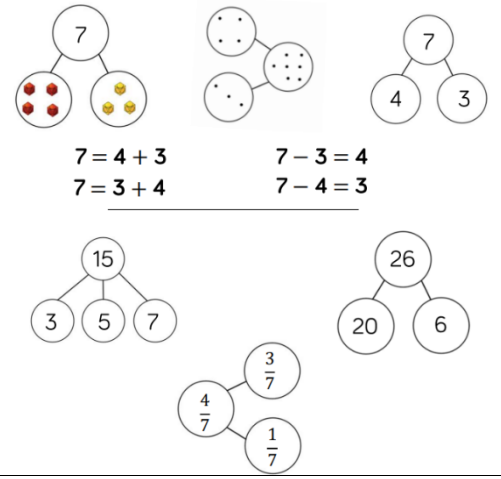
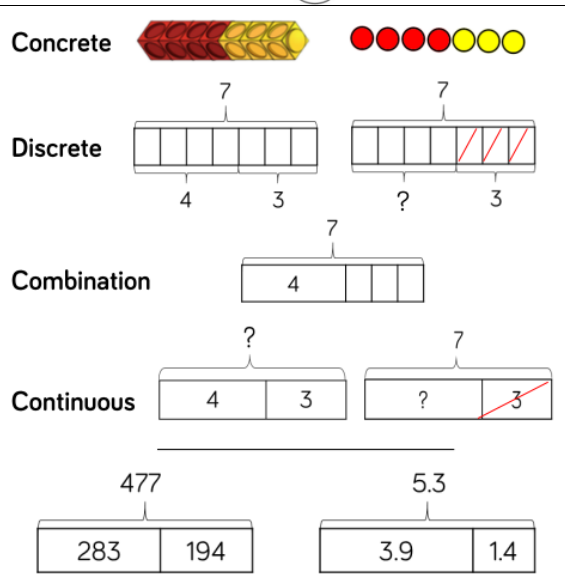
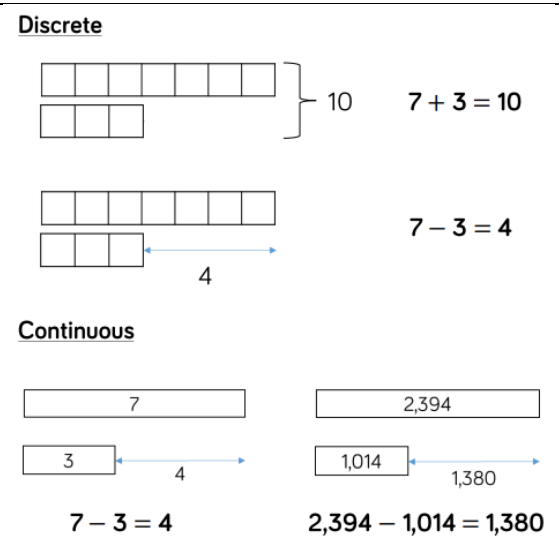
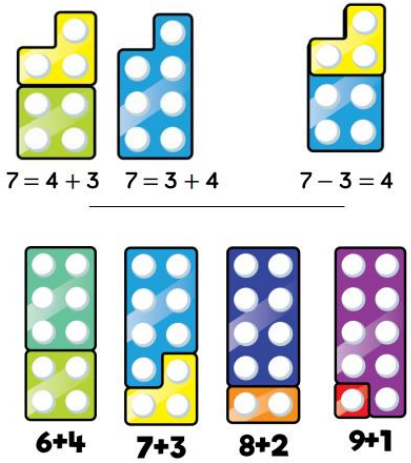
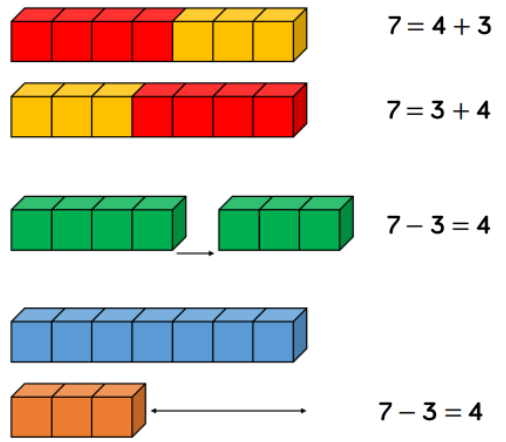
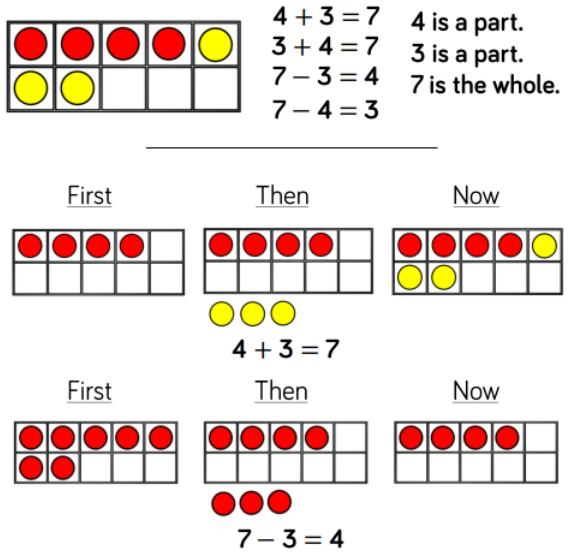
BEA Calculation Policy

