Sense of Number

Expanded Visual Calculation Policy

Concrete & Pictorial Policy



Holy Trinity CofE Primary School
February 2020



Graphic Design by Dave Godfrey
Compiled by the Sense of Number Maths Team

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'A picture is worth 1000 words!' www.senseofnumber.co.uk

CPA
reasoning

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Guide to using the

Concrete and Pictorial Visual Calculation Policy

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C: Concrete
(Real objects that children can touch and manipulate.)

P: Pictorial
(Images that help children picture the mathematics.)

A: Abstract
(Calculations written using symbols.
e.g. 2 + 2 = 4.)

A3 Wallchart Listing
84 Posters:

2: Introductory Pages
5: Resources Summary
7: Operation Overviews
12: Addition Posters
32: Subtraction Posters
59: Multipication Posters
70: Division Posters



The Full Sense of Number Visual Calculation Policy Package provides a comprehensive visual representation of a school's Calculation Policy.

1: CPVCP	Concrete and Pictorial VCP - The foundation of the policy, featuring key models and images to help children gain deep understanding of the abstract proceedures.
2: WSVCP	Written Strategies progression from jottings to formal written methods from Y1 to Y6.
3: MSVCP	Mental Strategies progression across KS1 and KS2.
4: ECPD	Editable Calculation Policy Document - a comprehensive written explanation of a school's calculation policy, featuring thumbnails of the posters from the three documents above.

Typical uses:

Classoom:	The posters are printed out (e.g. A4) and the appropriate slides are displayed for continual reference or on a working wall. Posters are used on the interactive whiteboard.
Reference:	The summary overviews are printed out and inserted in the teacher's planning folder.
Parents:	The posters are used to communicate to parents the methods being used within school.
Website:	Screen grabs of slides from the VCP are inserted on a schools' maths webpages.

(PLEASE NOTE: the VCP should not be placed on school website for copyright reasons.)
A secure PDF copy of the Editable Calculation Policy may be placed on the school webite.

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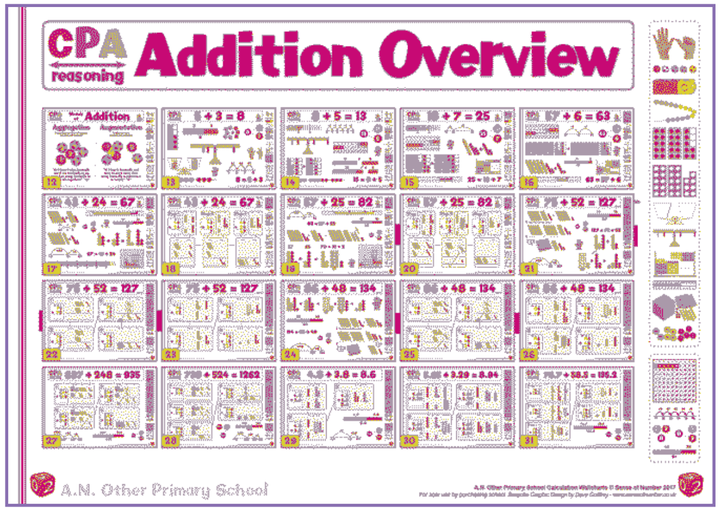
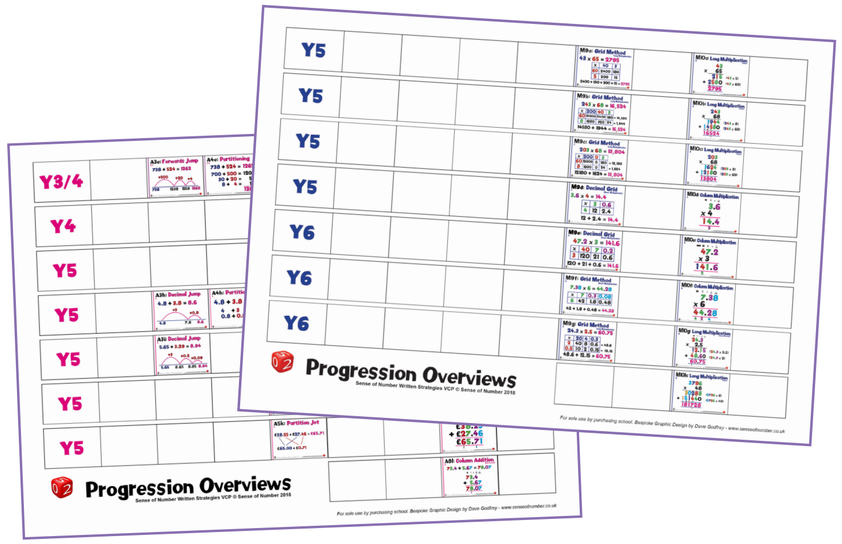
The Expanded Visual Calculation Policy helps children and teaching staff achieve mastery of all aspects of calculation. It contains the following three documents:

Concrete & Pictorial VCP



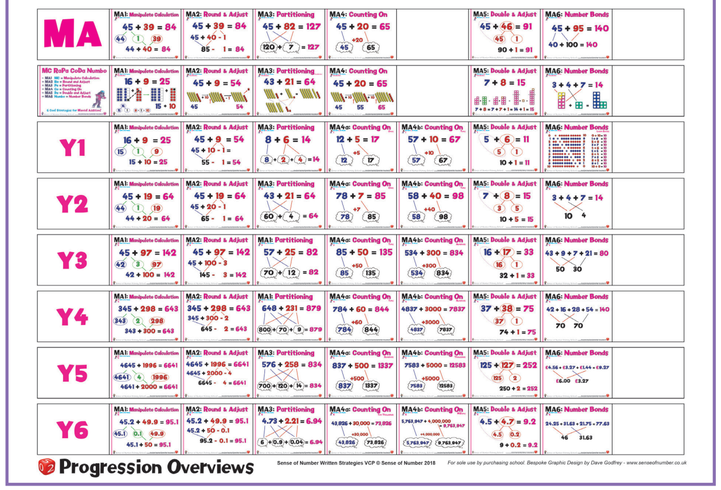
84 A3 wallcharts showing the range of models and images that help children to understand and master calculation strategies.

Written Strategies VCP



271 A4 posters showing the progression of written strategies (from Y1 to Y6) for all 4 operations in line with the National Curriculum.

Mental Strategies VCP



214 A4 posters showing the progression of mental strategies (from Y1 to Y6) for all 4 operations in line with the National Curriculum.

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EVCP Poster Guide



Code	Section	Concrete & Pictorial (84 A3 Wallcharts)		Written VCP (271 A4 Posters)		Mental VCP (215 A4 Posters)	
		Number of Wallcharts	Wallchart Numbers	No. of Posters	Poster Numbers	No. of Posters	Poster Numbers
	Policy Introduction Slides	4	1-4	4	1-4	4	1-4
	Introductory Posters	3	5-7	9	5-13		
	Operation Overviews	4	8-11	13	14-26	8	5-12
C	Counting Policy			15	27-41		
A	Addition	20	12-31	54	42-103		
MA	Mental Addtion					55	13-67
S	Subtraction	27	32-58	48	104-169		
MS	Mental Subtraction					63	68-130
M	Multiplication	11	59-69	39	170-209		
MM	Mental Multiplication					46	131-176
D	Division	15	70-84	55	210-264		
MD	Mental Division					38	177-215
	Multiplication Tables			11	265-275		
	Alternative layouts (Column & Number Lines)			29	276-306		

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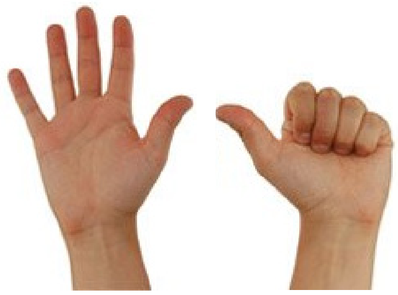
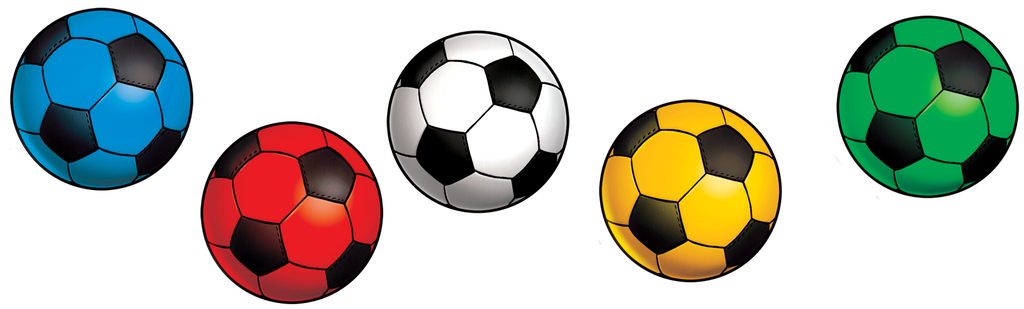
Concrete Resources





Fingers

Everyday Objects

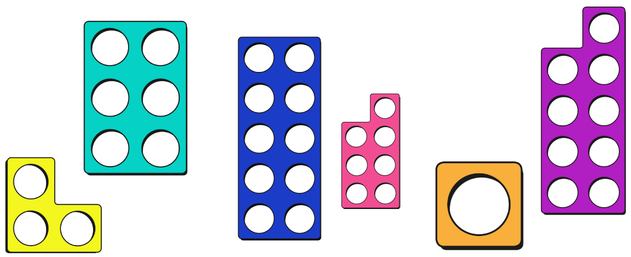


C: Concrete

(Real objects that children can touch and manipulate.)

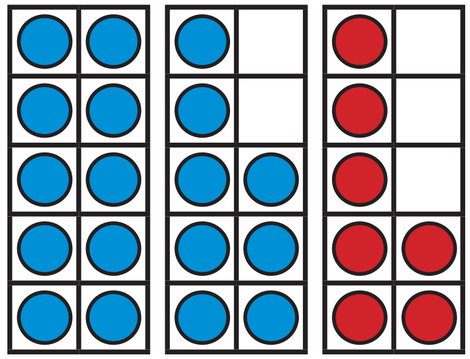
C: Generic Concrete

(Physical resources that children can touch and manipulate which can represent a number or any everyday object.)



Number Shapes

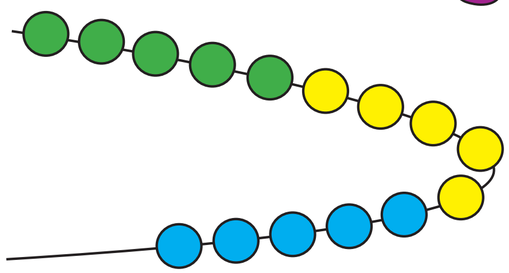
Cubes



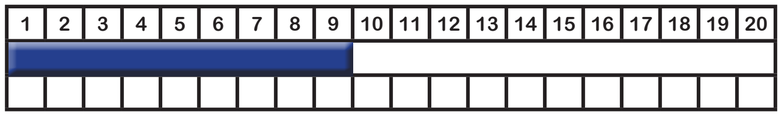
10s Frames

(Egg Boxes)

Bead String



Number Rods



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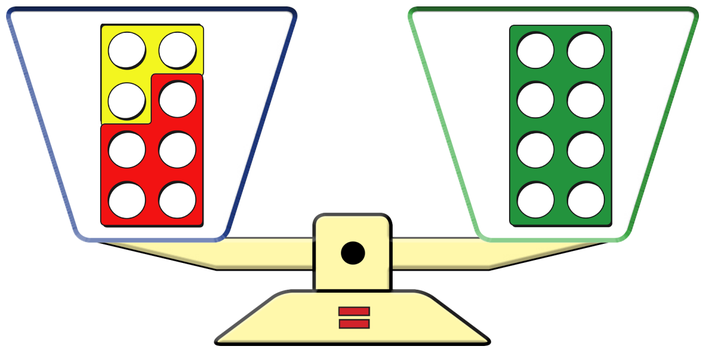
Concrete Resources

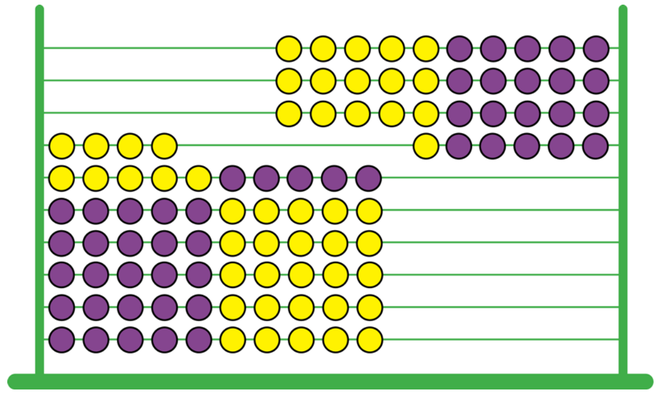
Pan Balance



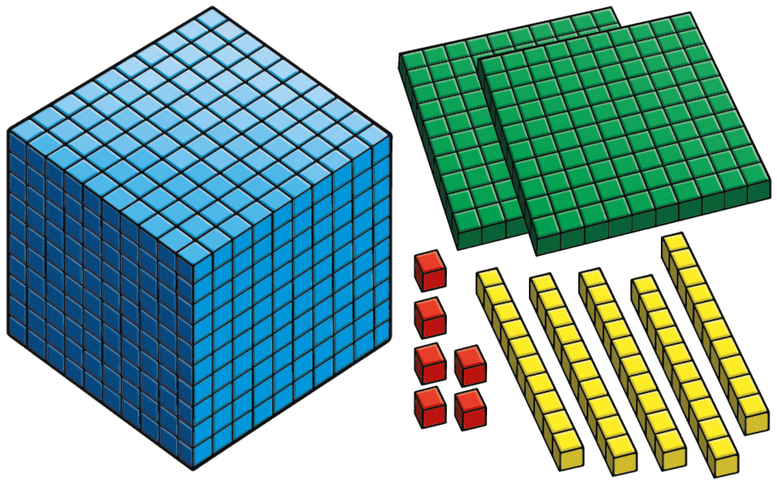
Balance Scales



Slavonic Abacus



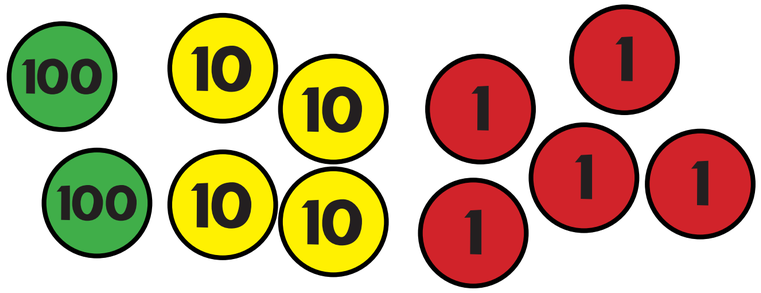
Base 10



C: Generic Concrete

(Physical resources that children can touch and manipulate which can represent a number or any everyday object.)

Place Value Counters



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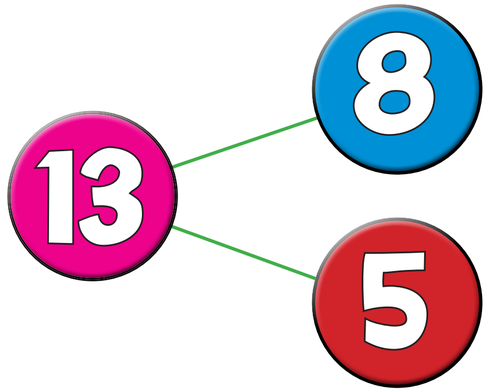
Pictorial Resources



100 Square

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

Number Bond Diagram

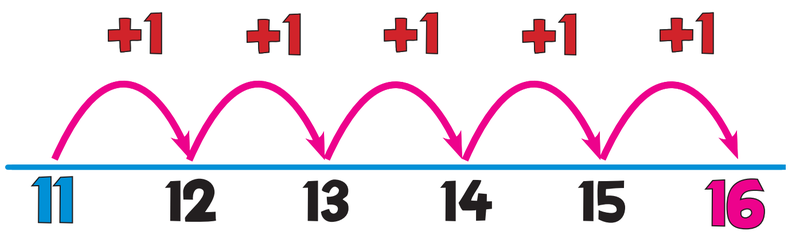


P: Pictorial

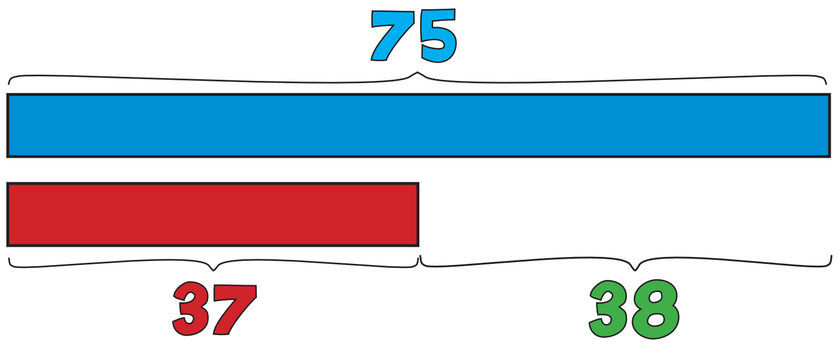
(Additional images that help children picture the mathematics.)



Number Line



Bar Model



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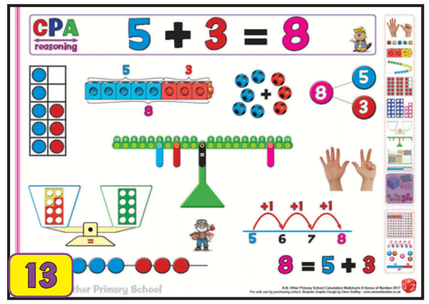

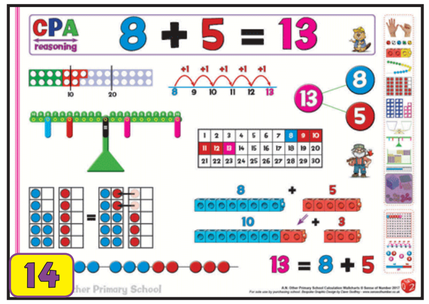

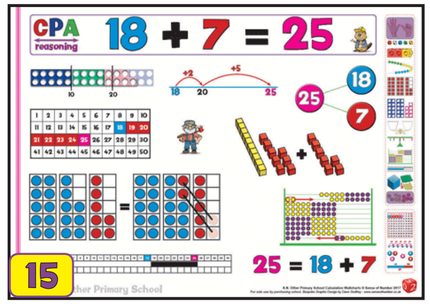

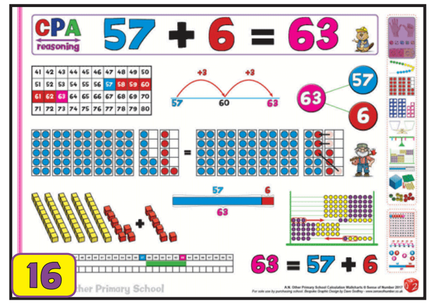

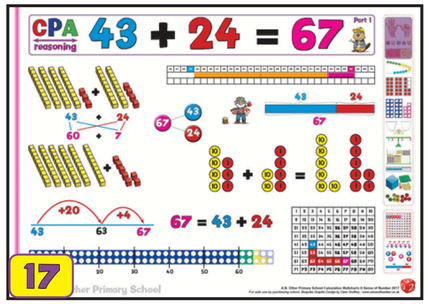

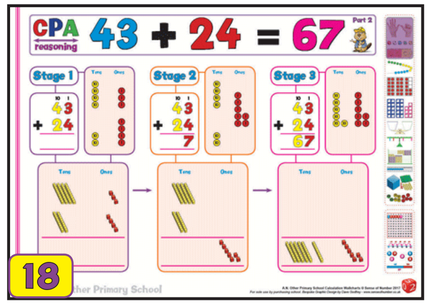

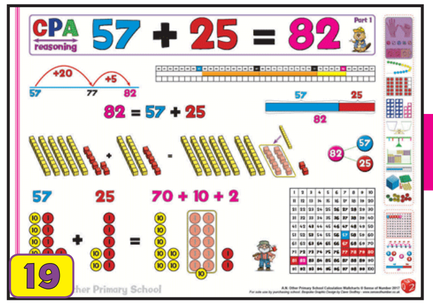

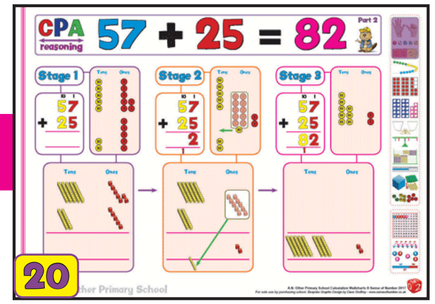

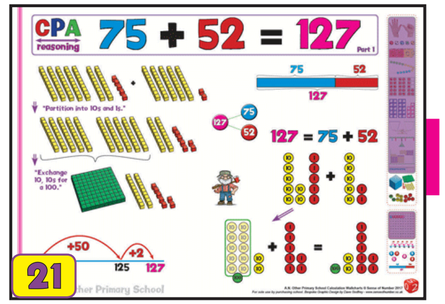

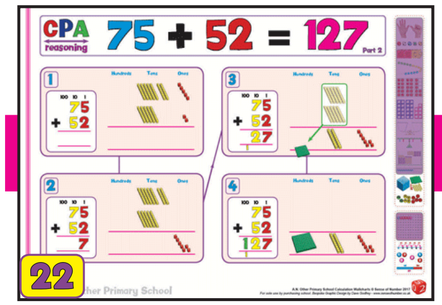

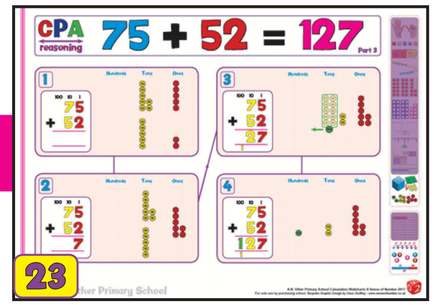

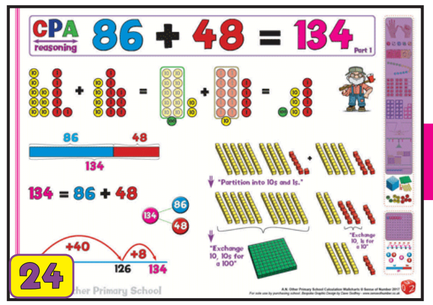

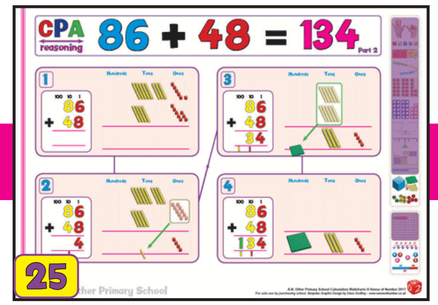

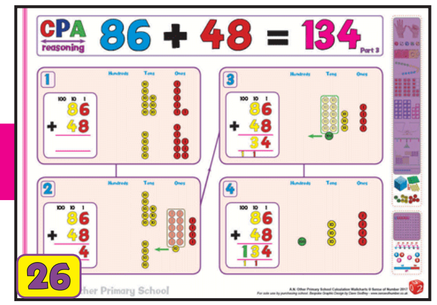

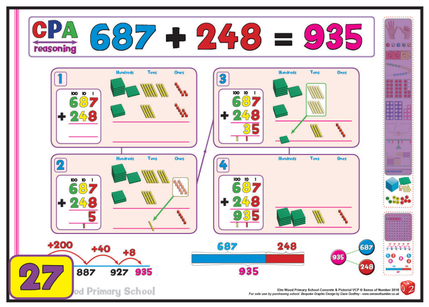

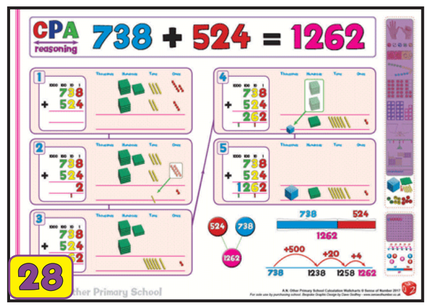

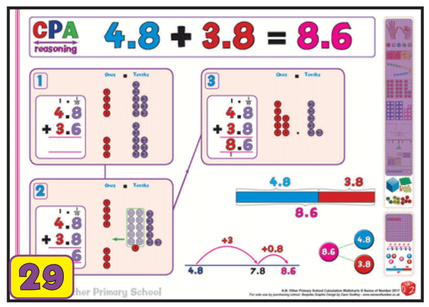

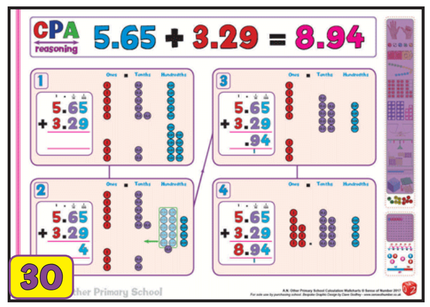

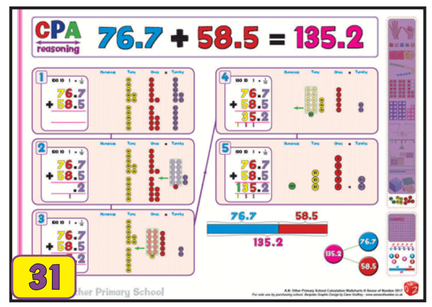

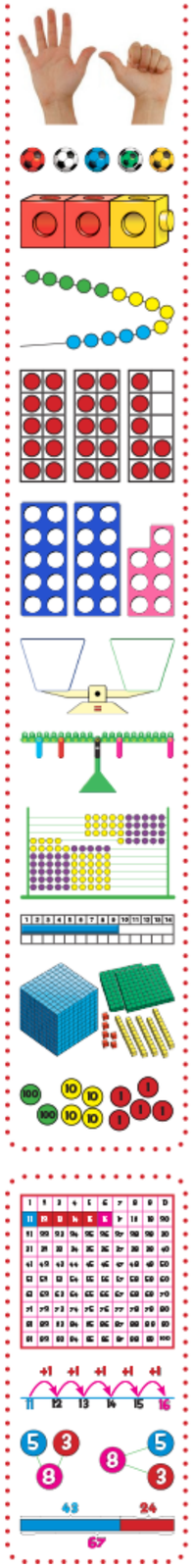

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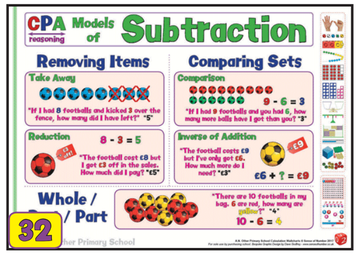

