. Now, look at the 10s place. Can you take 7 tens from 3 tens?

Hundreds	Tens	Ones
	13	
1	~~3~~	15
~~2~~	~~4~~	~~5~~
− 1	7	8
	6	7

Step 3:

No, so trade 1 hundred for 10 tens. Now subtract in each column.

245 - 178 = 67



Milestones:

- This algorithm may be used in place of or concurrently with the traditional subtraction algorithm.
- The only difference between this algorithm and the traditional algorithm is the order in which you trade and subtract.