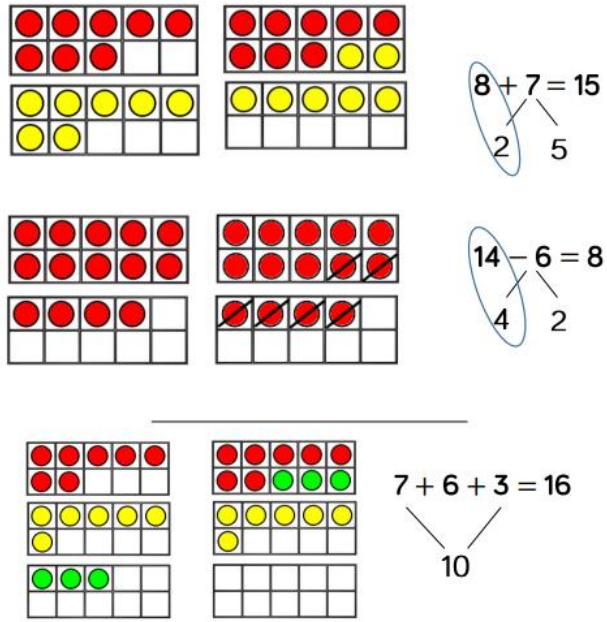
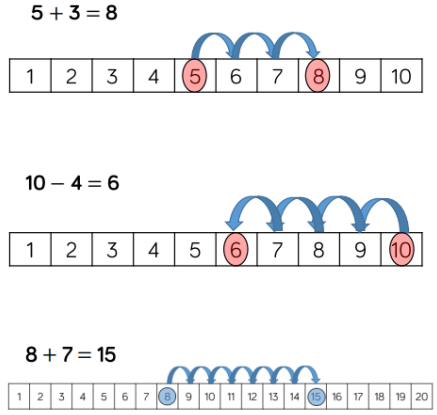
This policy has been adapted from the White Rose Maths Hub Calculation Policy. The policy is broken into methods and skills. For each skill, the policy identifies the appropriate methods to use. It is a working document and will be revised and amended as necessary.

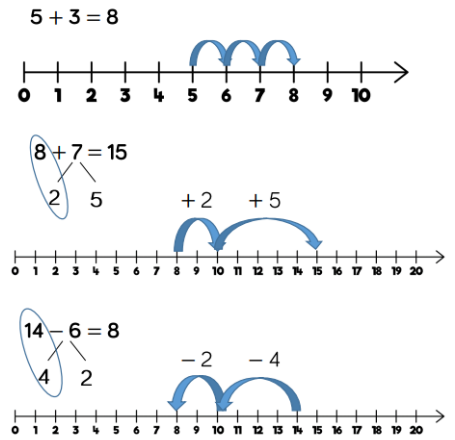
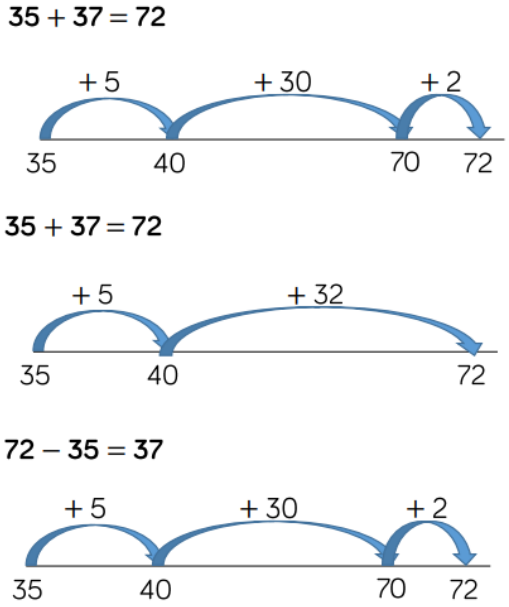
Methods – Addition and Subtraction