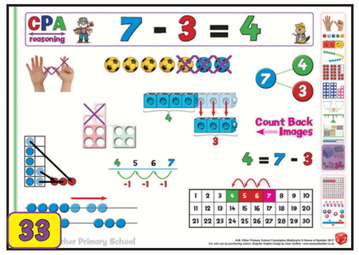

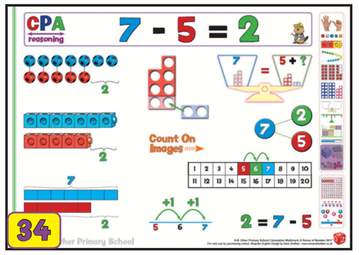

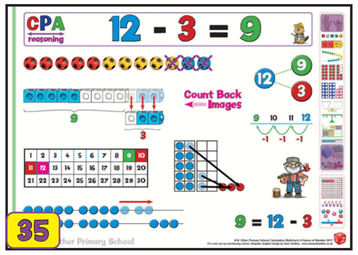

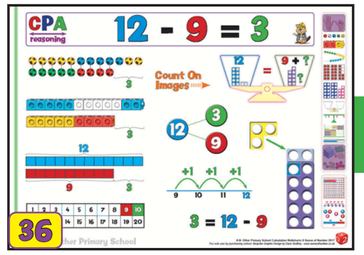

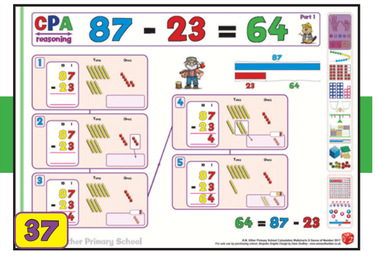

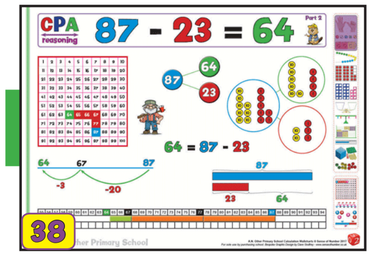

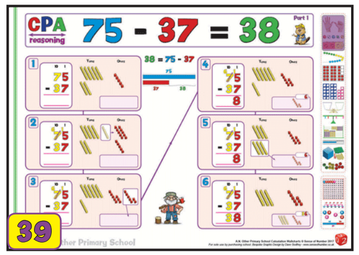

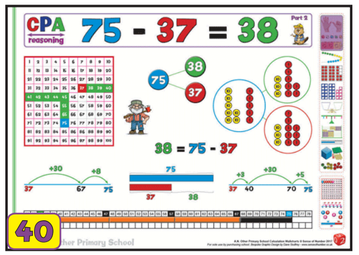

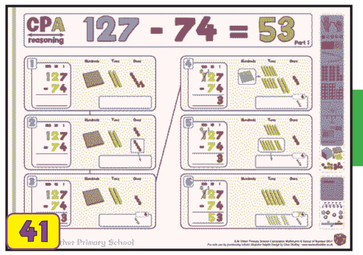

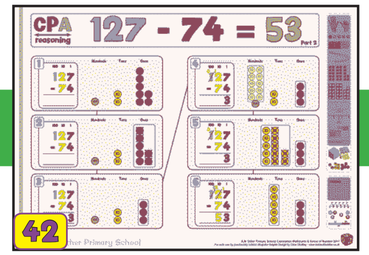

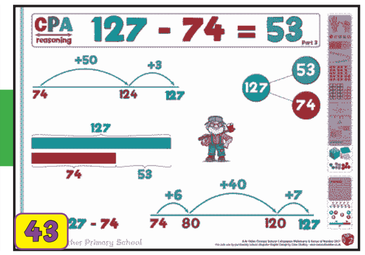

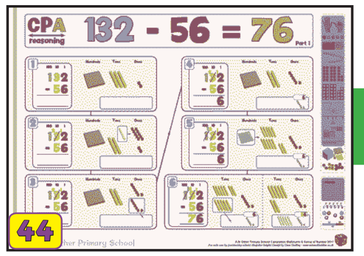

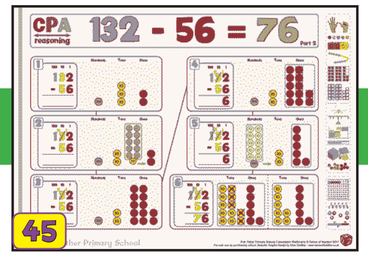

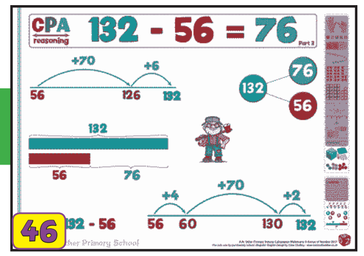

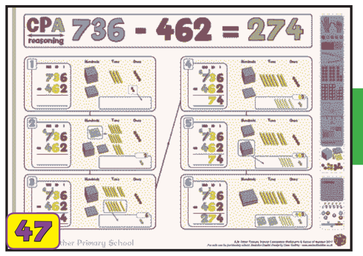

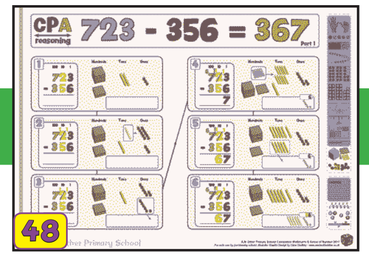

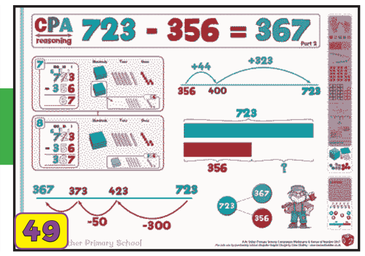

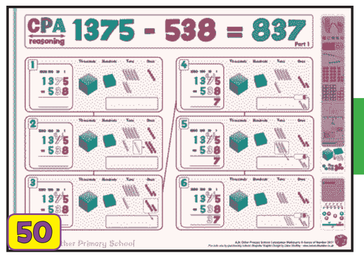

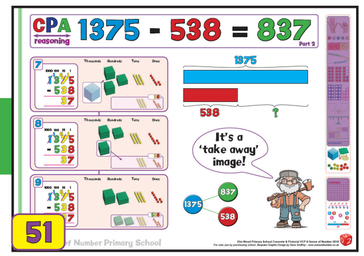

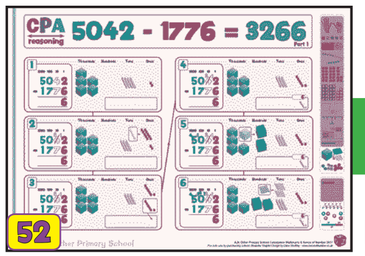

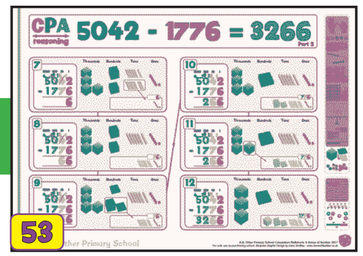

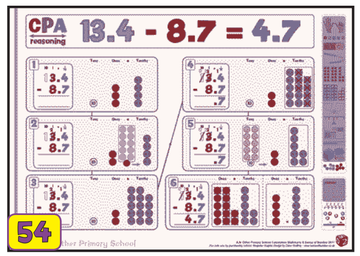

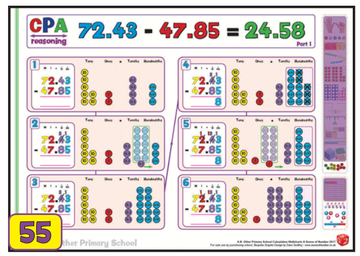

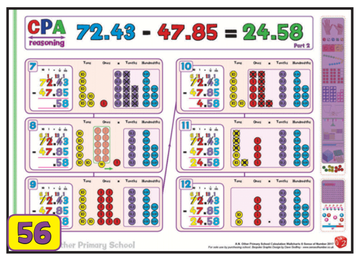

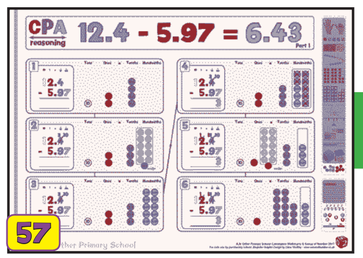

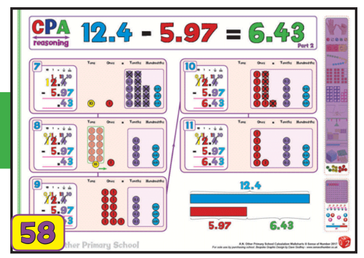

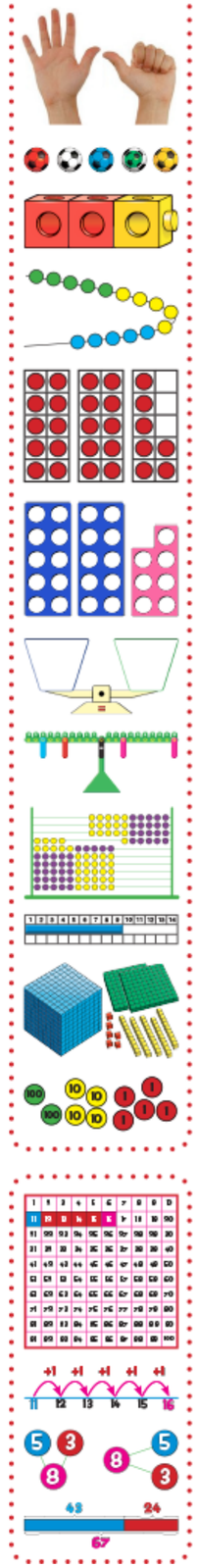

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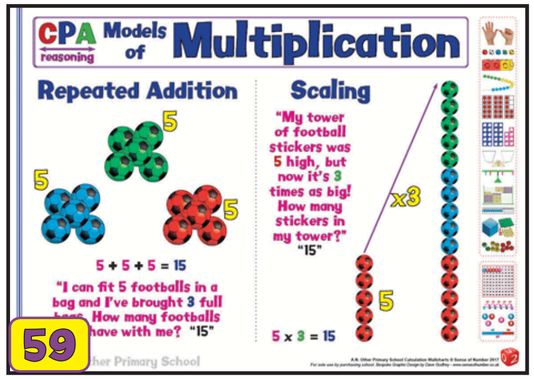

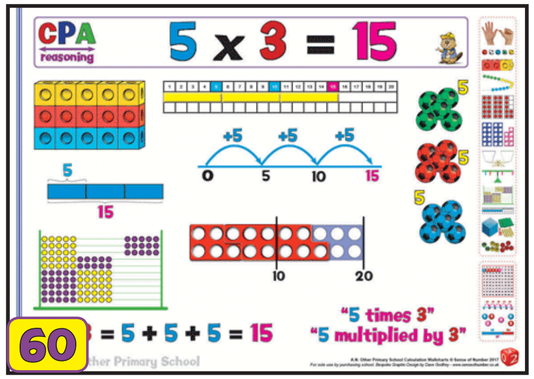

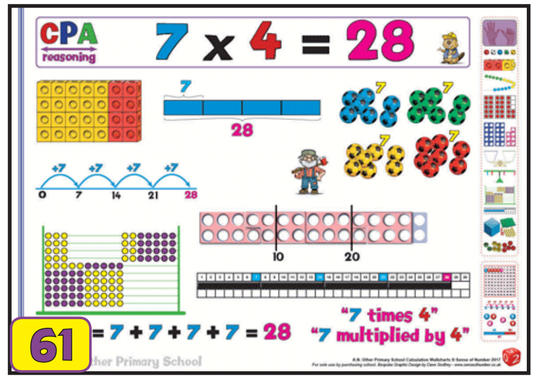

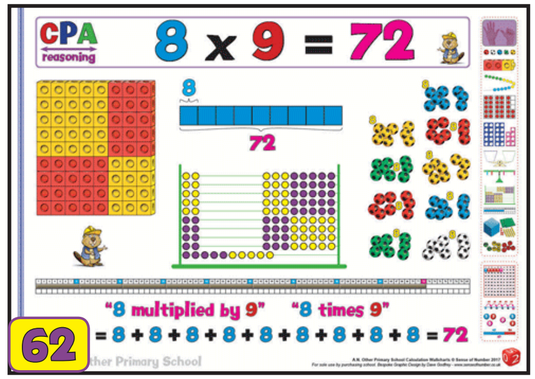

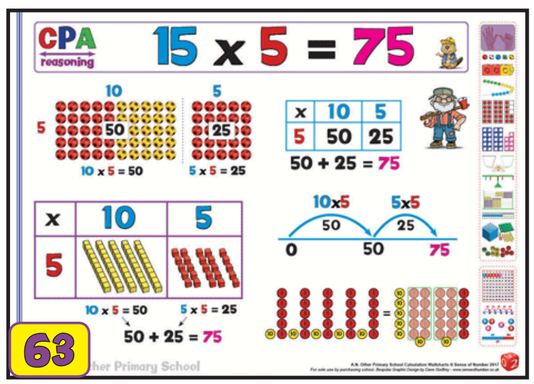

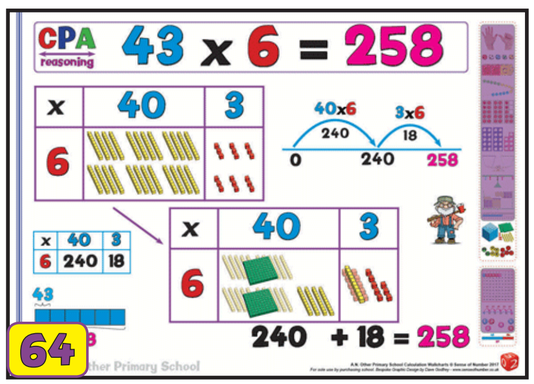

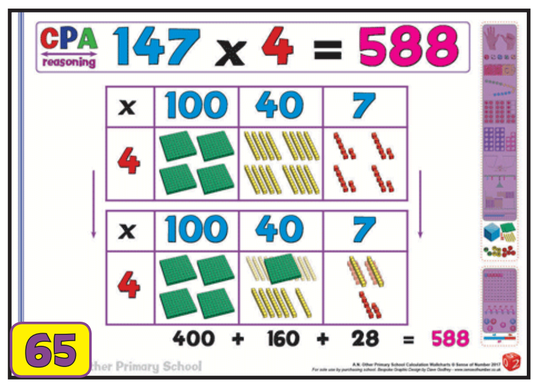

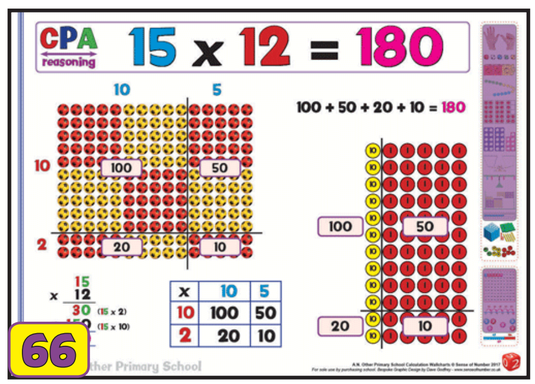

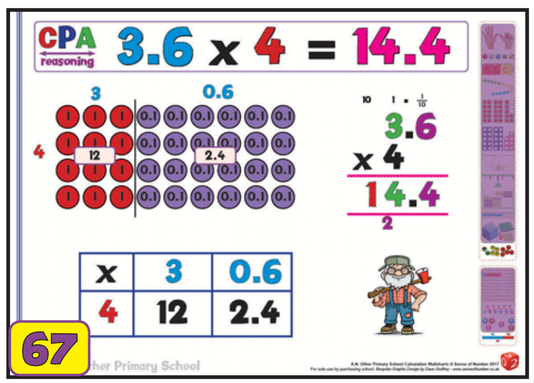

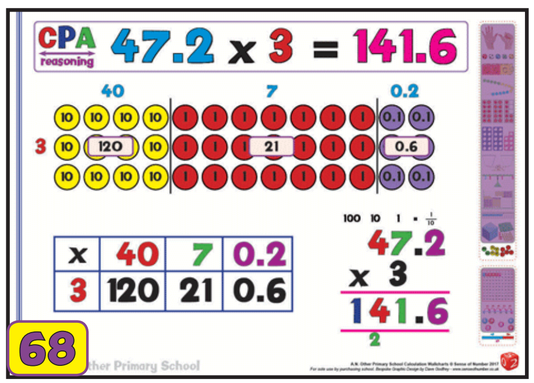

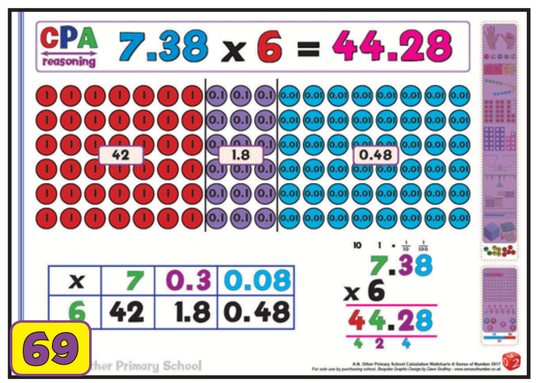

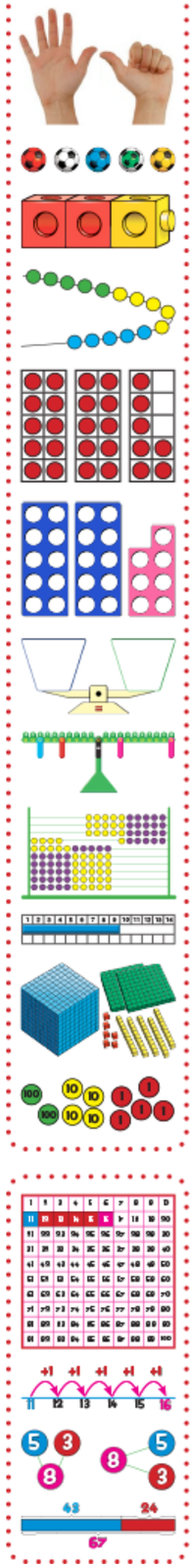

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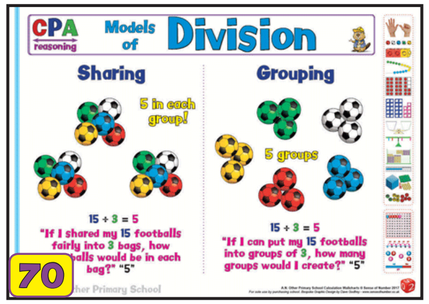

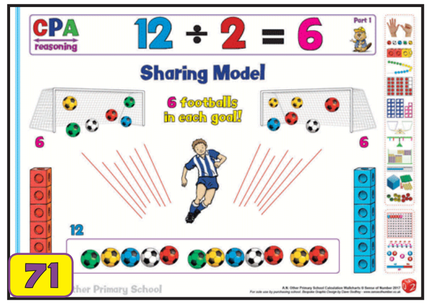

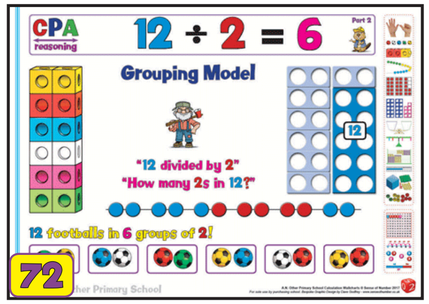

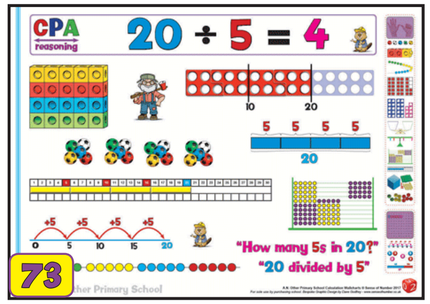

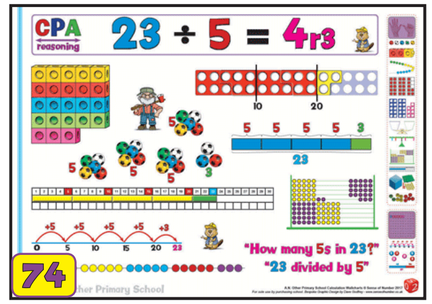

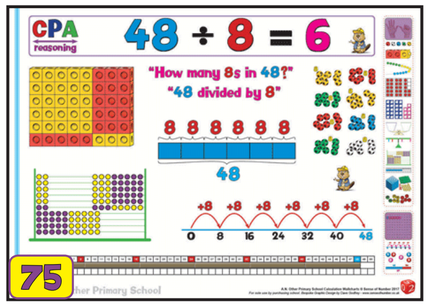

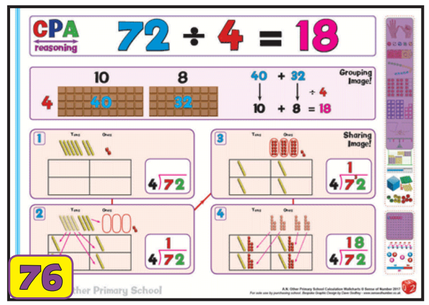

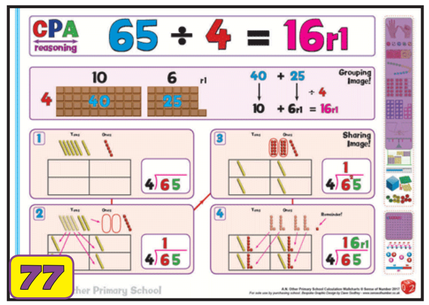

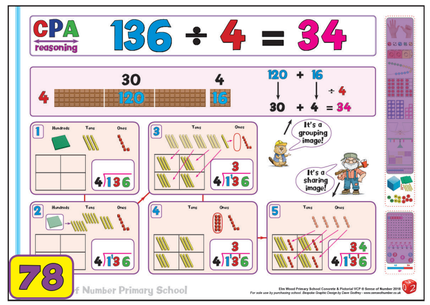

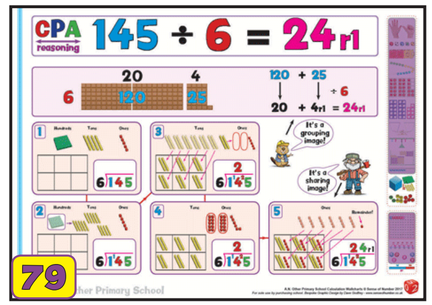

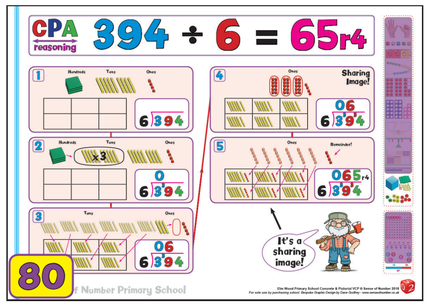

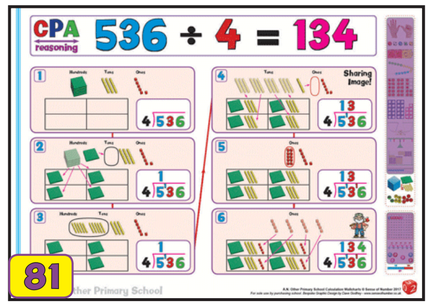

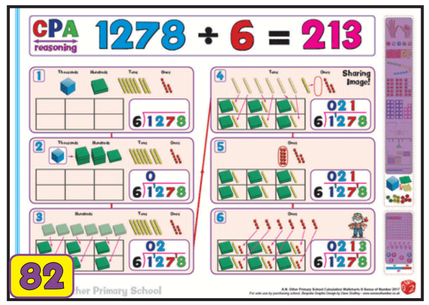

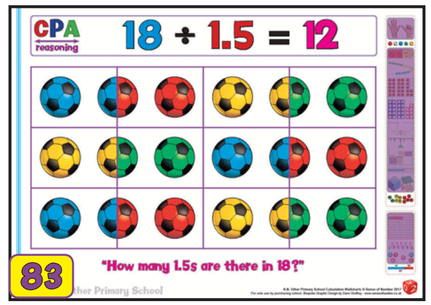

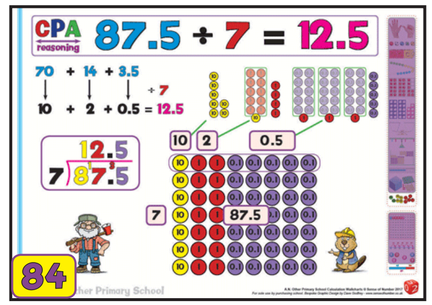

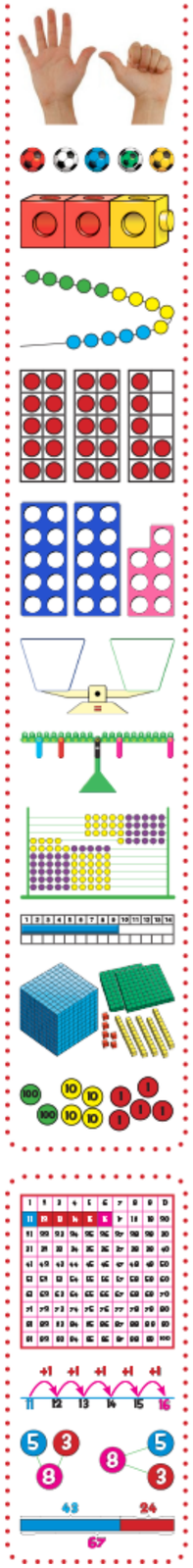

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Models of Addition



Aggregation

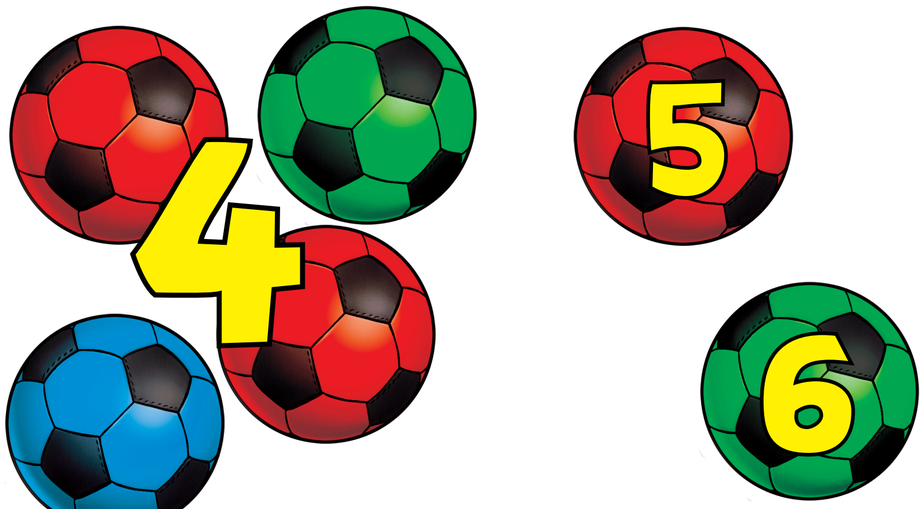
Combining two sets of objects (counting all method!)



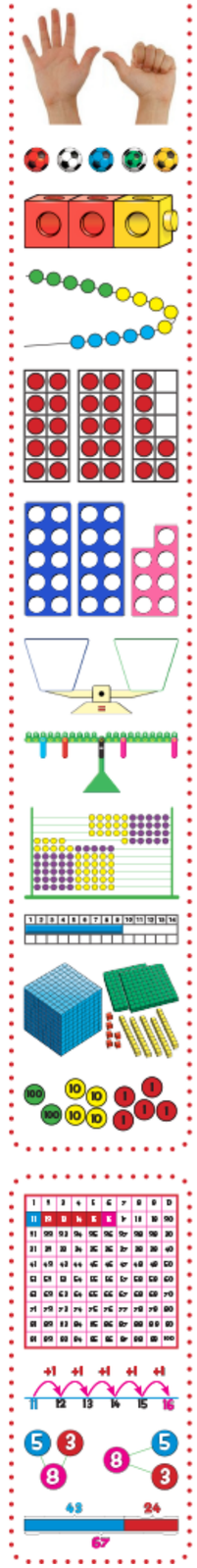
"If I have 4 blue footballs and 2 red footballs in my bag, how many footballs do I have all together?" "6"

Augmentation

Adding to a set (counting on method!)



"If I had 4 footballs and then found 2 more, how many footballs would I have in total?" "6"



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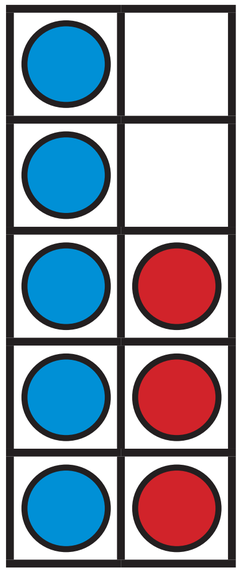
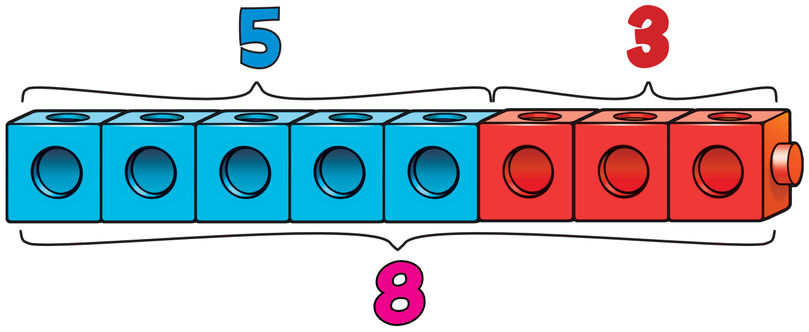
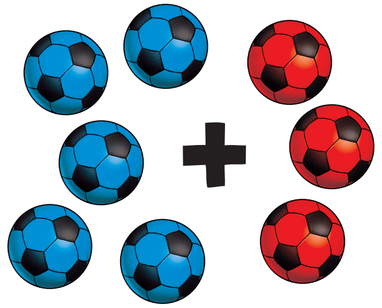
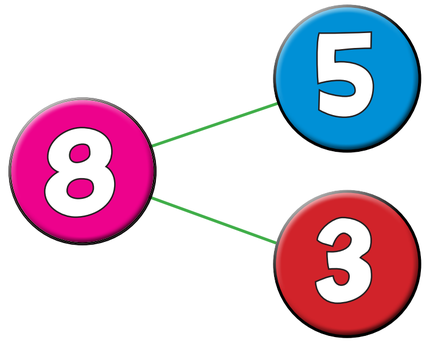
5 + 3 = 8

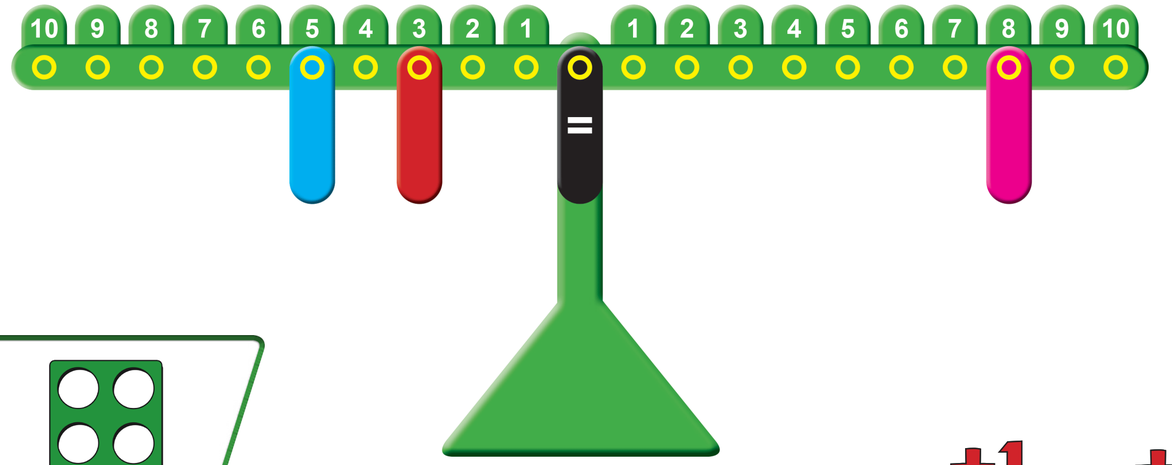


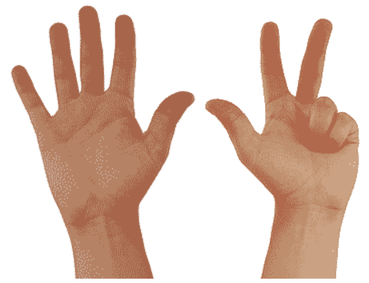


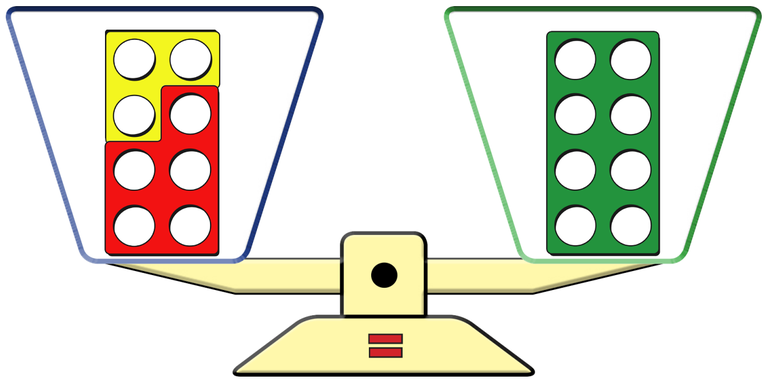




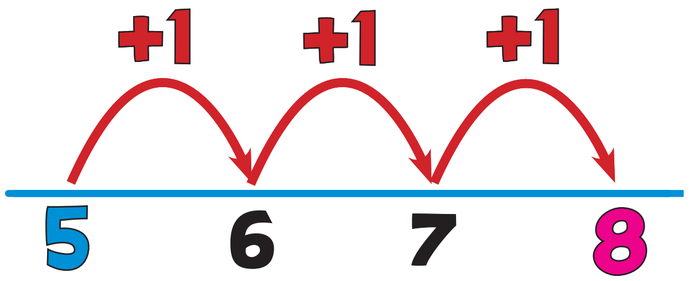


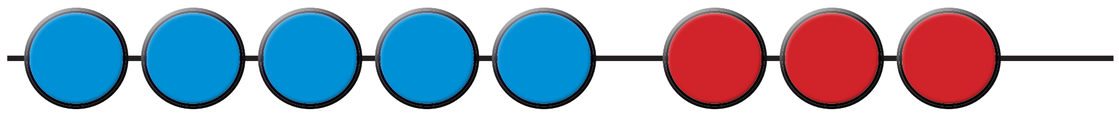




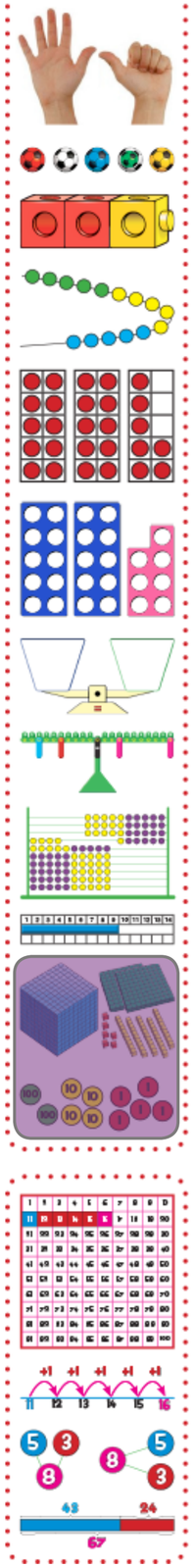








8 = 5 + 3



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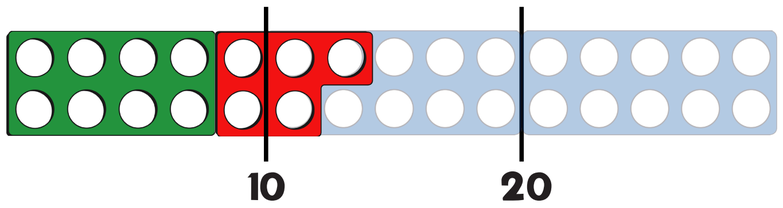
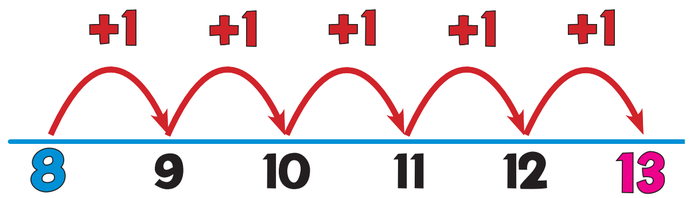
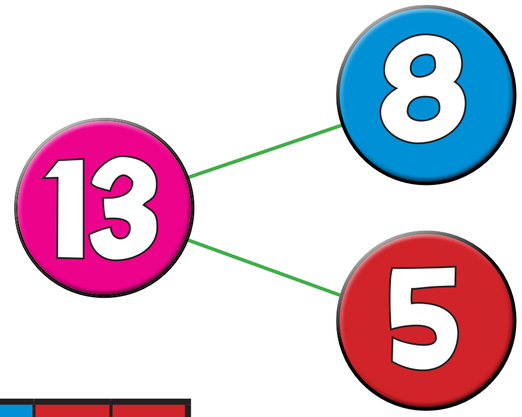
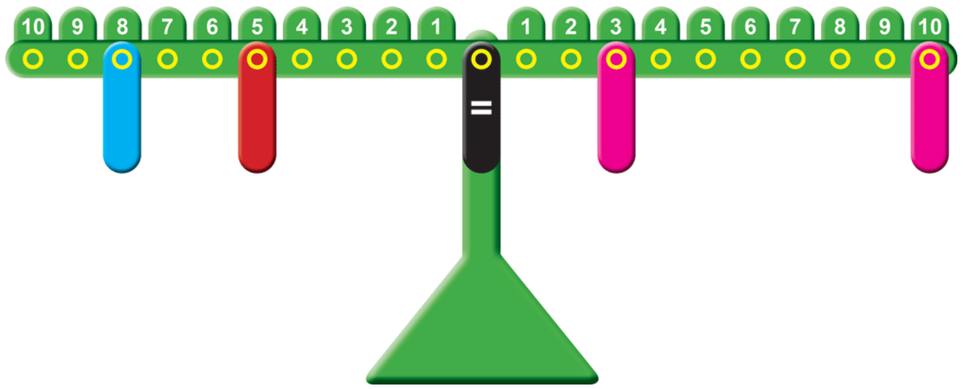
8 + 5 = 13











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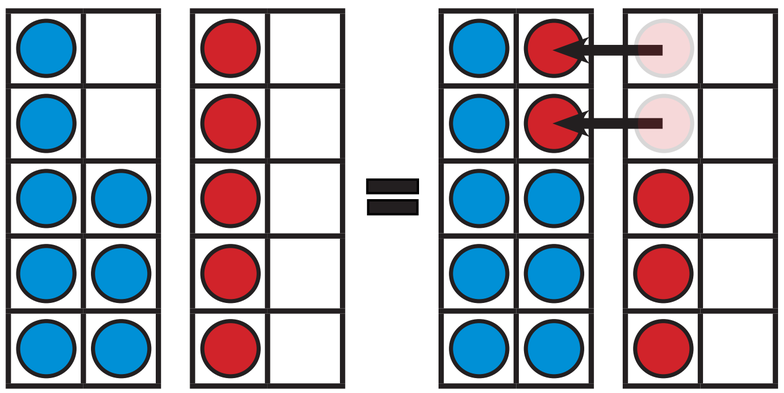
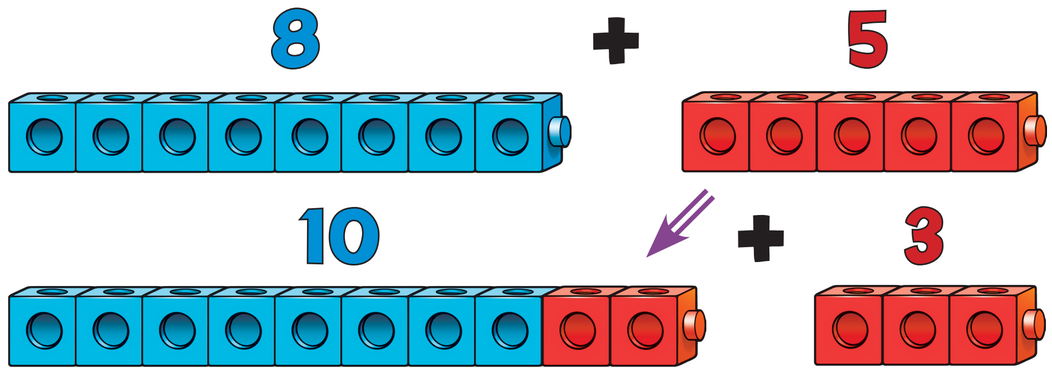
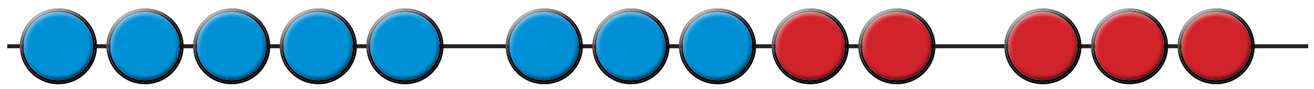
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30

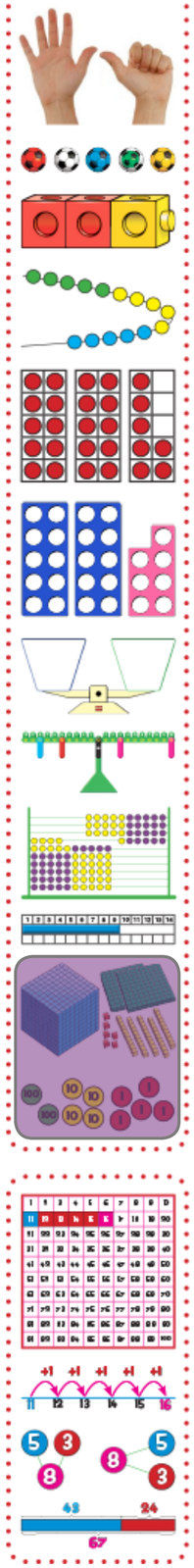








13 = 8 + 5



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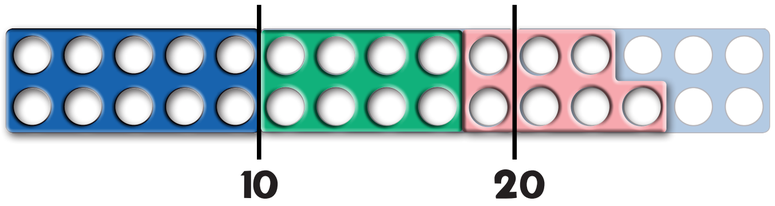
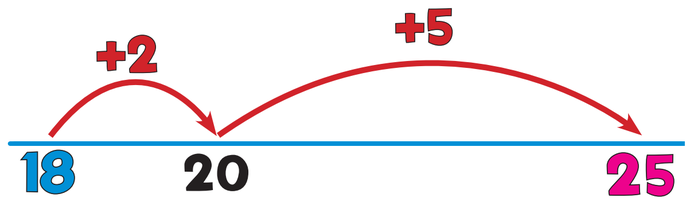
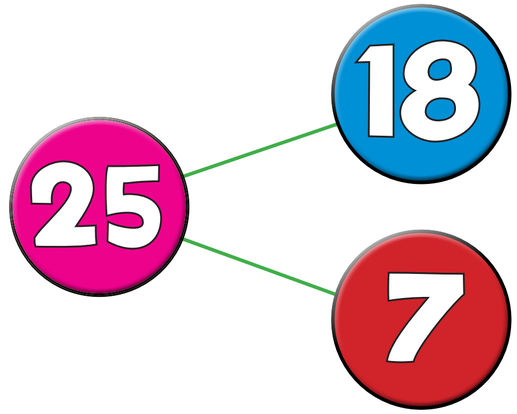
CPA reasoning

18 + 7 = 25

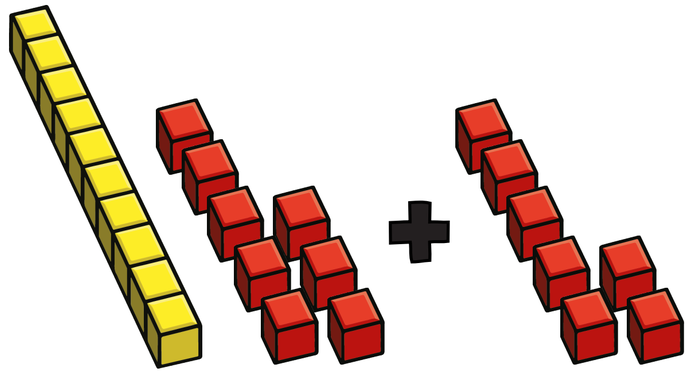


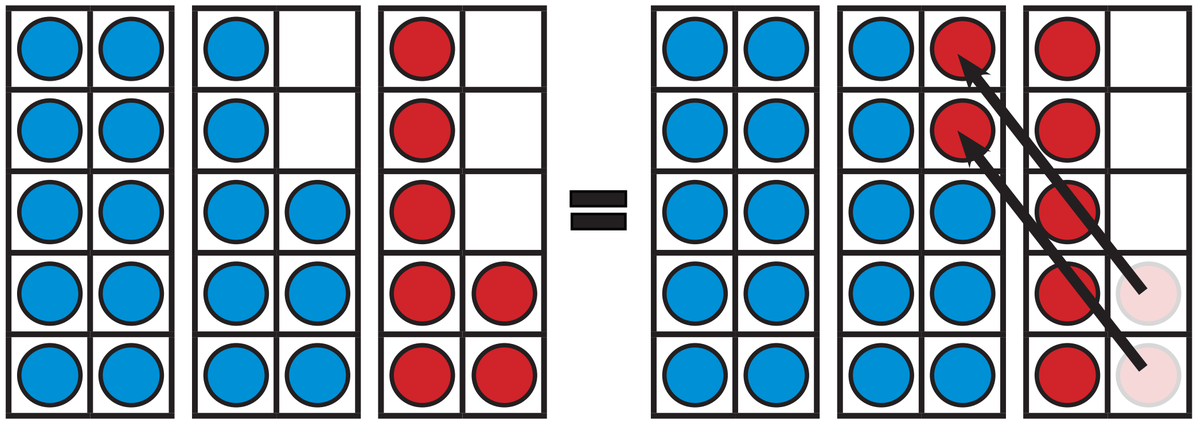


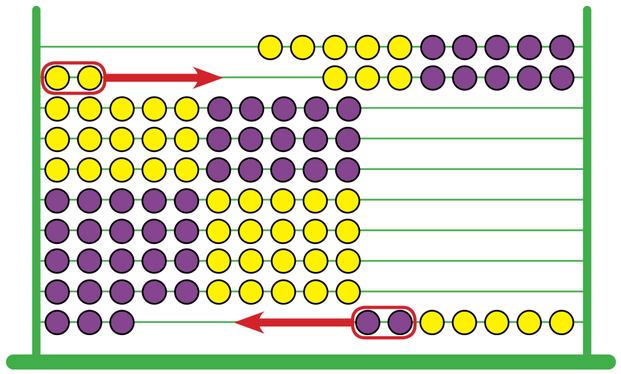


1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
41	42	43	44	45	46	47	48	49	50