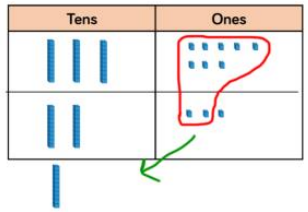
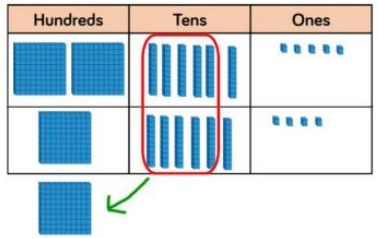
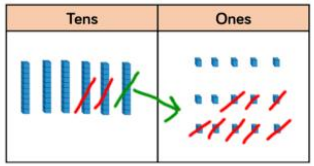
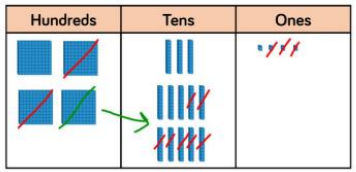
Method	Ways to use	Examples
Part Whole Models	Part + Part = whole Whole – Part = Part Partition numbers into tens and ones. Can be used to partition a number into two or more parts.	
Bar Model (single)	Concrete: cubes and counters. Discrete: a good starting point for smaller numbers (each box represents one whole). Combination: counting on from the larger number. Continuous: each rectangle represents a number, question mark = value not found.	

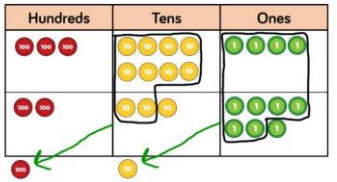
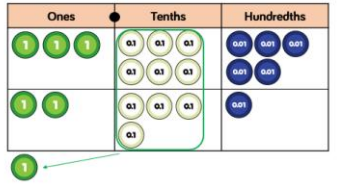
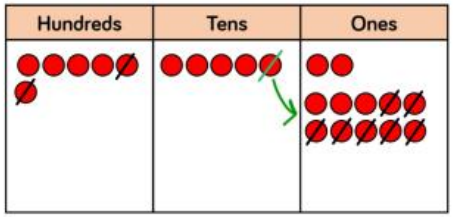
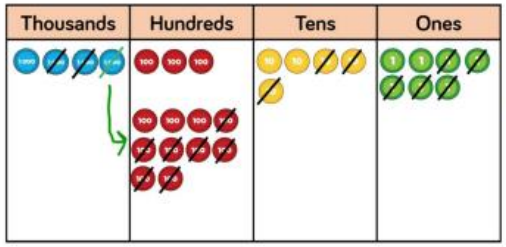
Method	Ways to use	Examples
Bar Model (multiple)	Useful to compare quantities. Smaller numbers can be represented as a discrete bar model. Continuous bar models more effective for larger numbers.	
Numicon	Useful for *subitise* numbers, *aggregation*, *partitioning* and number bonds. Part + Part = Whole If more confident with Numicon, pupils can *subitise* the *total*.	

Method	Ways to use	Examples
Cubes	Use for addition and subtraction of 1-digit (smaller) numbers. Can use different colours to represent numbers. Subtraction: Start with the whole and remove number of cubes that need subtracting. Subtraction as *difference:* Both numbers are made and lined up to find the *difference*.	
Ten Frames (within 10)	Help understand the different structures of addition and subtraction. Introduction to *aggregation* and *partitioning*. Use ten frames to look at *augmentation* and take-away.	