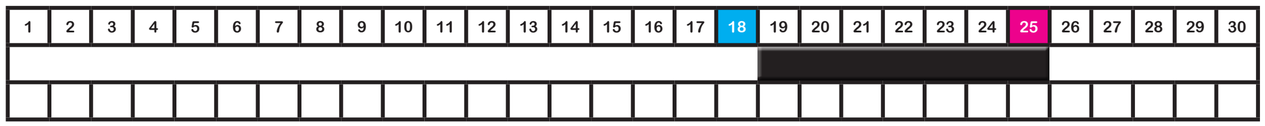


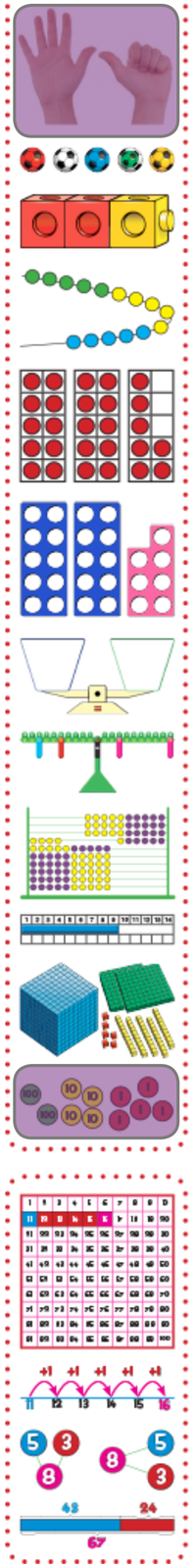












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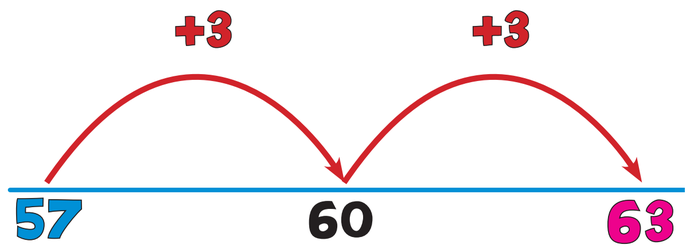
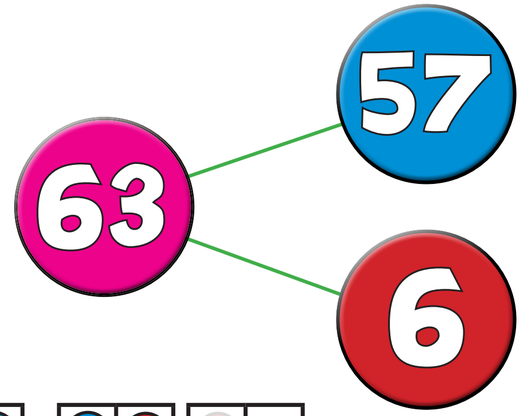
CPA reasoning

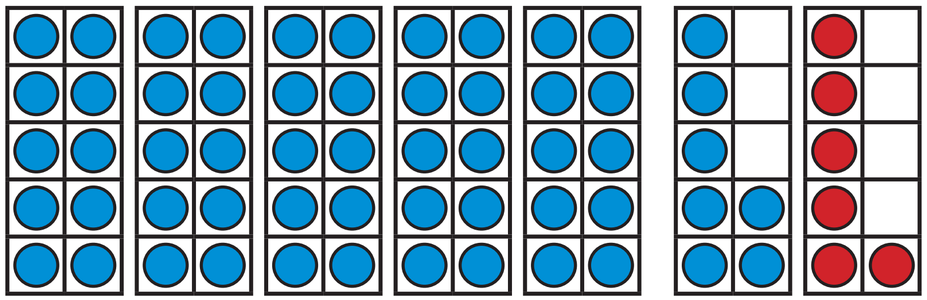
57 + 6 = 63

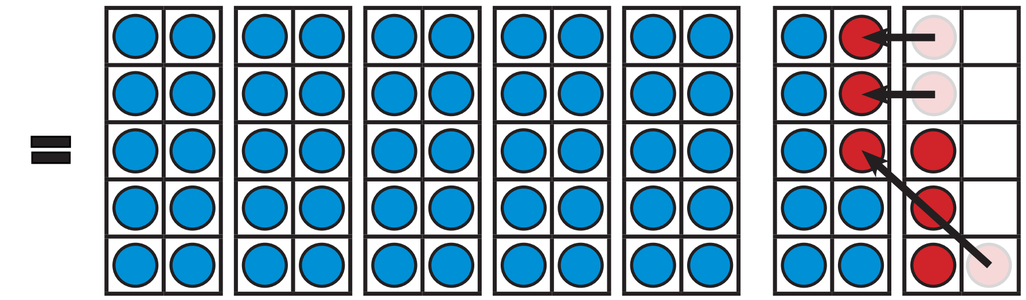


41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80

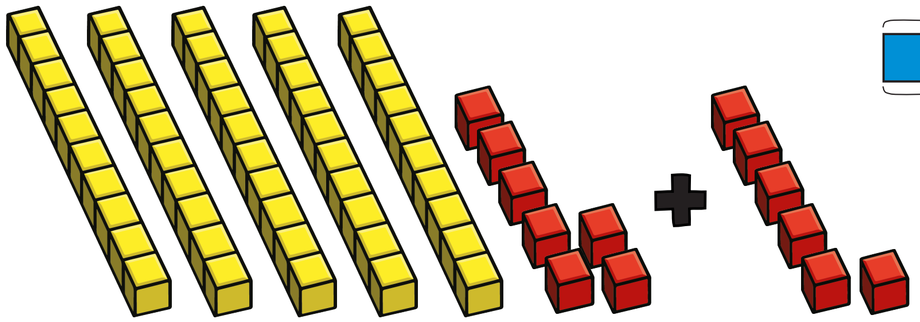


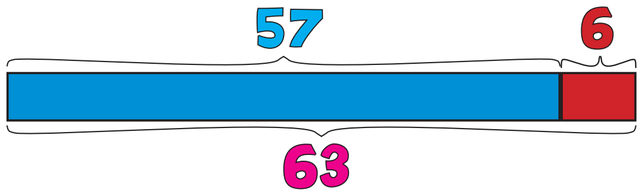


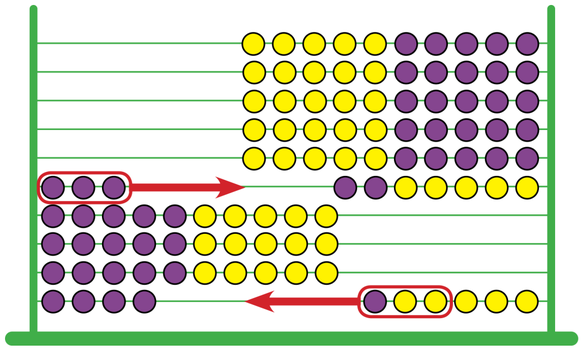






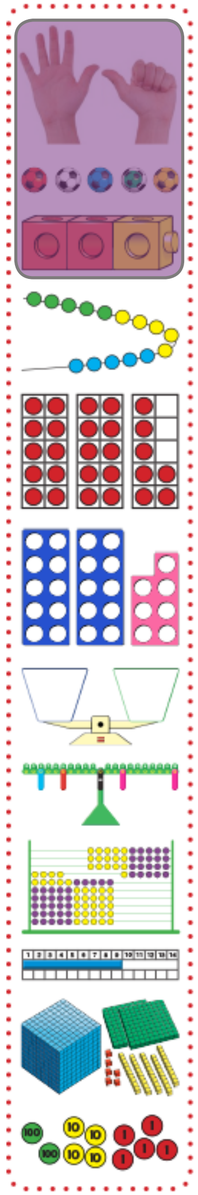






41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70

$63 = 57 + 6$



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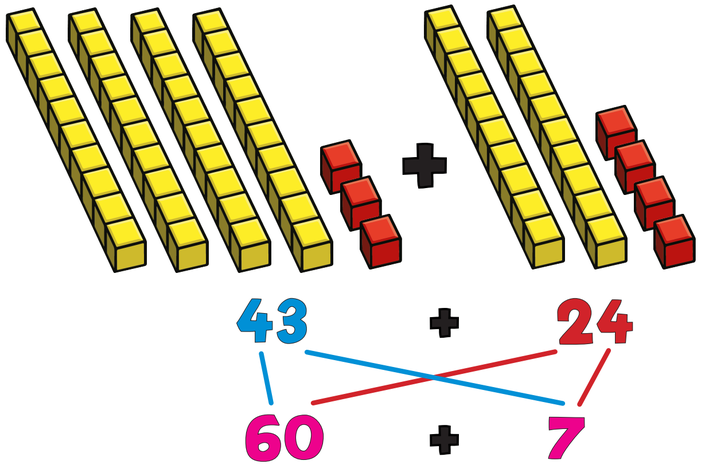
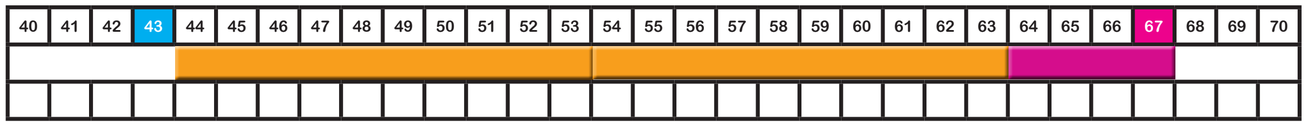
CPA reasoning

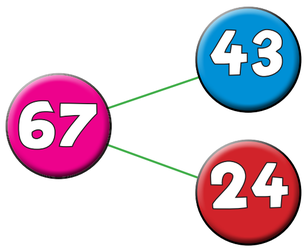
43 + 24 = 67

Part 1

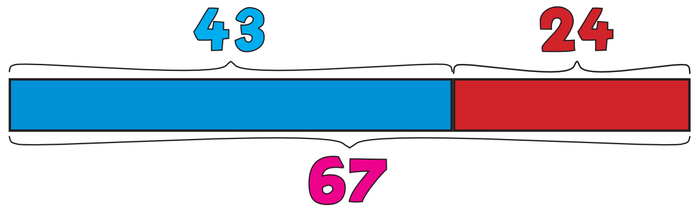


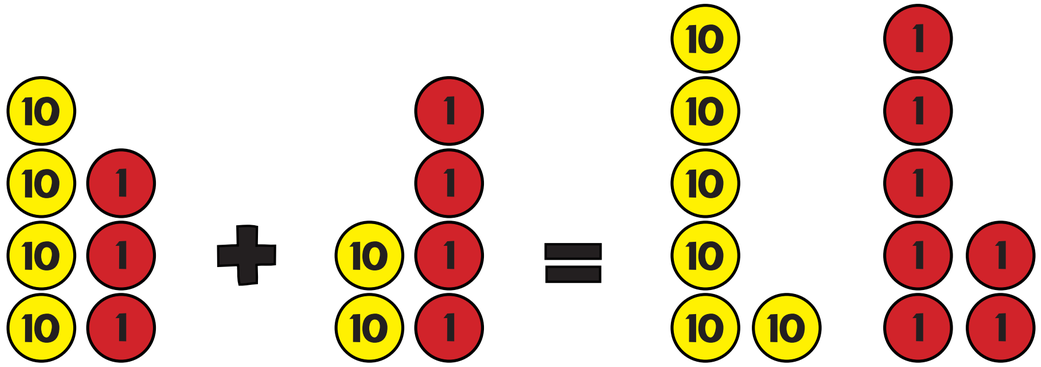


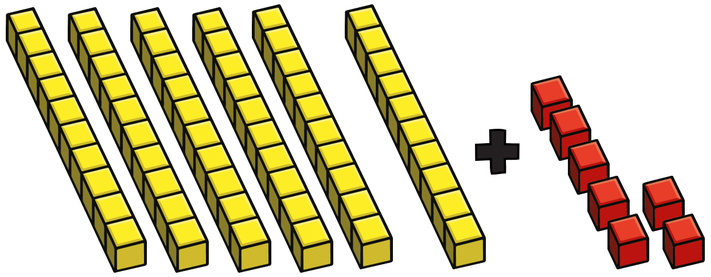


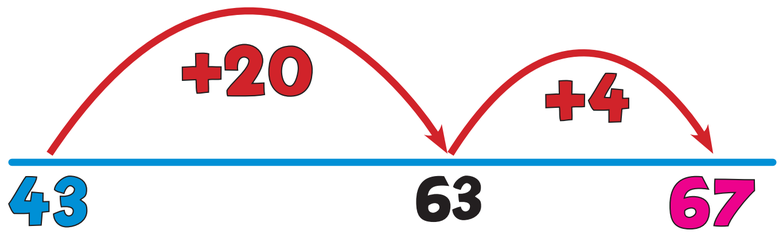




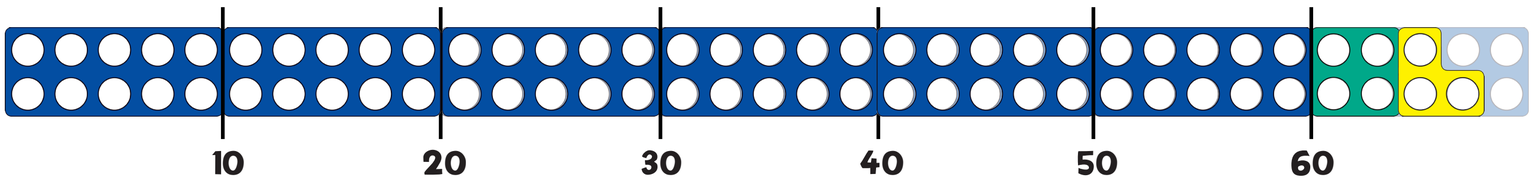








67 = 43 + 24



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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
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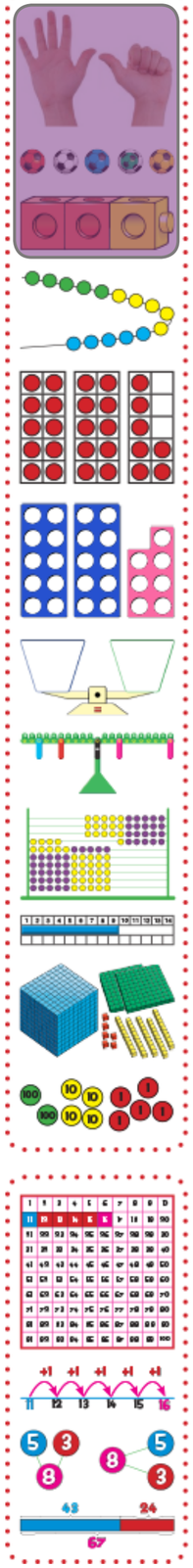

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CPA reasoning

43 + 24 = 67

Part 2



Stage 1

10 1
4 3
+ 2 4

Tens Ones

10 10 10 10 | 1 1 1
10 10 | 1 1 1

Stage 2

10 1
4 3
+ 2 4
7

Tens Ones

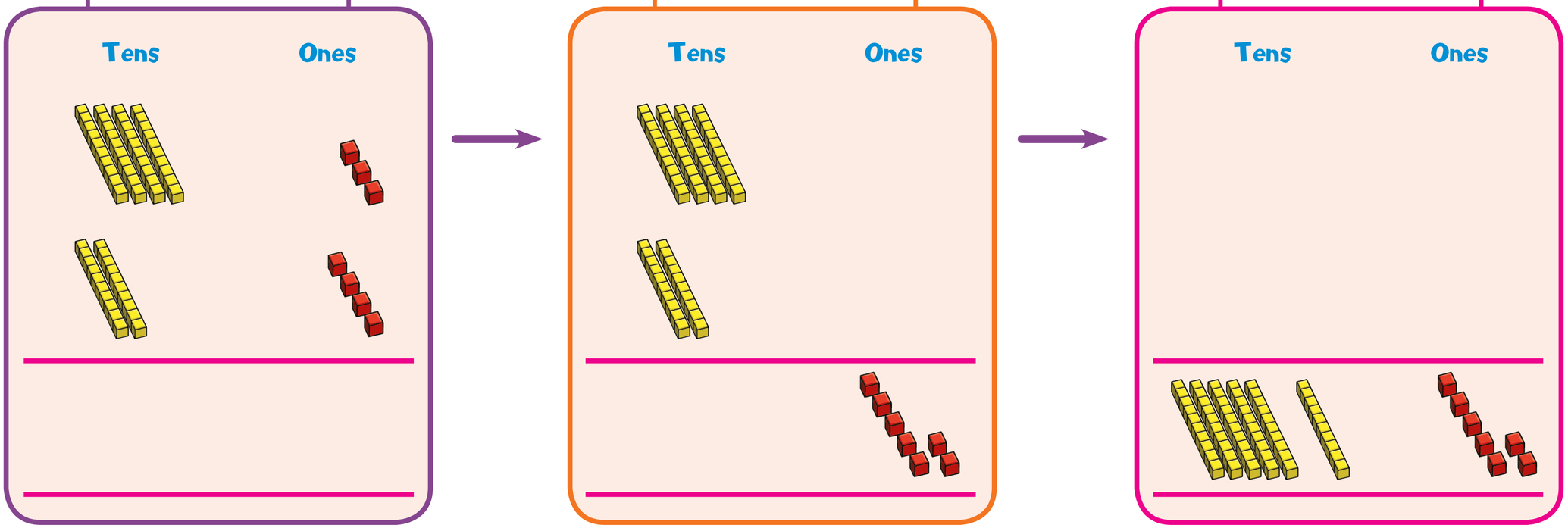
10 10 10 10 | 1 1 1 1 1
10 10

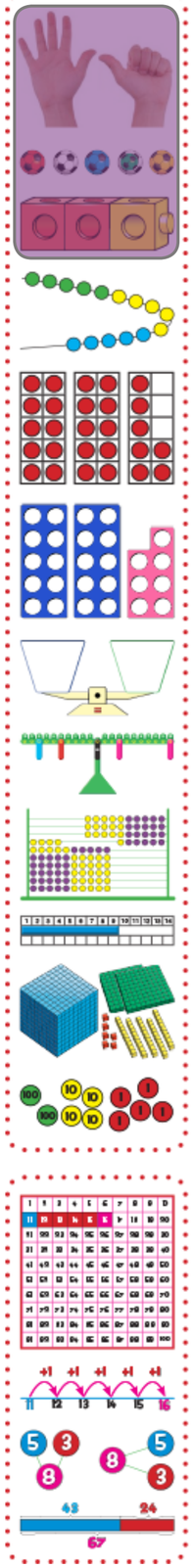
Stage 3

10 1
4 3
+ 2 4
6 7

Tens Ones

10 10 10 10 10 | 1 1 1 1 1
10





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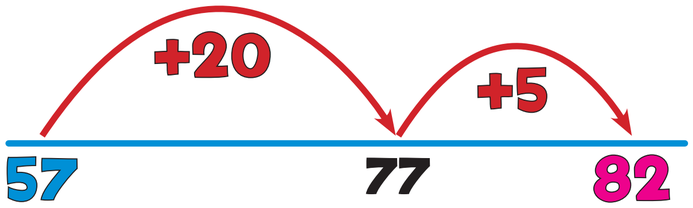
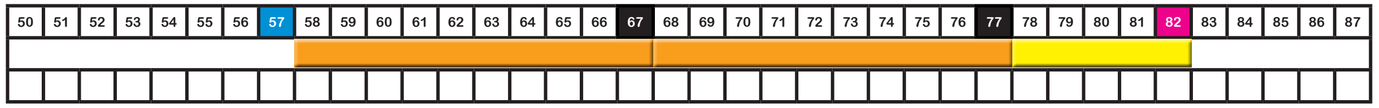
CPA reasoning

57 + 25 = 82

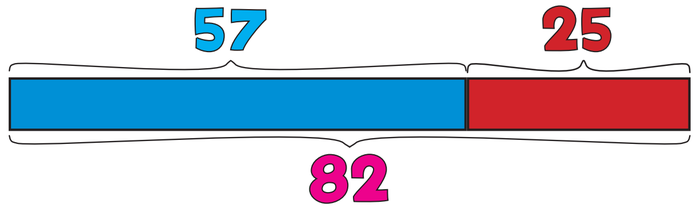
Part 1

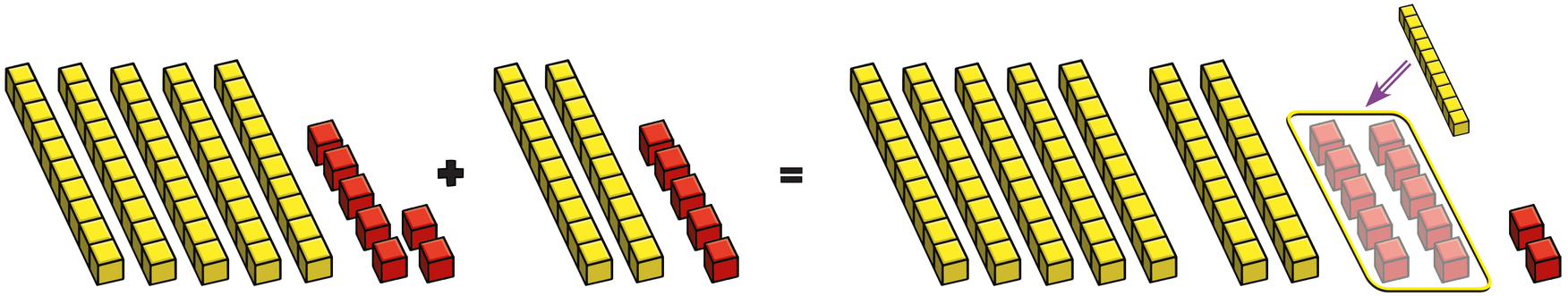


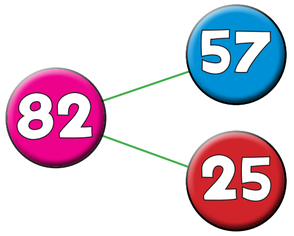




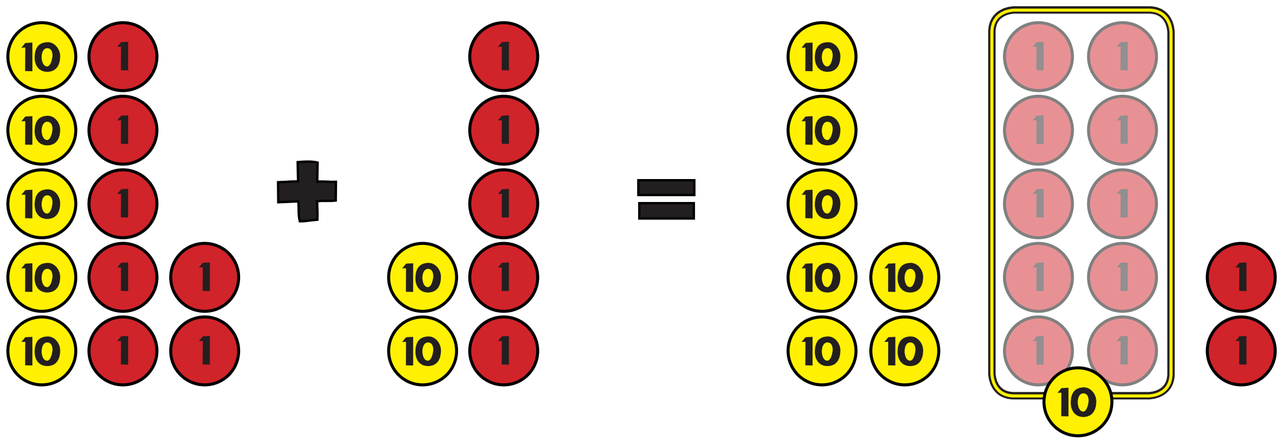
82 = 57 + 25







57 + 25 = 70 + 10 + 2





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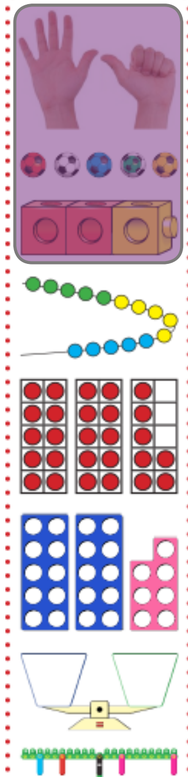
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100



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CPA reasoning

57 + 25 = 82

Part 2



Stage 1

$$\begin{array}{r} {\scriptstyle 10\ \ 1} \\ 57 \\ +\ 25 \\ \hline \\ \hline \end{array}$$

Tens	Ones
10 10 10 10 10	1 1 1 1 1 1 1
10 10	1 1 1 1 1

Stage 2

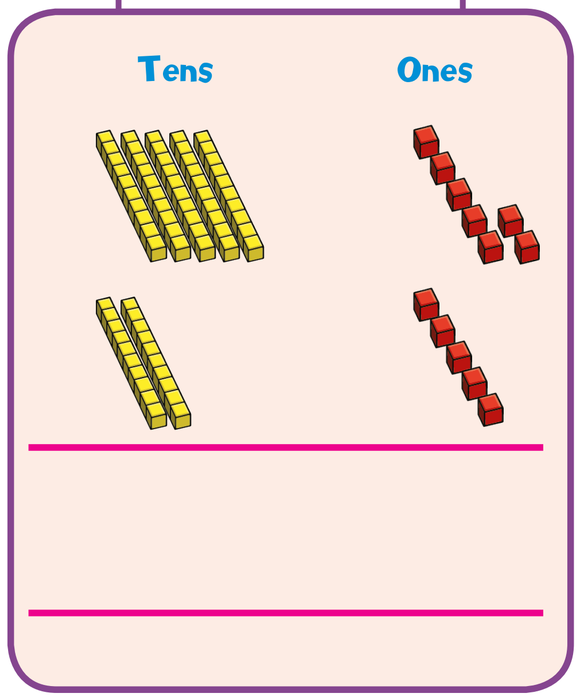
$$\begin{array}{r} {\scriptstyle 10\ \ 1} \\ 57 \\ +\ 25 \\ \hline 2 \\ \hline 1 \end{array}$$

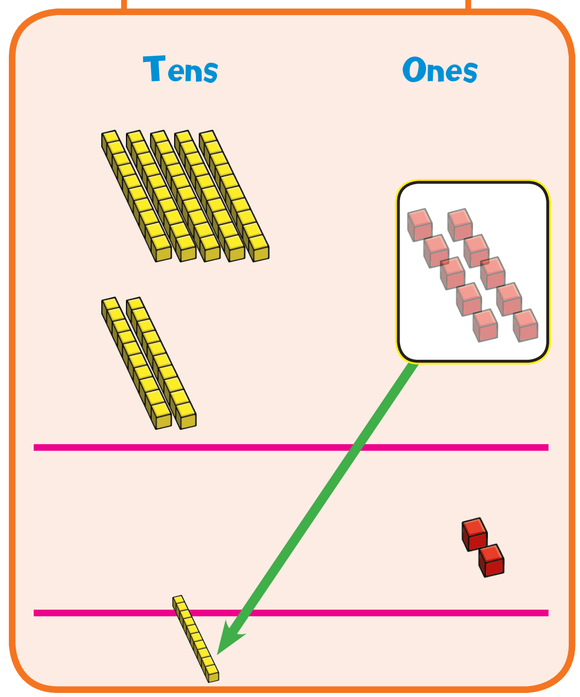
Tens	Ones
10 10 10 10 10	1 1
10 10	

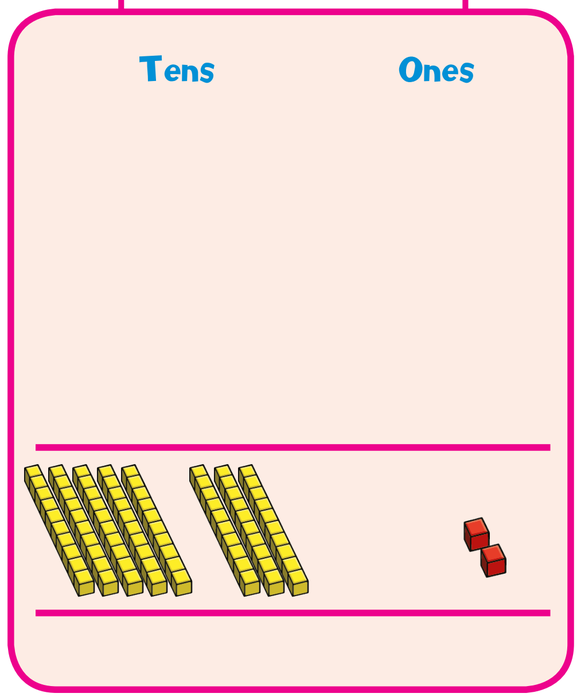
Stage 3

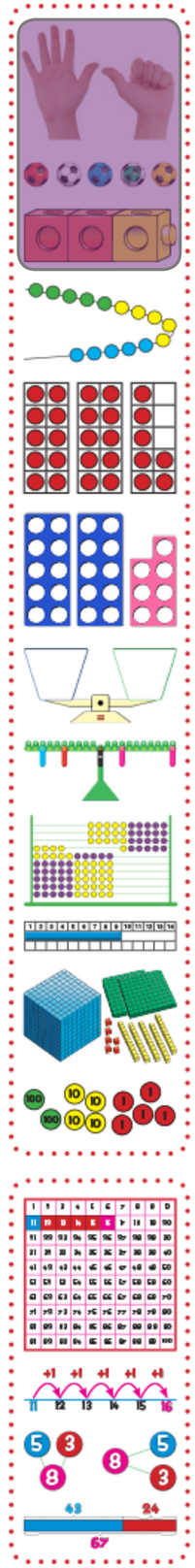
$$\begin{array}{r} {\scriptstyle 10\ \ 1} \\ 57 \\ +\ 25 \\ \hline 82 \\ \hline 1 \end{array}$$

Tens	Ones
10 10 10 10 10	1 1









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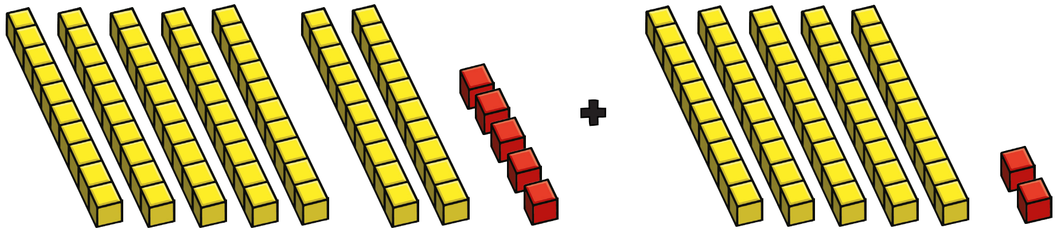
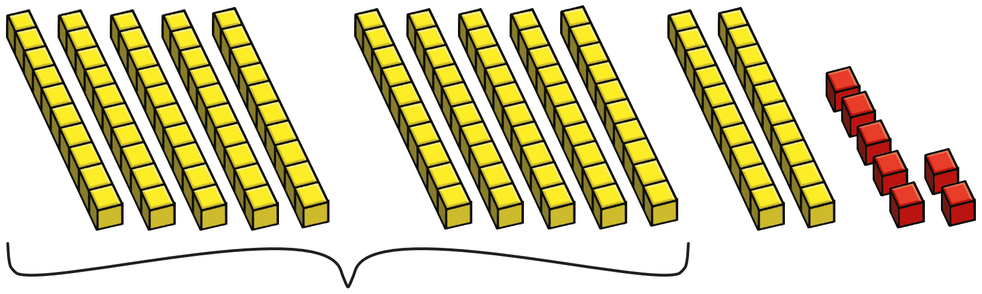
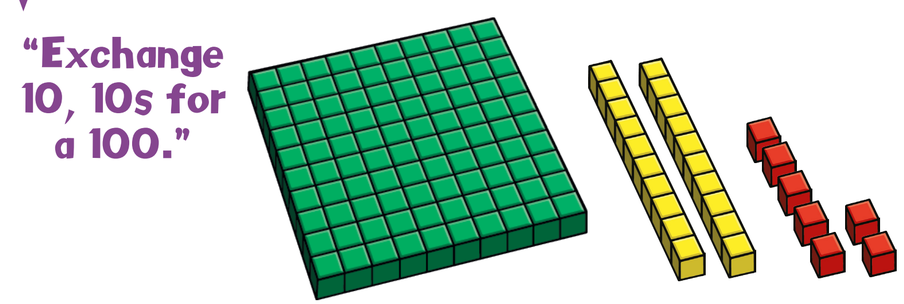
CPA reasoning 75 + 52 = 127 Part 1

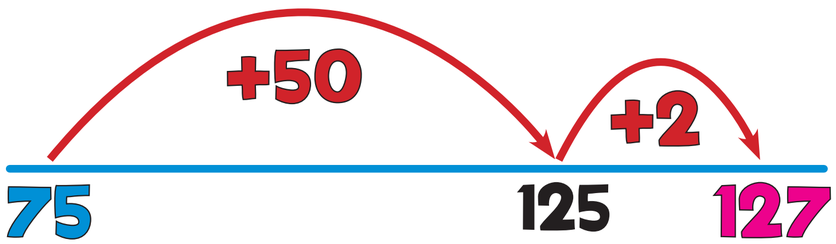


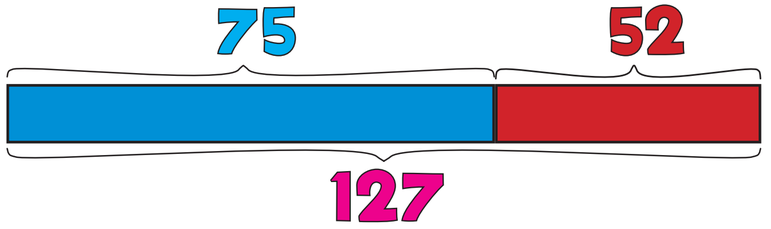
"Partition into 10s and 1s."

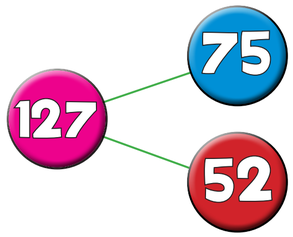


"Exchange 10, 10s for a 100."

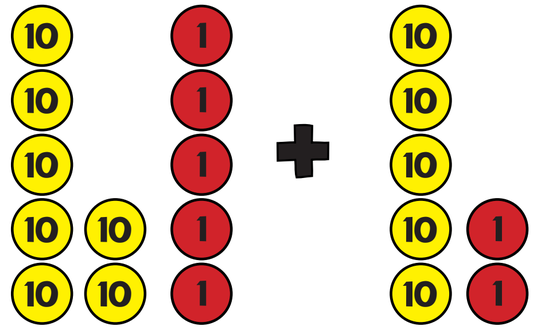




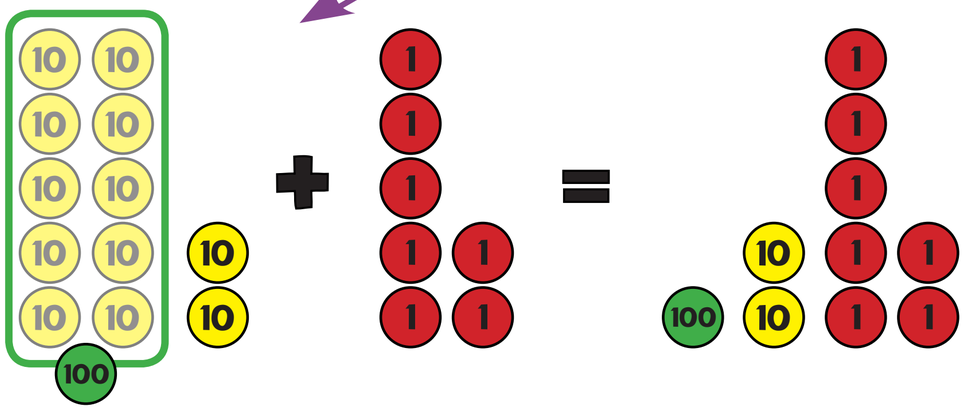


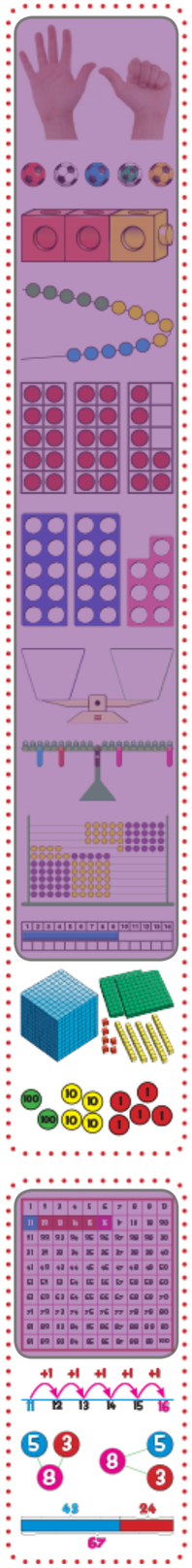


127 = 75 + 52









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CPA reasoning

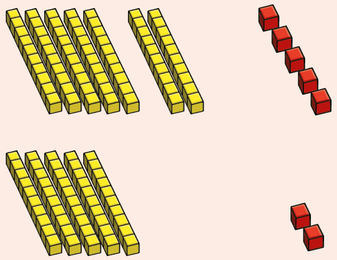
75 + 52 = 127

Part 2

1

100	10	1
	7	5
+	5	2

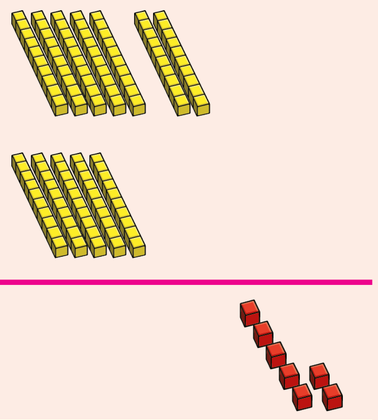
Hundreds Tens Ones



2

100	10	1
	7	5
+	5	2
		7

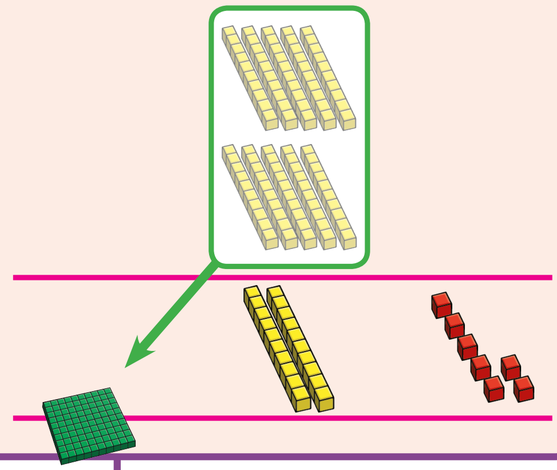
Hundreds Tens Ones



3

100	10	1
	7	5
+	5	2
	2	7
	1	

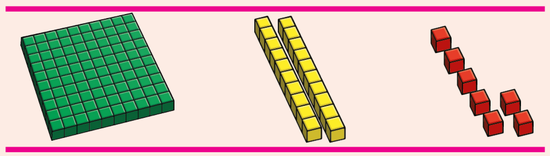
Hundreds Tens Ones

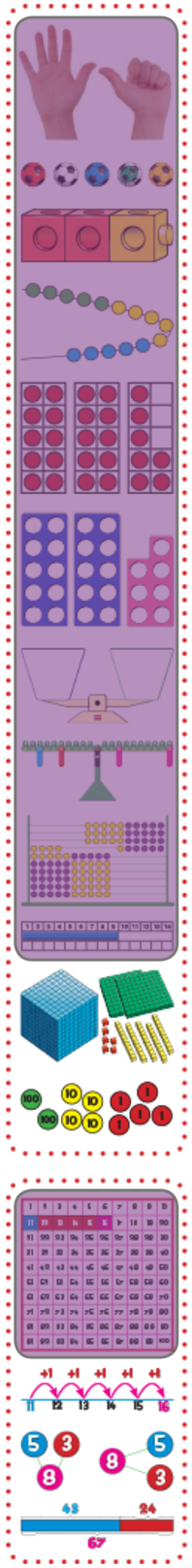


4

100	10	1
	7	5
+	5	2
1	2	7
	1	

Hundreds Tens Ones





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CPA reasoning

75 + 52 = 127

Part 3

1

100	10	1
	7	5
+	5	2

Hundreds | Tens | Ones

10 10 10 10 10 10 10 10 10 10 | 1 1 1 1 1

2

100	10	1
	7	5
+	5	2
		7

Hundreds | Tens | Ones

10 10 10 10 10 10 10 10 10 10 | 1 1 1 1 1 1 1

3

100	10	1
	7	5
+	5	2
	2	7
	1	

Hundreds | Tens | Ones

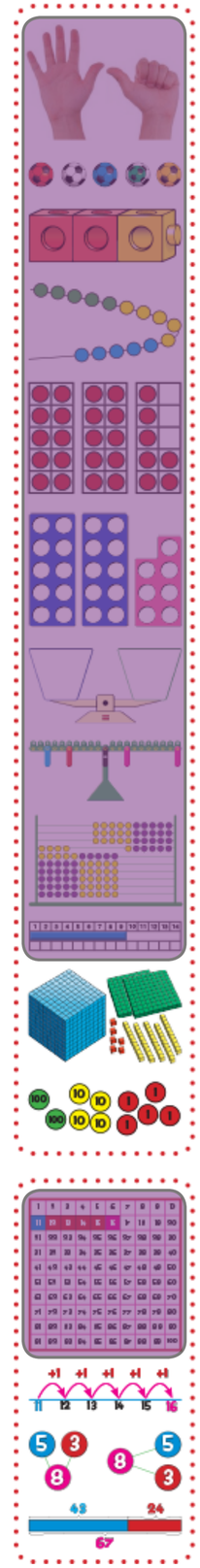
10 10 10 10 10 10 10 10 10 10 | 100 | 10 10 | 1 1 1 1 1 1 1

4

100	10	1
	7	5
+	5	2
1	2	7
	1	

Hundreds | Tens | Ones

100 | 10 10 | 1 1 1 1 1 1 1



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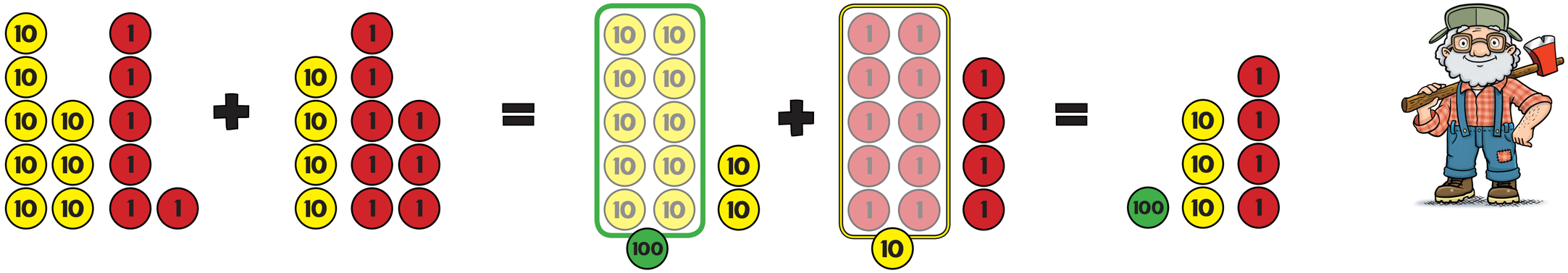
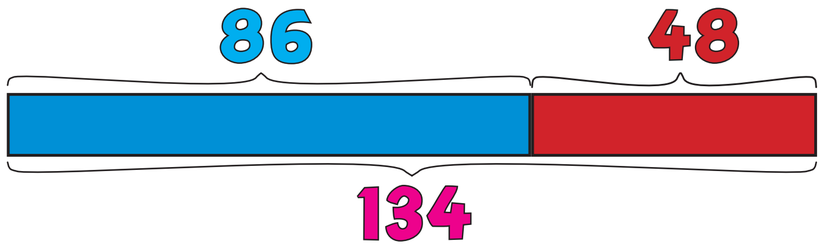
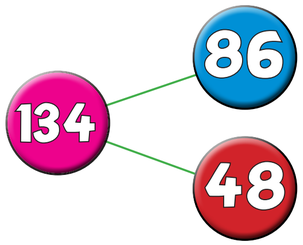
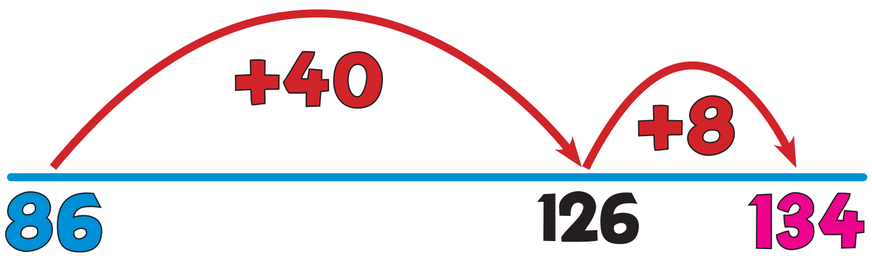
CPA reasoning 86 + 48 = 134 Part 1

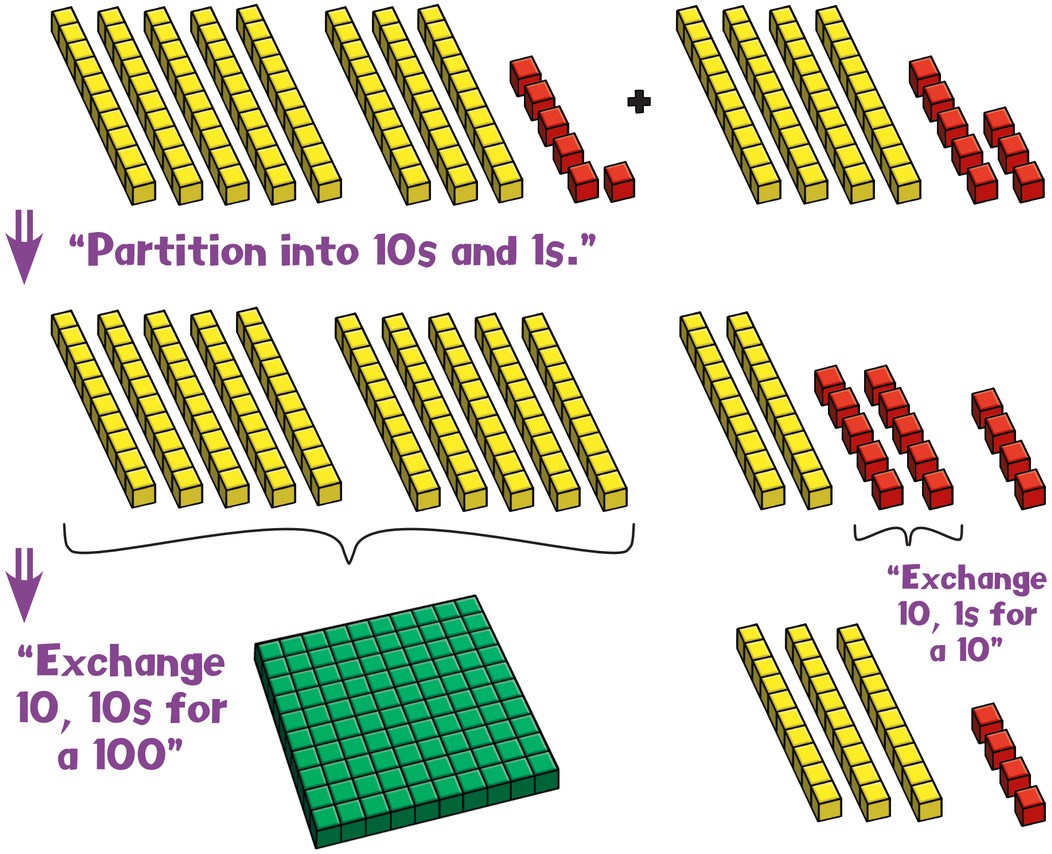


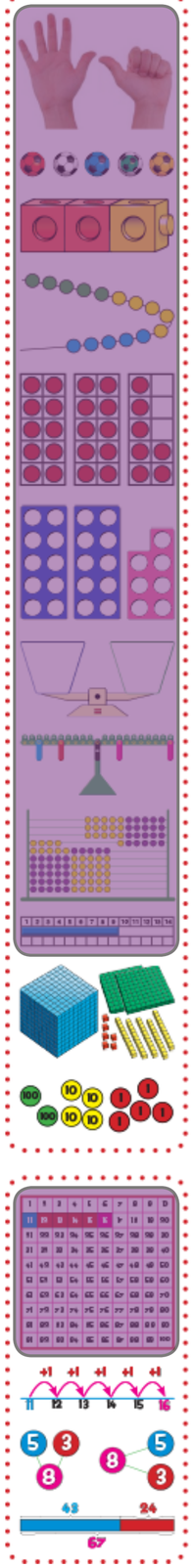


134 = 86 + 48









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CPA reasoning

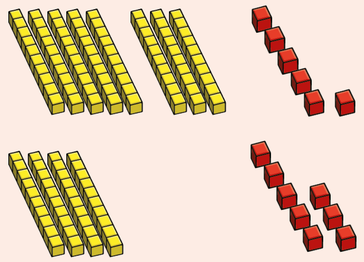
86 + 48 = 134

Part 2

1

100	10	1
	8	6
+	4	8

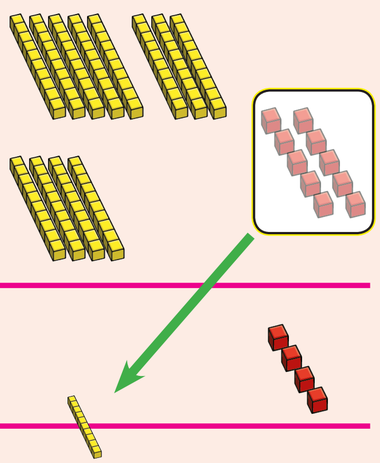
Hundreds Tens Ones



2

100	10	1
	8	6
+	4	8
		4
	1	

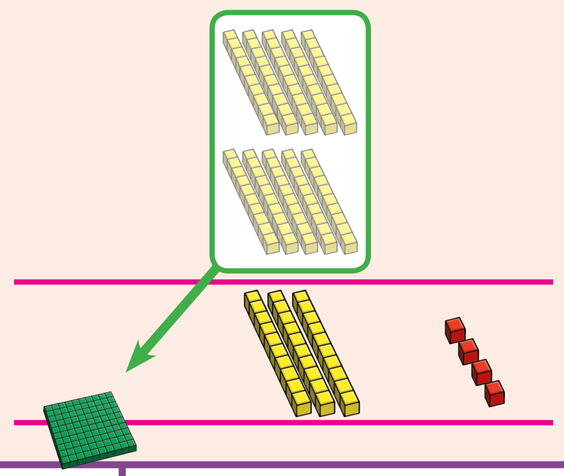
Hundreds Tens Ones



3

100	10	1
	8	6
+	4	8
	3	4
	1	1

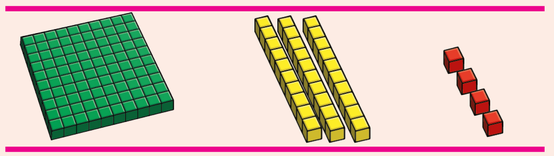
Hundreds Tens Ones

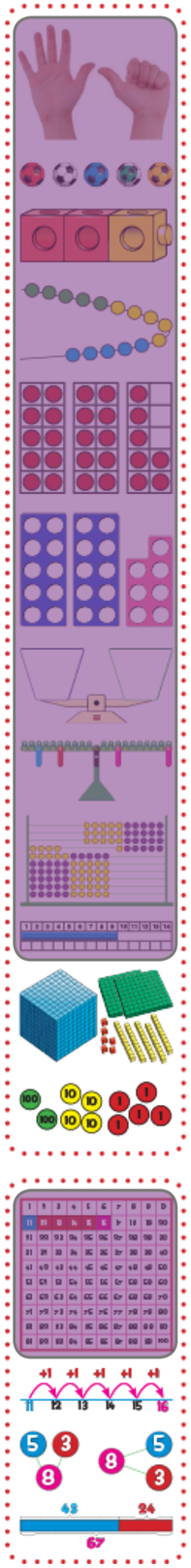


4

100	10	1
	8	6
+	4	8
1	3	4
	1	1

Hundreds Tens Ones





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CPA reasoning

86 + 48 = 134

Part 3

1

100	10	1
	8	6
+	4	8

Hundreds | Tens | Ones

10 10 | 1 1 1 1 1 1

10 10 10 10 | 1 1 1 1

2

100	10	1
	8	6
+	4	8
		4
	1	

Hundreds | Tens | Ones

10 10 10 10 10 10 | 1 1 1 1

10 10 10 10 | 1 1 1 1

3

100	10	1
	8	6
+	4	8
	3	4
	1	1

Hundreds | Tens | Ones

10 10 10 10 10 10 10 10 10 10 | 1 1 1 1

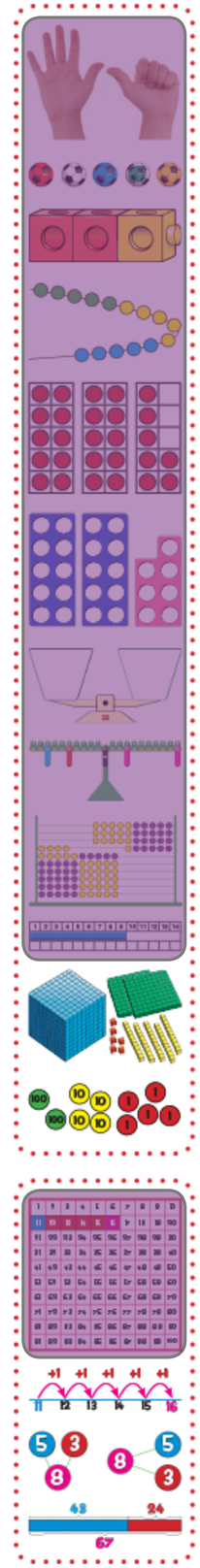
100

4

100	10	1
	8	6
+	4	8
1	3	4
1	1	

Hundreds | Tens | Ones

100 | 10 10 10 | 1 1 1 1



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CPA reasoning

687 + 248 = 935

1

100	10	1
6	8	7
+ 2	4	8

Hundreds Tens Ones

2

100	10	1
6	8	7
+ 2	4	8
		5
	1	

Hundreds Tens Ones

3

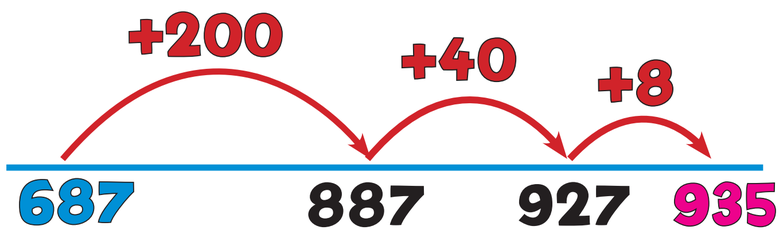
100	10	1
6	8	7
+ 2	4	8
	3	5
1	1	

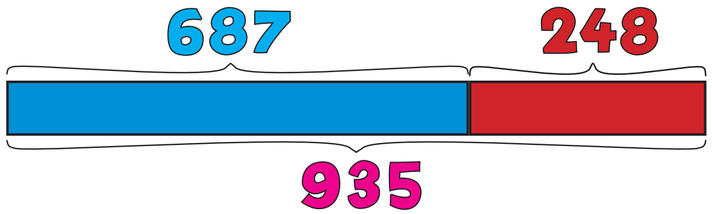
Hundreds Tens Ones

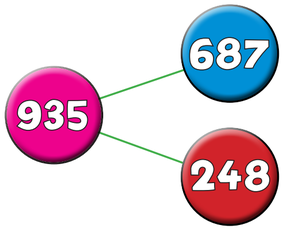
4

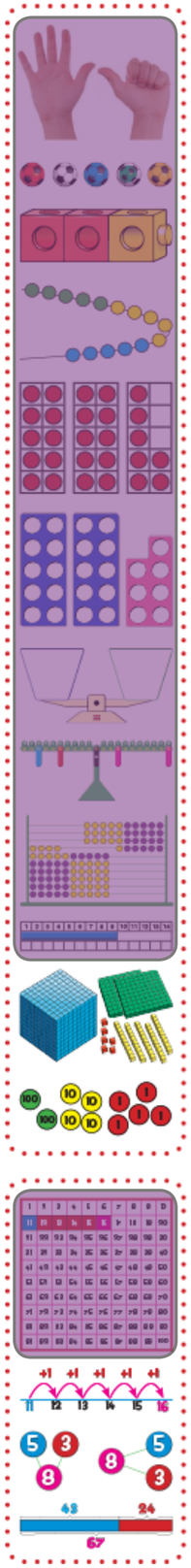
100	10	1
6	8	7
+ 2	4	8
9	3	5
1	1	

Hundreds Tens Ones









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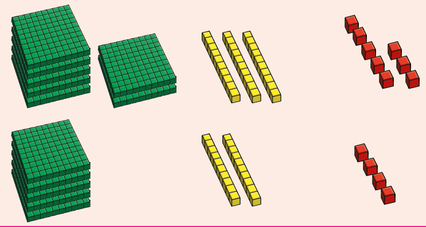
CPA reasoning

738 + 524 = 1262

1

1000	100	10	1
	7	3	8
+	5	2	4

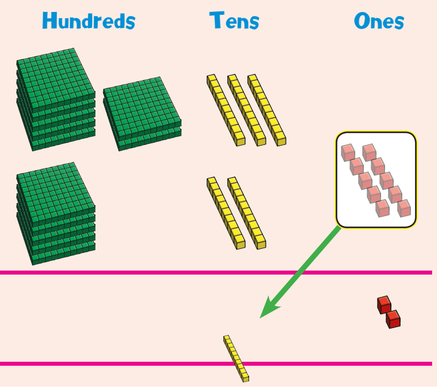
Thousands | Hundreds | Tens | Ones



2

1000	100	10	1
	7	3	8
+	5	2	4
			2
	1		

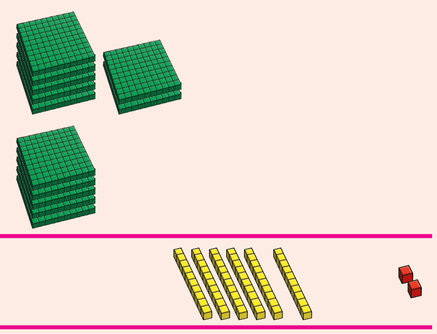
Thousands | Hundreds | Tens | Ones



3

1000	100	10	1
	7	3	8
+	5	2	4
		6	2
	1		

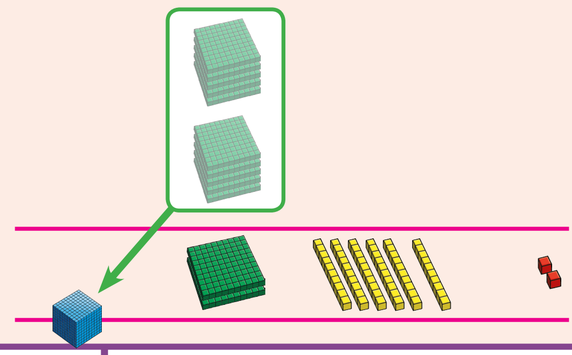
Thousands | Hundreds | Tens | Ones



4

1000	100	10	1
	7	3	8
+	5	2	4
	2	6	2
1		1	

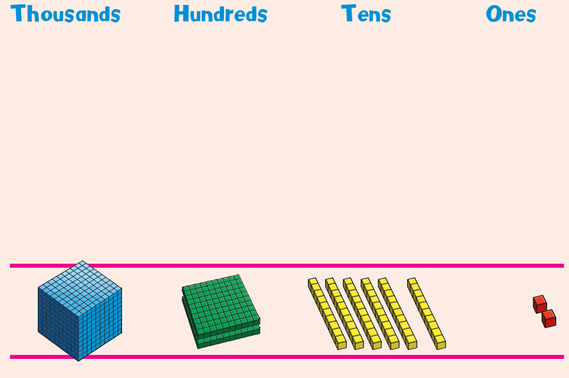
Thousands | Hundreds | Tens | Ones

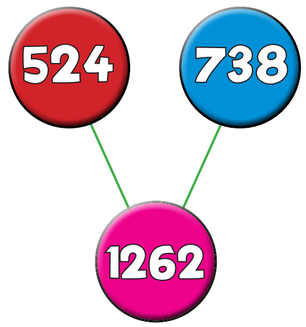


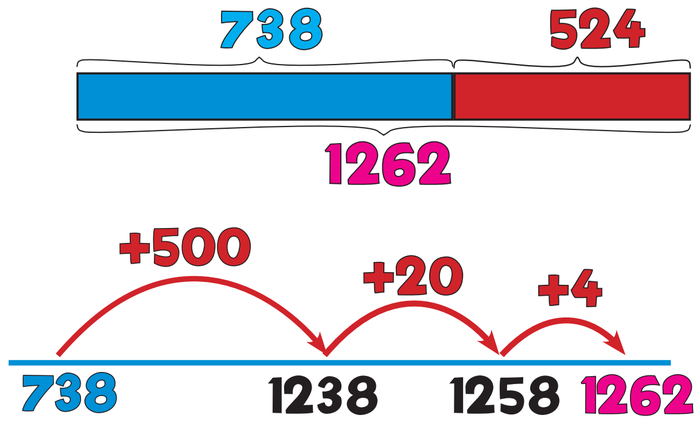
5

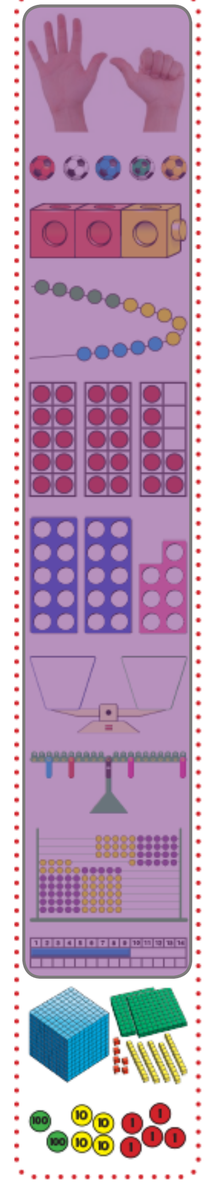
1000	100	10	1
	7	3	8
+	5	2	4
1	2	6	2
1		1	

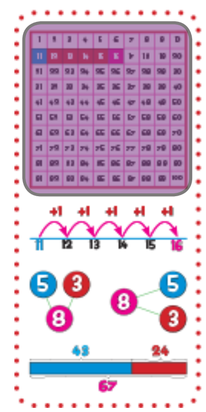
Thousands | Hundreds | Tens | Ones











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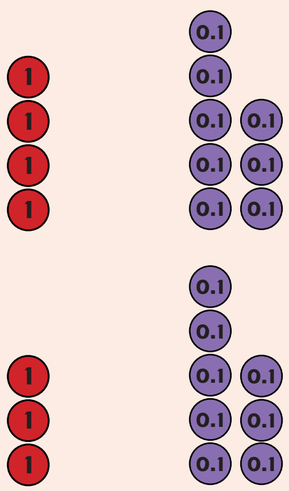
CPA reasoning

4.8 + 3.8 = 8.6

1

1	▪	$\frac{1}{10}$
4	.	8
+ 3	.	8

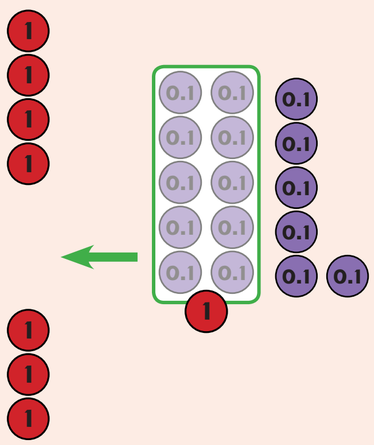
Ones ▪ Tenths



2

Ones ▪ Tenths

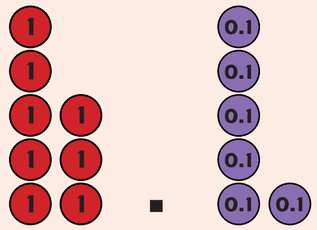
1	▪	$\frac{1}{10}$
4	.	8
+ 3	.	8
	.	6
1		

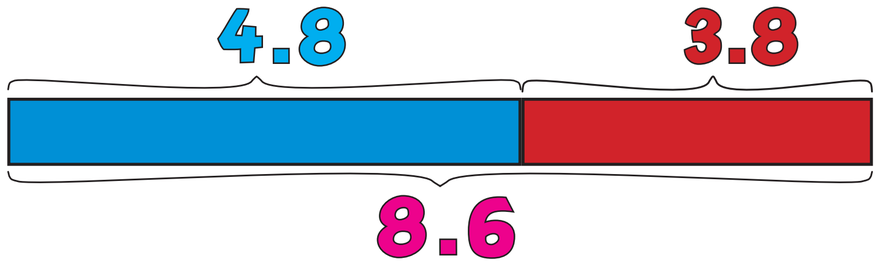


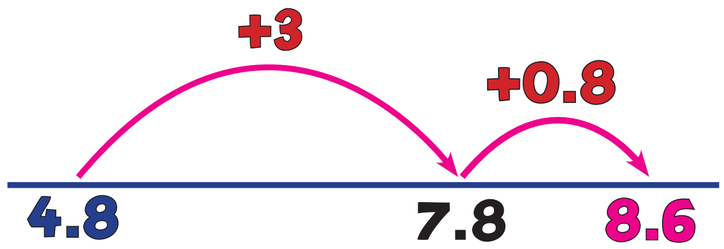
3

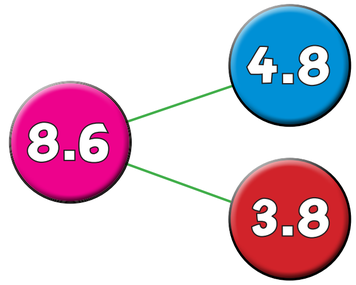
Ones ▪ Tenths

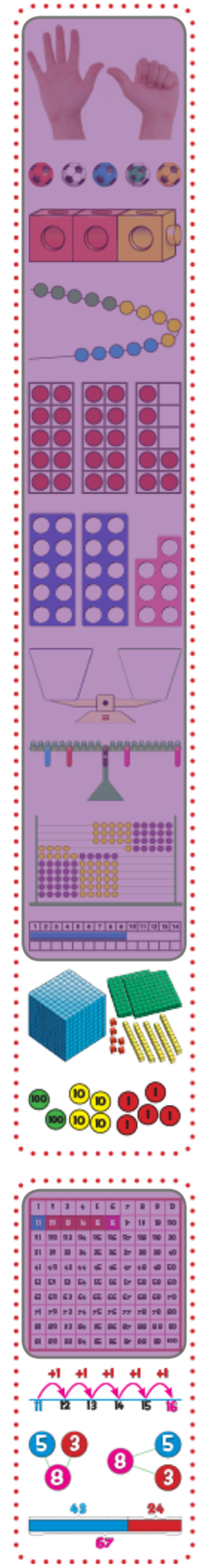
1	▪	$\frac{1}{10}$
4	.	8
+ 3	.	8
8	.	6
1		











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CPA reasoning

5.65 + 3.29 = 8.94

1

1	.	$\frac{1}{10}$	$\frac{1}{100}$
	5	. 6	5
+	3	. 2	9

Ones	.	Tenths	Hundredths
1 1 1 1 1		0.1 0.1 0.1 0.1 0.1 0.1	0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01
1 1 1		0.1 0.1	0.01 0.01 0.01 0.01 0.01 0.01

2

1	.	$\frac{1}{10}$	$\frac{1}{100}$
	5	. 6	5
+	3	. 2	9
			4
		1	

Ones	.	Tenths	Hundredths
1 1 1 1 1		0.1 0.1 0.1 0.1 0.1 0.1	0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01
1 1 1		0.1 0.1	0.1

3

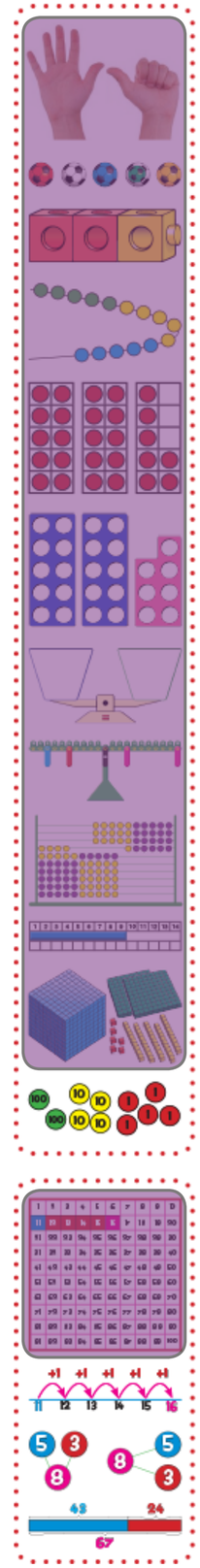
1	.	$\frac{1}{10}$	$\frac{1}{100}$
	5	. 6	5
+	3	. 2	9
		. 9	4
		1	

Ones	.	Tenths	Hundredths
1 1 1 1 1		0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1	0.01 0.01 0.01 0.01
1 1 1			

4

1	.	$\frac{1}{10}$	$\frac{1}{100}$
	5	. 6	5
+	3	. 2	9
	8	. 9	4
	1		

Ones	.	Tenths	Hundredths
1 1 1 1 1 1 1	.	0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1	0.01 0.01 0.01 0.01



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CPA reasoning

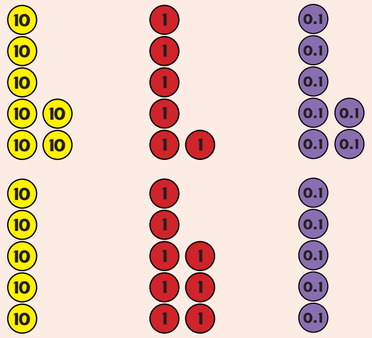
76.7 + 58.5 = 135.2

1

100 10 1 . $\frac{1}{10}$

76.7
+ 58.5

Hundreds Tens Ones . Tenths

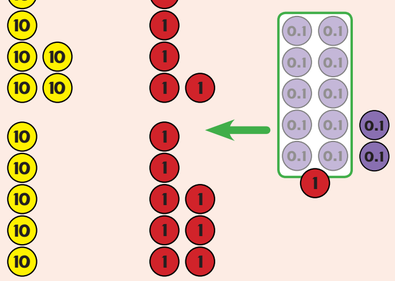


2

100 10 1 . $\frac{1}{10}$

76.7
+ 58.5
.2
1

Hundreds Tens Ones . Tenths

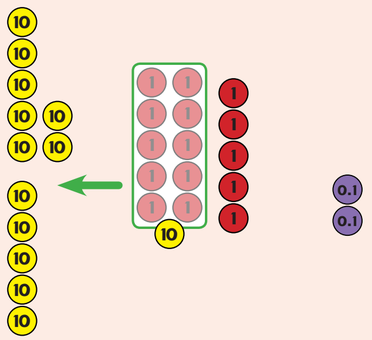


3

100 10 1 . $\frac{1}{10}$

76.7
+ 58.5
5.2
1 1

Hundreds Tens Ones . Tenths

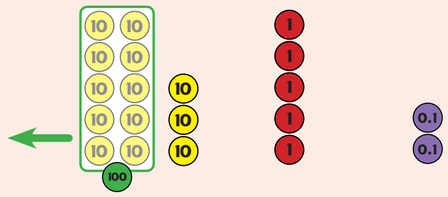


4

100 10 1 . $\frac{1}{10}$

76.7
+ 58.5
35.2
1 1 1

Hundreds Tens Ones . Tenths

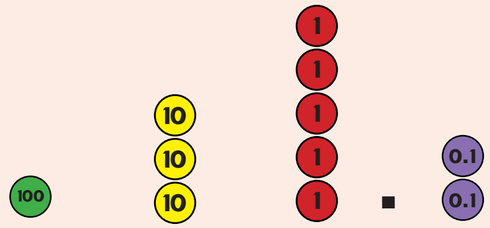


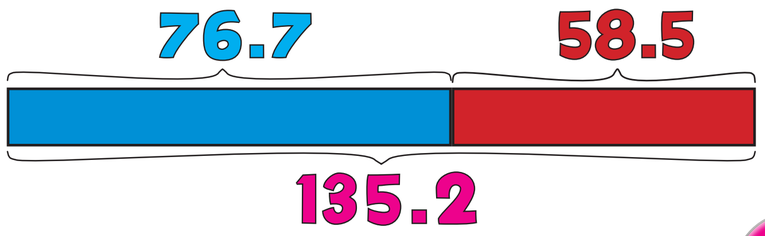
5

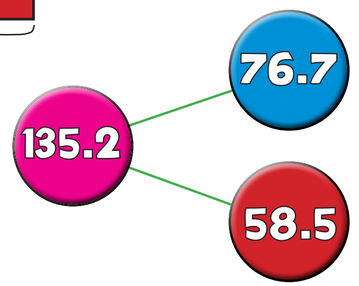
100 10 1 . $\frac{1}{10}$

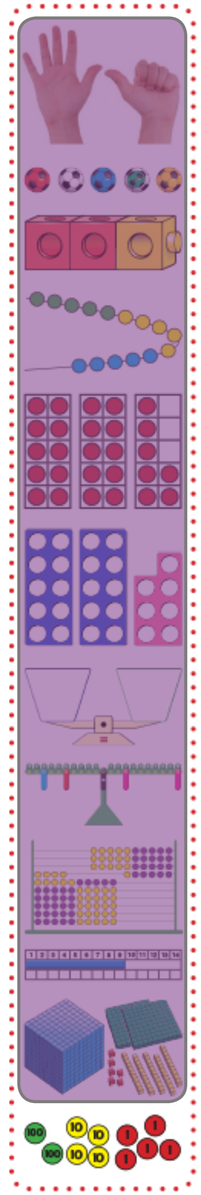
76.7
+ 58.5
135.2
1 1 1

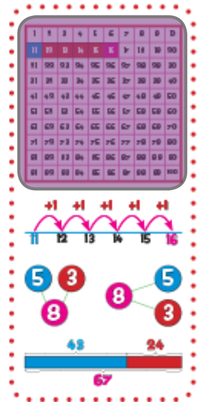
Hundreds Tens Ones . Tenths











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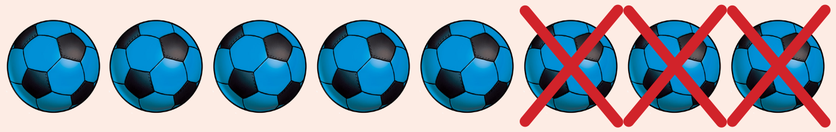
CPA Models of Subtraction

CPA reasoning

Reduction

Removing a Part



"If I had 8 footballs and kicked 3 over the fence, how many did I have left?" "5"

Reducing the Whole

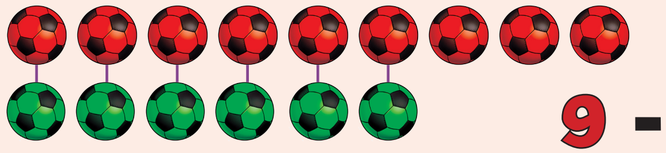


8 - 3 = 5

"The football cost £8 but I got £3 off in the sales. How much did I pay? "£5"

Comparison

Comparing Parts

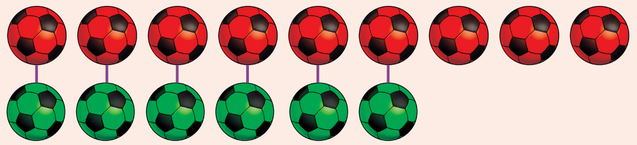


9 - 6 = 3

"If I had 9 footballs and you had 6, how many more balls have I got than you? "3"

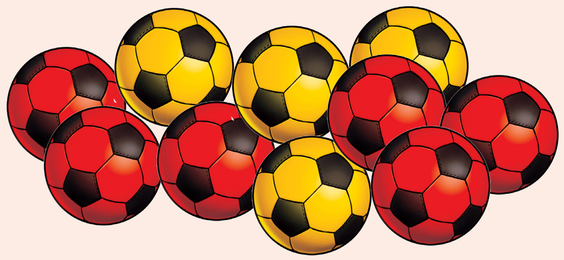
Equating Parts

9 - 6 = 3



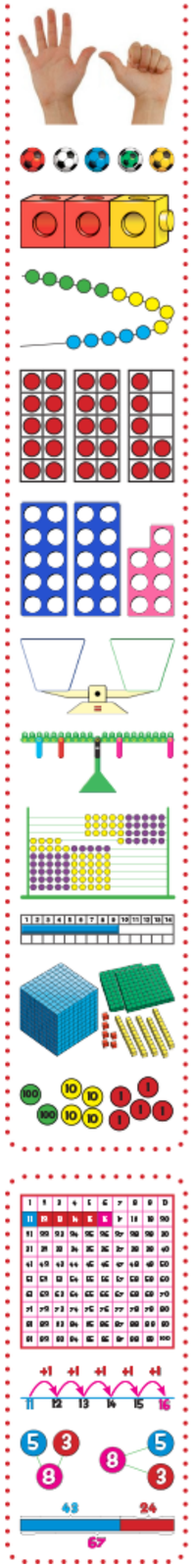
"If I had 9 footballs and you had 6, how many more balls would you need to buy to have the same amount as me? "3"

Partitioning



"There are 10 footballs in my bag. 6 are red, how many are yellow?" "4"

10 - 6 = 4



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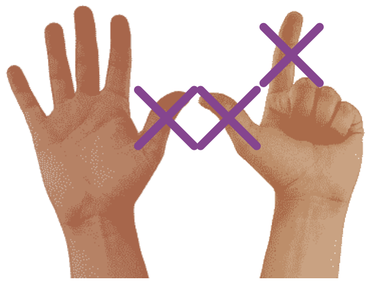
CPA

reasoning

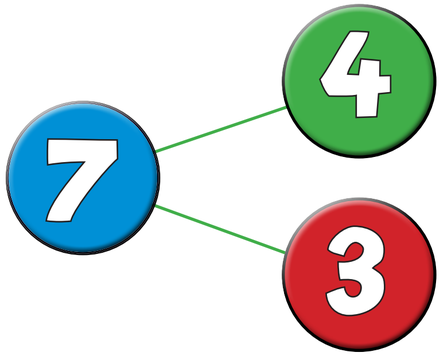


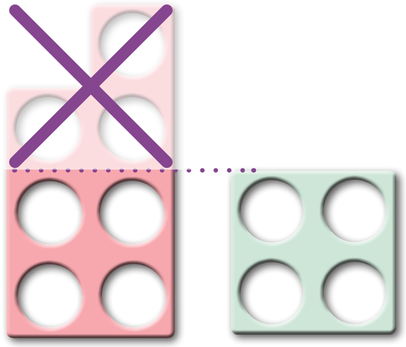
7 - 3 = 4

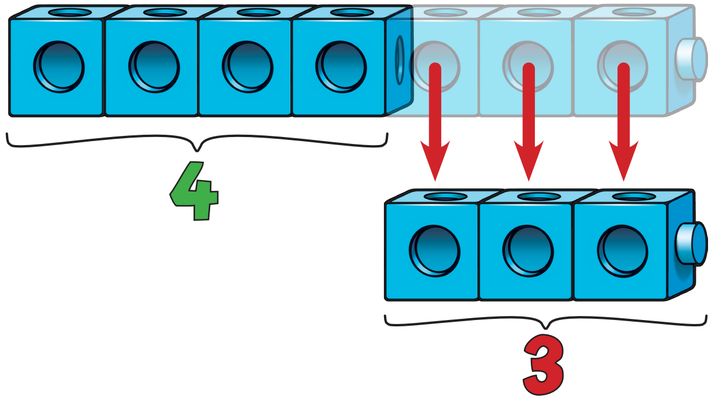












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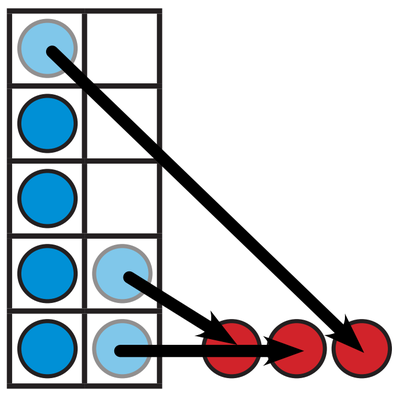

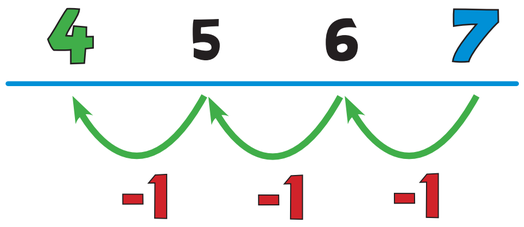

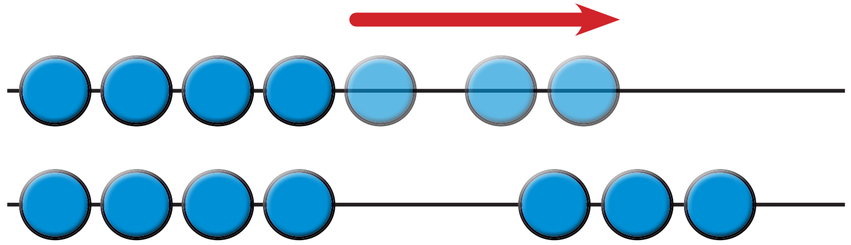

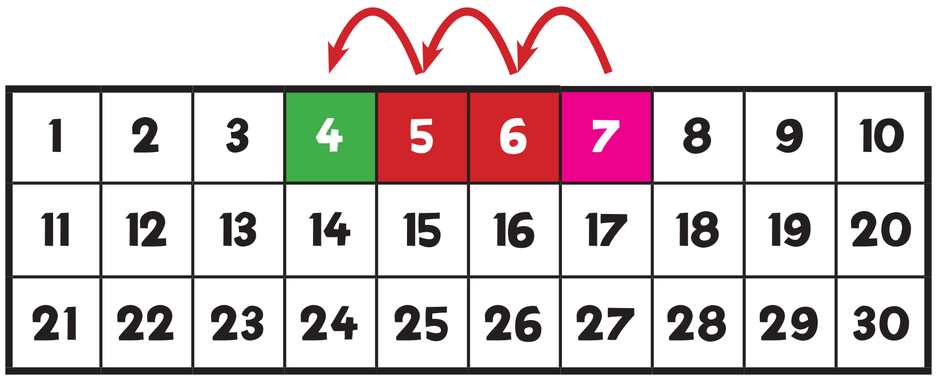

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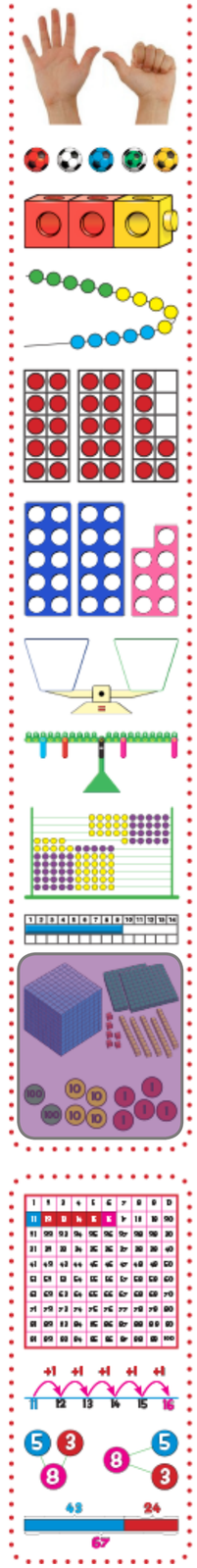
21	22	23	24	25	26	27	28	29	30

4 = 7 - 3



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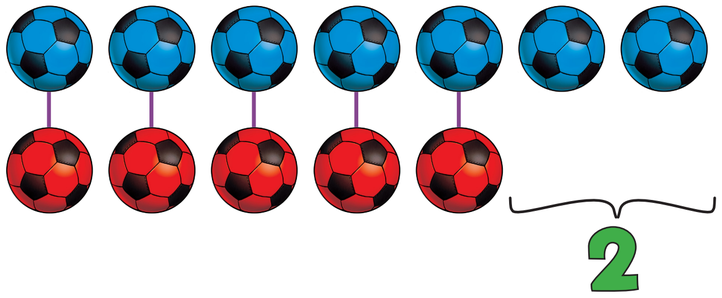
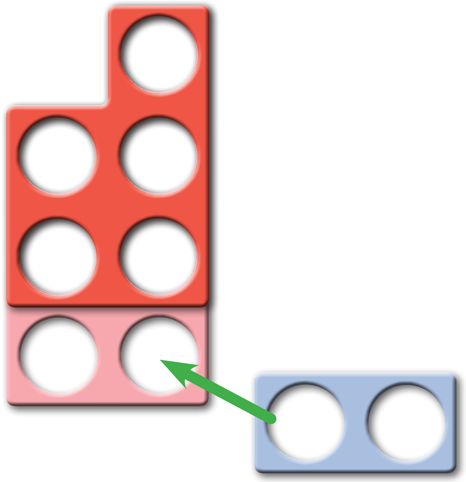
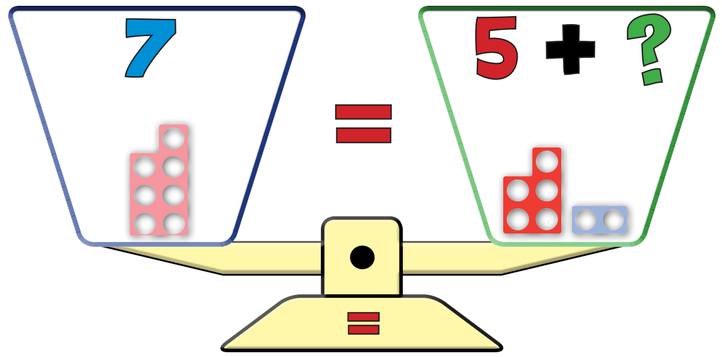
CPA

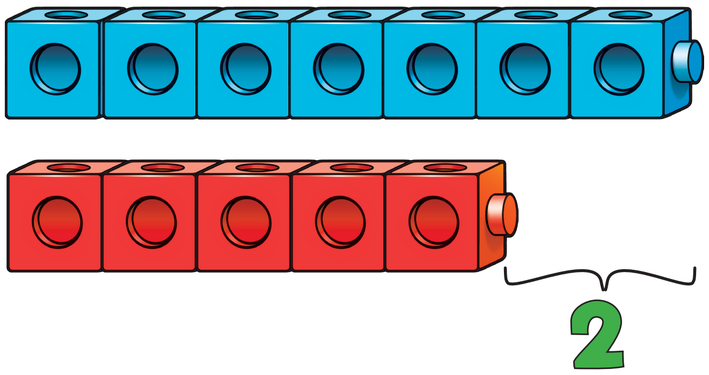
reasoning

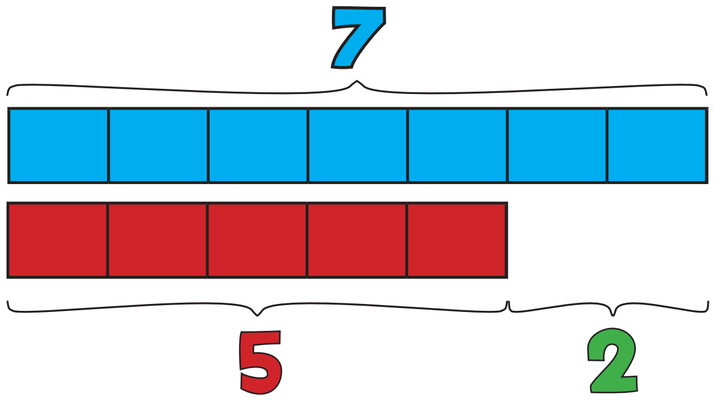
7 - 5 = 2











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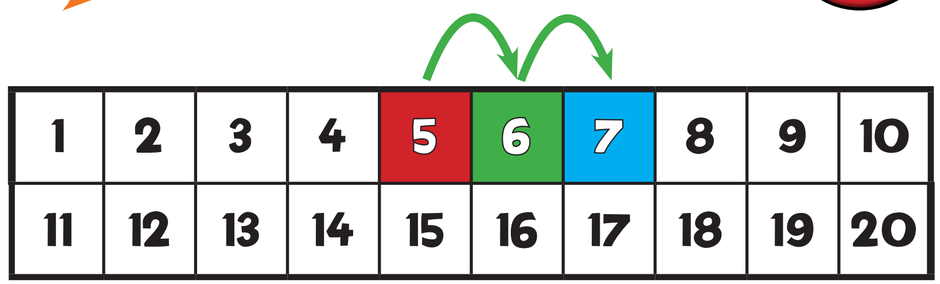
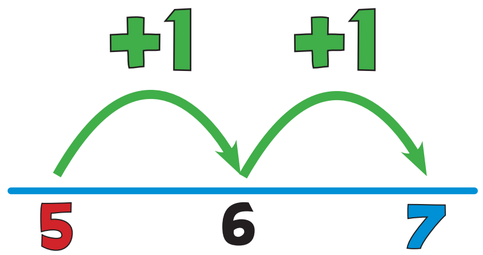
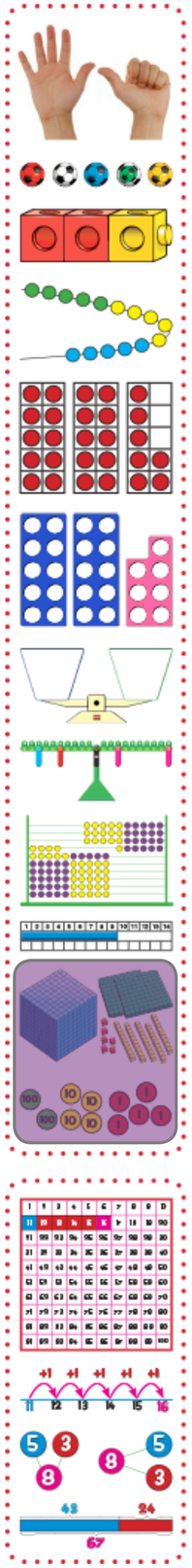




2 = 7 - 5



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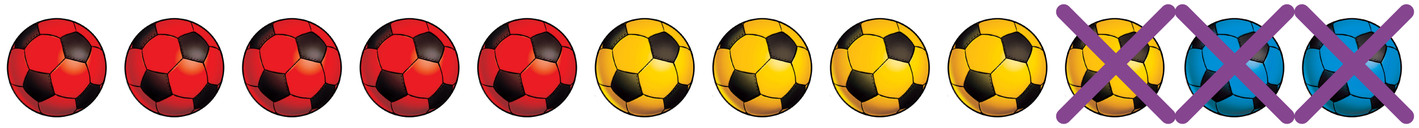
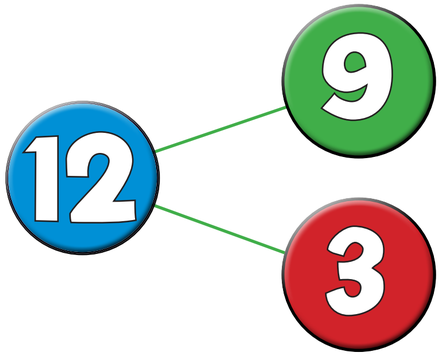
CPA

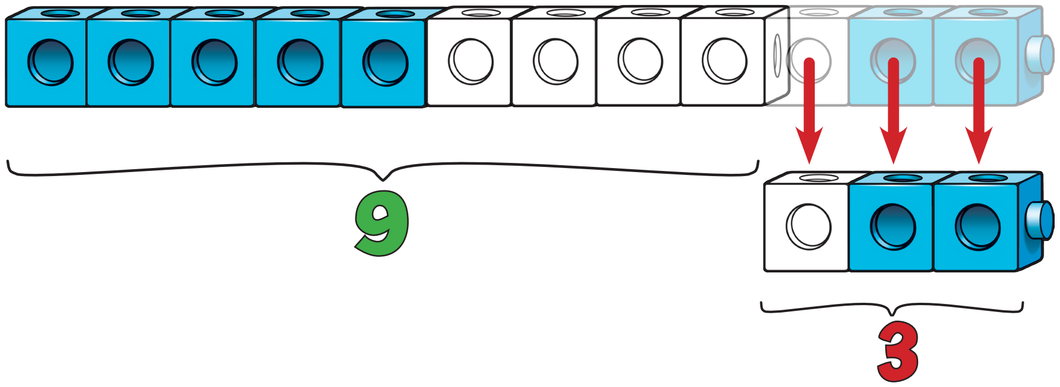
reasoning

12 - 3 = 9









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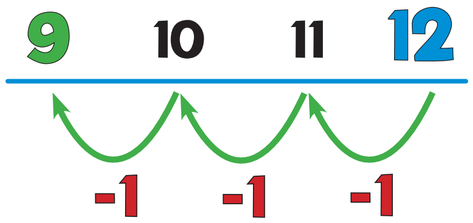

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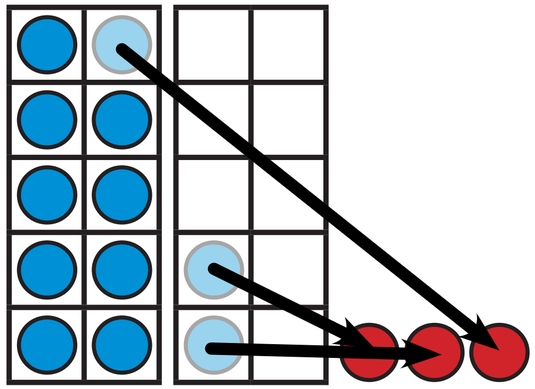
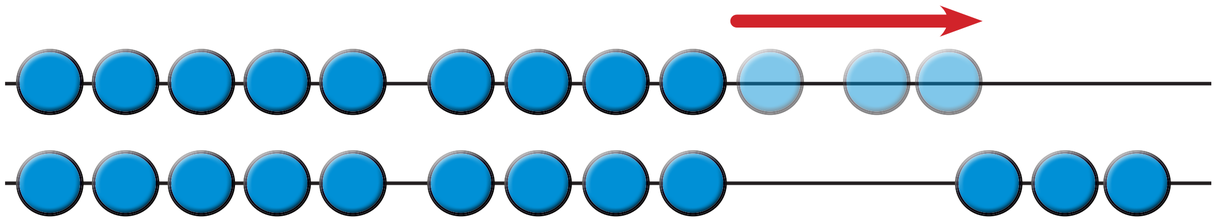
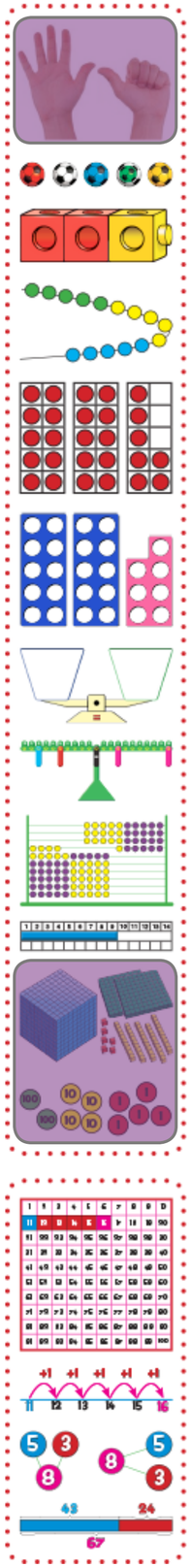






9 = 12 - 3



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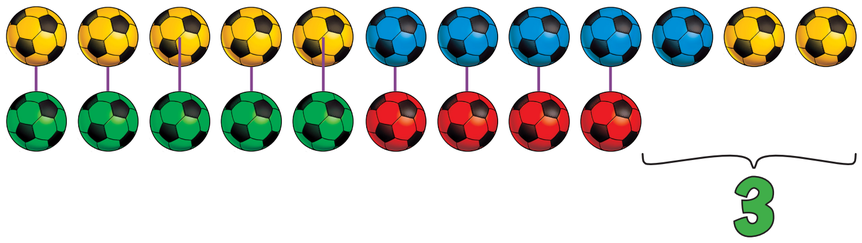
CPA

reasoning

12 - 9 = 3





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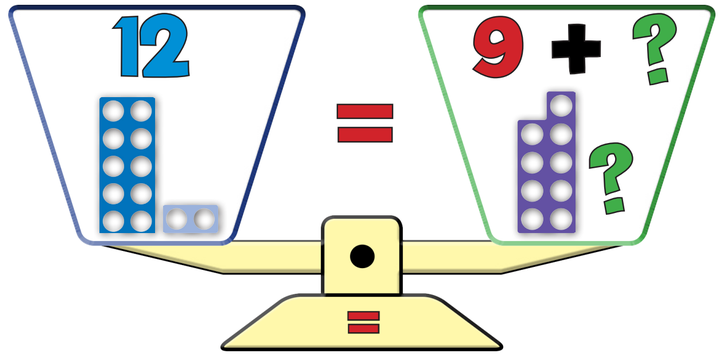

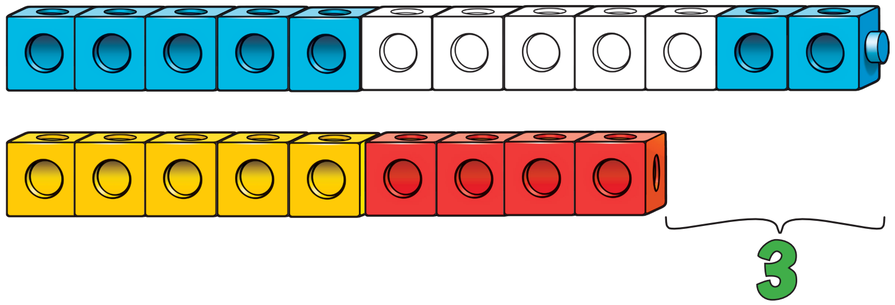

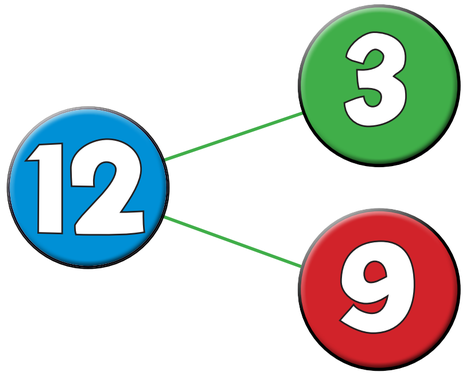

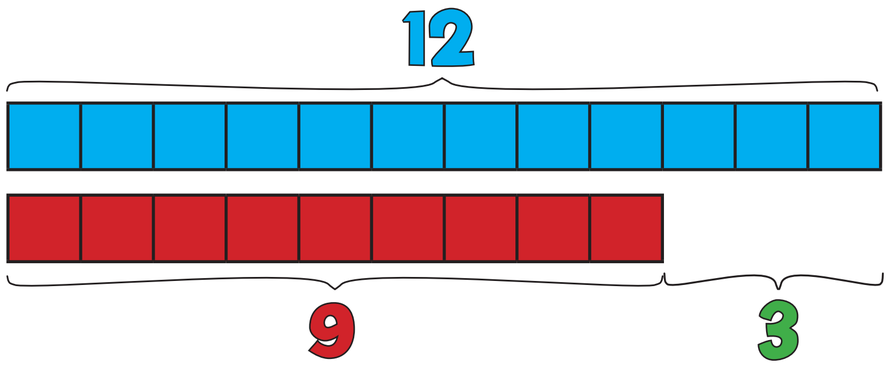

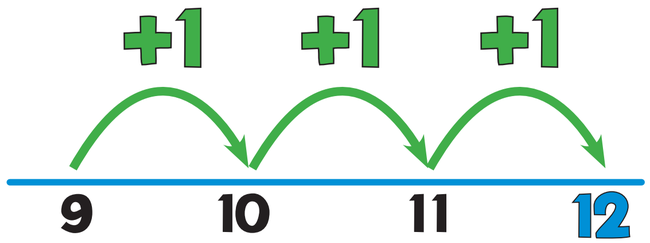

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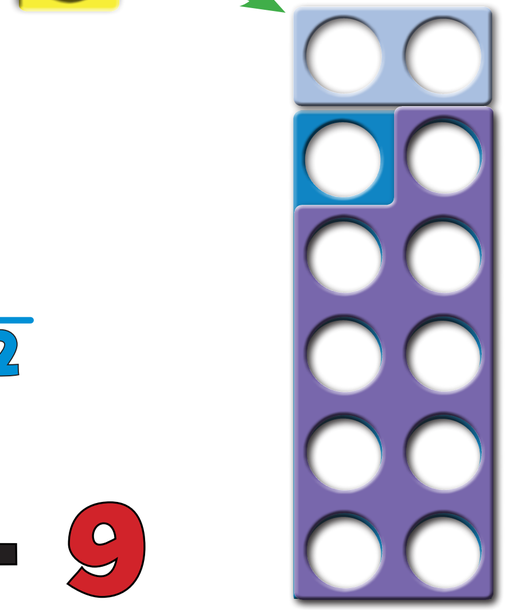

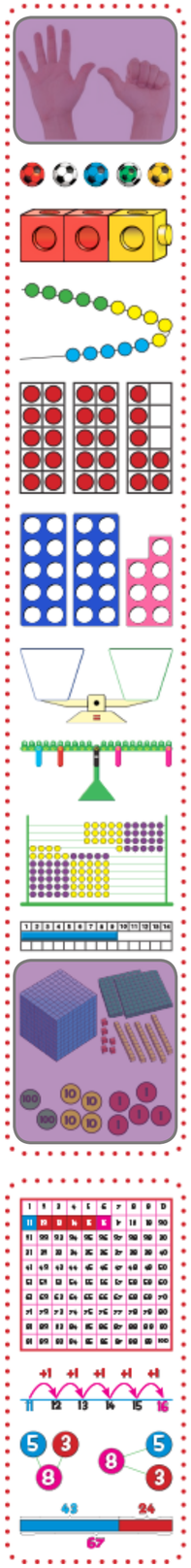

$$3 = 12 - 9$$

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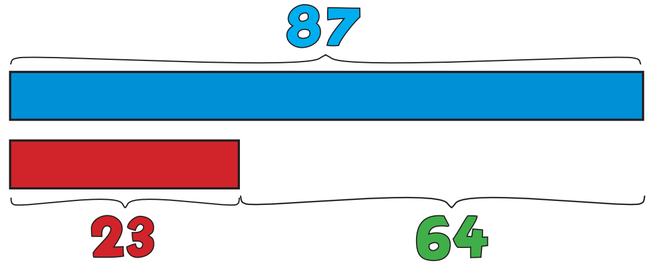
CPA reasoning

87 - 23 = 64

Part 1





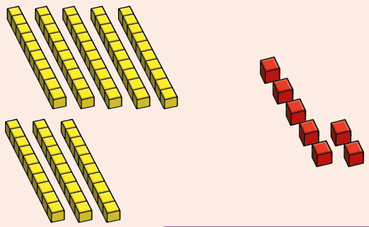


1

10 1

8 7
- 2 3

Tens Ones

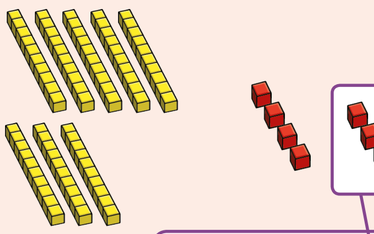


2

10 1

8 7
- 2 3

Tens Ones

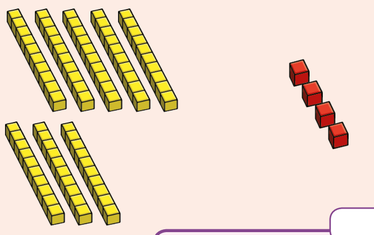


3

10 1

8 7
- 2 3
4

Tens Ones

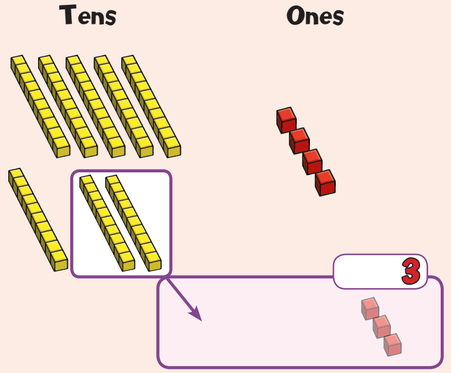


4

10 1

8 7
- 2 3
4

Tens Ones

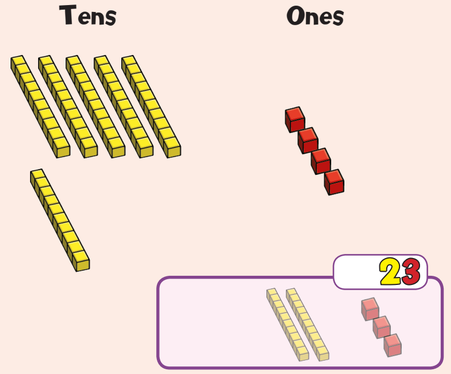


5

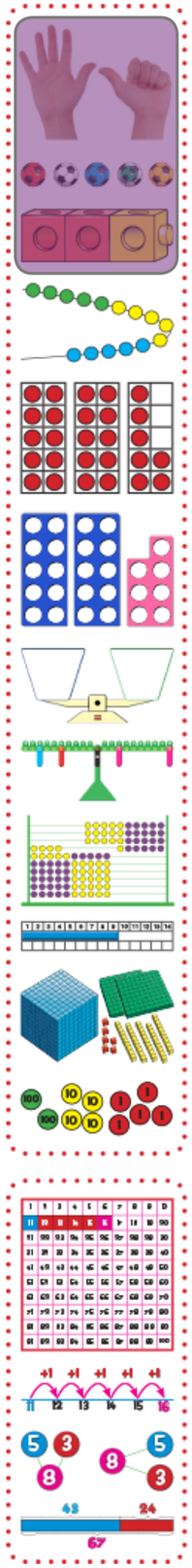
10 1

8 7
- 2 3
6 4

Tens Ones



64 = 87 - 23



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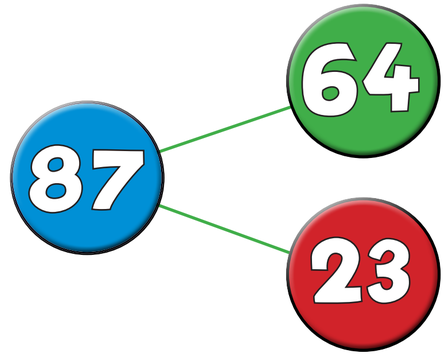
CPA reasoning

87 - 23 = 64

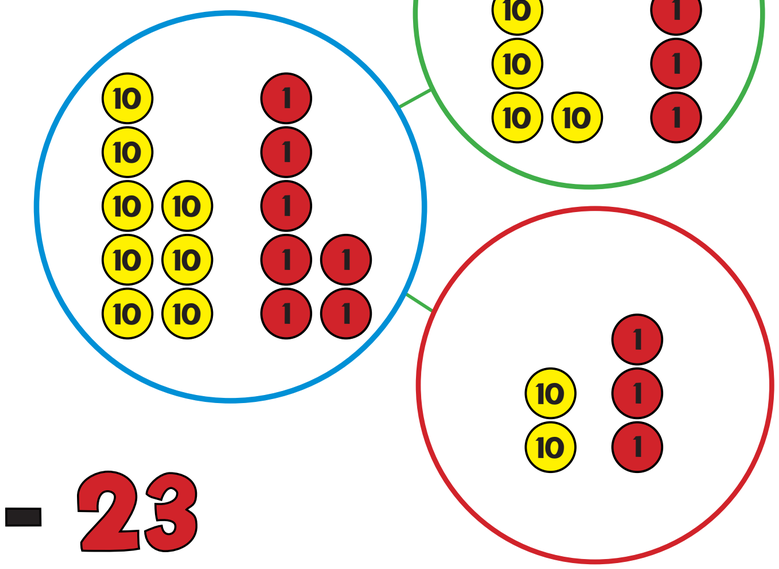
Part 2



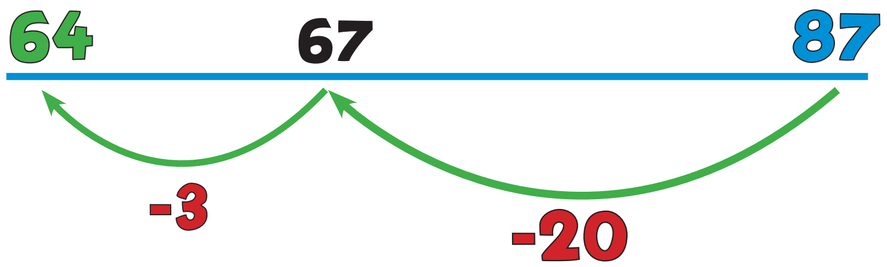
1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

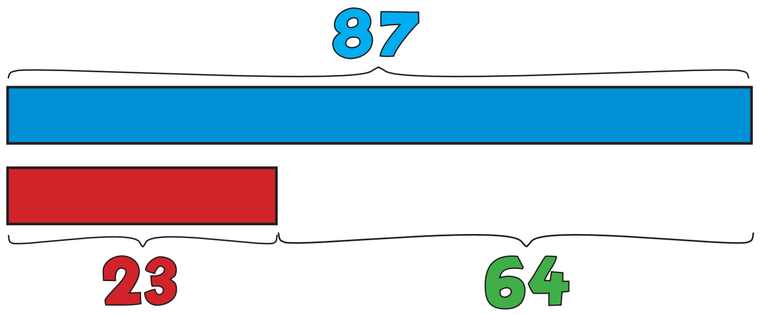




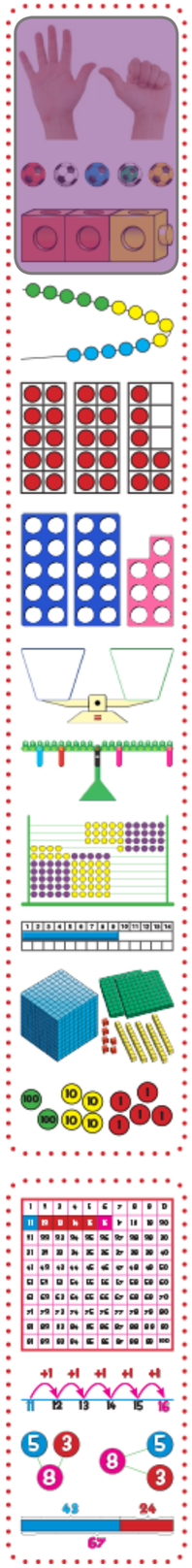


64 = 87 - 23





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



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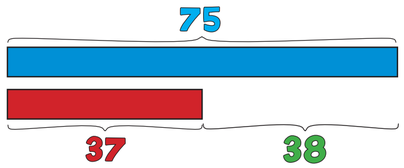
CPA reasoning

75 - 37 = 38

Part 1



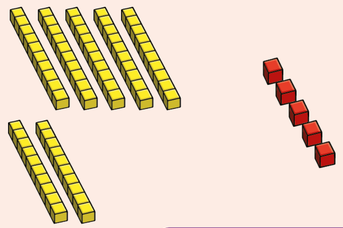
38 = 75 - 37



1

10	1
7	5
- 3	7

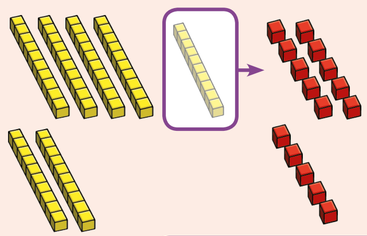
Tens Ones



2

10	1
6 7	1 5
- 3	7

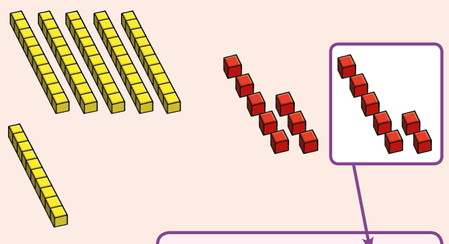
Tens Ones



3

10	1
6 7	1 5
- 3	7

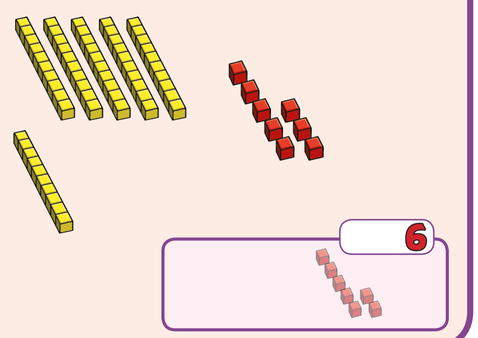
Tens Ones



4

10	1
6 7	1 5
- 3	7
	8

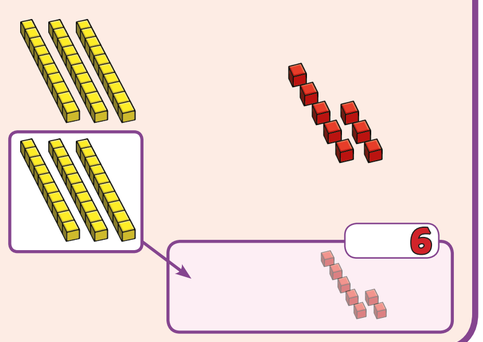
Tens Ones



5

10	1
6 7	1 5
- 3	7
	8

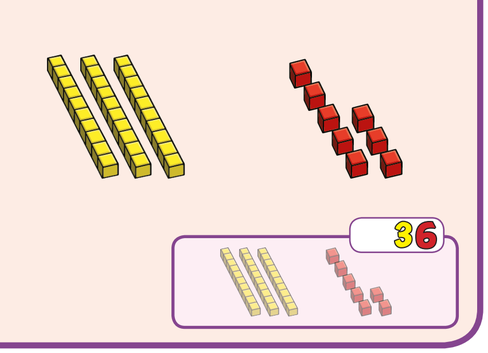
Tens Ones



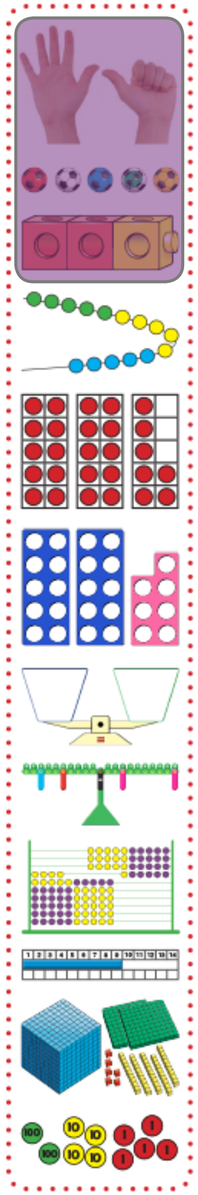
6

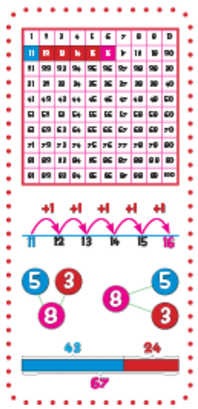
10	1
6 7	1 5
- 3	7
3	8

Tens Ones









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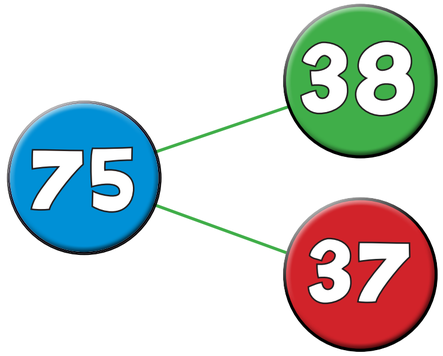
CPA reasoning

75 - 37 = 38

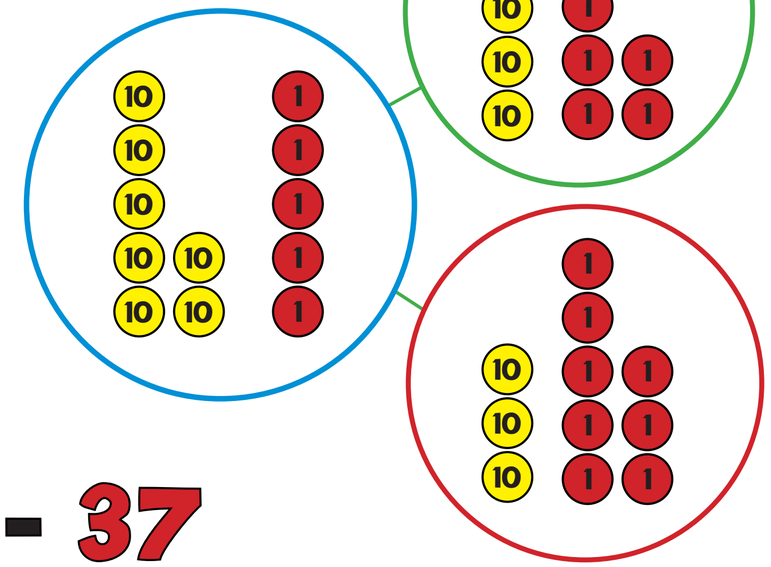
Part 2



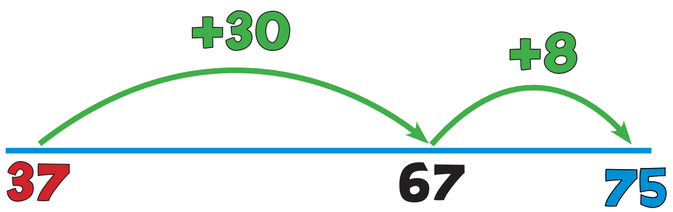
1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	86	88	89	90
91	92	93	94	95	96	97	98	99	100

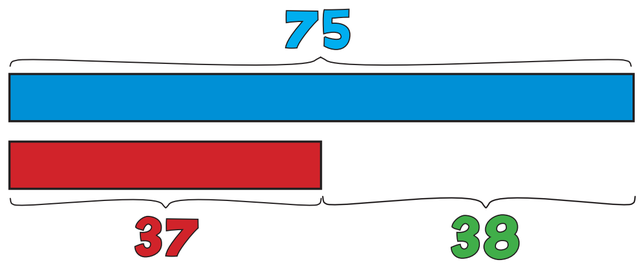


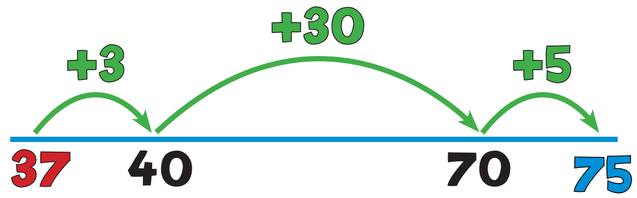




38 = 75 - 37







| | | | | | | | | |

CPA reasoning

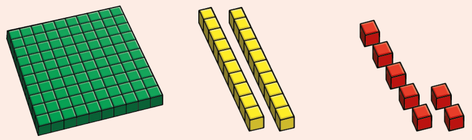
127 - 74 = 53

Part 1

1

100	10	1
1	2	7
-	7	4

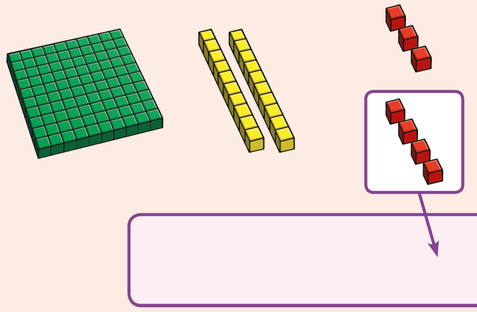
Hundreds Tens Ones



2

100	10	1
1	2	7
-	7	4

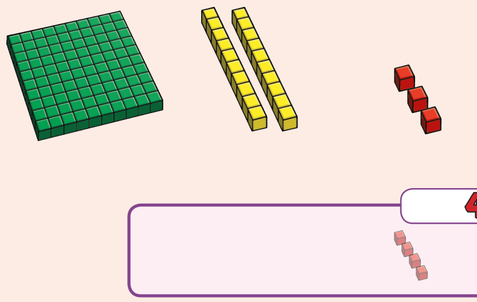
Hundreds Tens Ones



3

100	10	1
1	2	7
-	7	4
		3

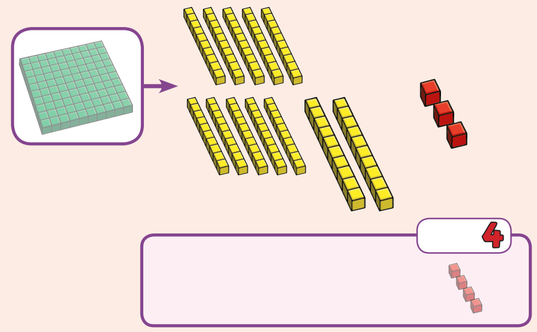
Hundreds Tens Ones



4

100	10	1
0	1	
1	2	7
-	7	4
		3

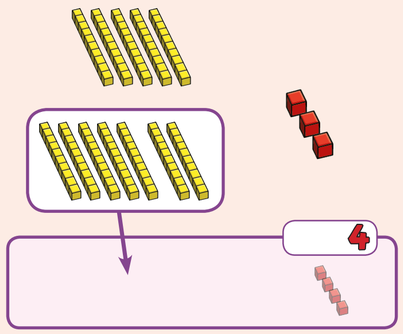
Hundreds Tens Ones



5

100	10	1
0	1	
1	2	7
-	7	4
		3

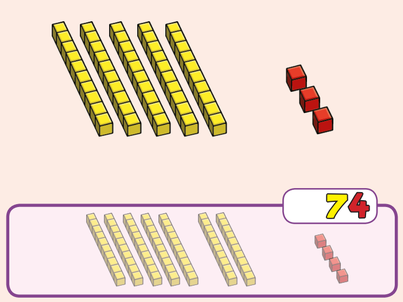
Hundreds Tens Ones

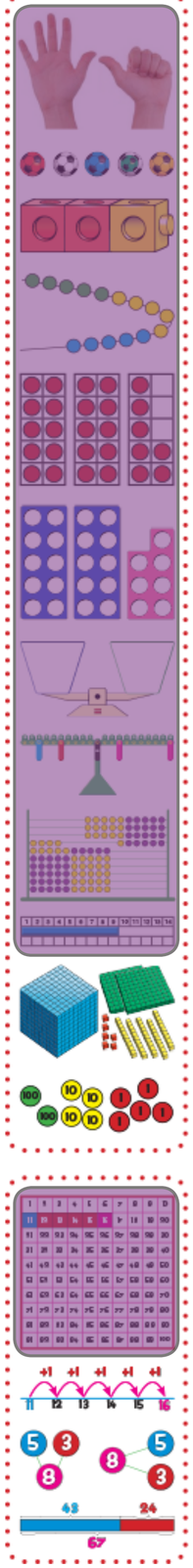


6

100	10	1
0	1	
1	2	7
-	7	4
	5	3

Hundreds Tens Ones





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CPA reasoning

127 - 74 = 53

Part 2

1

100 10 1

127

- 74

Hundreds	Tens	Ones
100	10 10	1 1 1 1 1 1

2

100 10 1

127

- 74

Hundreds	Tens	Ones
100	10 10	~~1 1~~ 1 1 ~~1~~ 1 ~~1~~ 1 ~~1~~

3

100 10 1

127

- 74

3

Hundreds	Tens	Ones
100	10 10	1 1 1

4

100 10 1

~~0~~ ~~1~~

~~1~~27

- 74

3

Hundreds	Tens	Ones
10 10 10 10 10 10 10 10 10 10	10 10	1 1 1

5

100 10 1

~~0~~ ~~1~~

~~1~~27

- 74

3

Hundreds	Tens	Ones
10 10 10 10 10	~~10 10 10 10 10~~	1 1 1

6

100 10 1

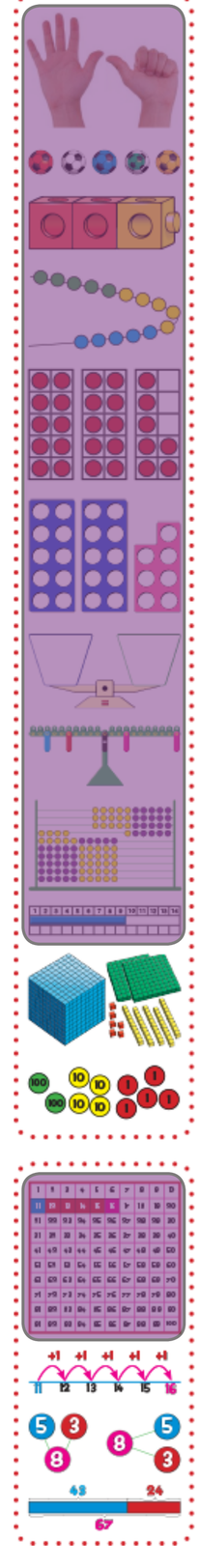
~~1~~ ~~2~~ ~~1~~

~~1~~~~2~~~~1~~7

- 74

53

Hundreds	Tens	Ones
	10 10 10 10 10	1 1 1



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