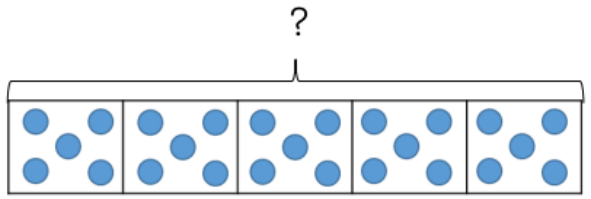
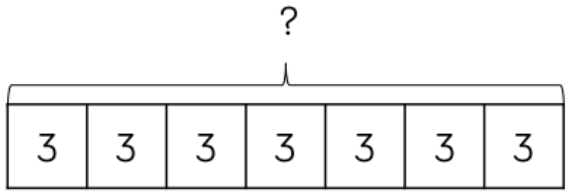
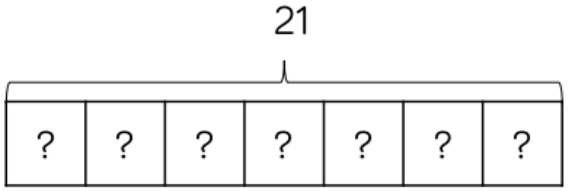
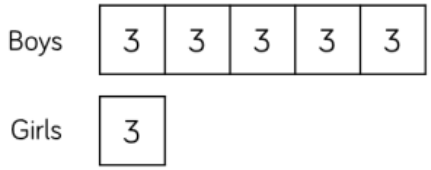
Method	Ways to use	Examples
Ten Frames (within 20)	Adding two single digits: Pupils can make each number on separate ten frames before moving part of one number to make 10. Subtracting a one-digit number from a two-digit number: Firstly, make the larger number on 2 ten frames then remove the smaller number. Adding three single-digit numbers: Pupils make each number on 3 separate 10 frames before considering which order to add them. Supports with making number bonds and making links to effective mental methods.	
Number Tracks	Support understanding of *augmentation* and *reduction*. Adding = counting on to find the *total*. Subtracting = counting back to find their answer. Use of counters to support. Works well alongside ten frames.	

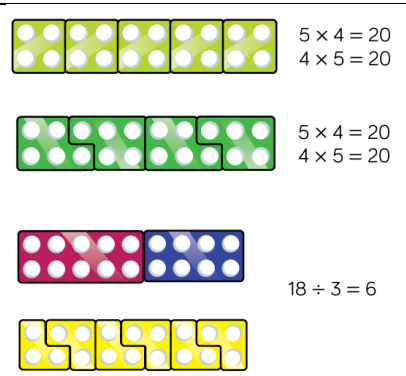
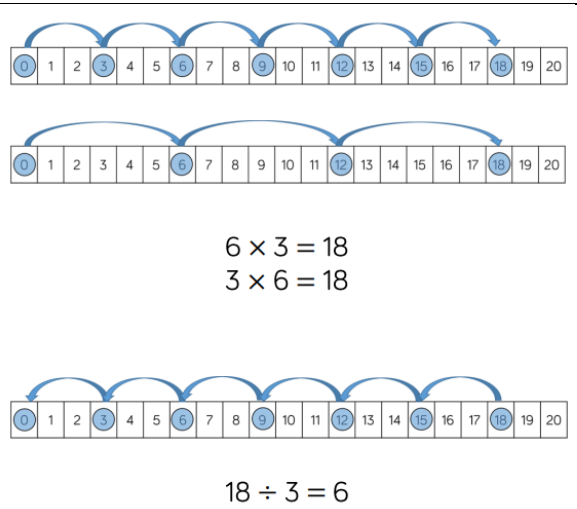
Method	Ways to use	Examples
Number Lines (labelled)	Start with counting forward and back in ones, skill links to number tracks. Develop further by dd/subtracting numbers by jumping to the nearest 10 and then jumping to find the *total*.	
Number Lines (blank)	Developing from labelled number lines, pupils can add by jumping to the nearest 10 and then adding the rest of the number as a whole or by adding the tens and ones separately. Same process for counting backwards. Find the *difference* between two numbers, starting at the smaller number then add the parts counted on to get answer.	

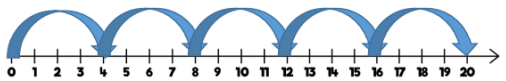
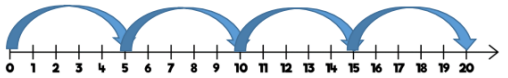
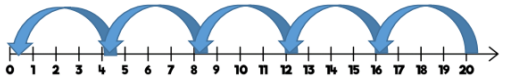
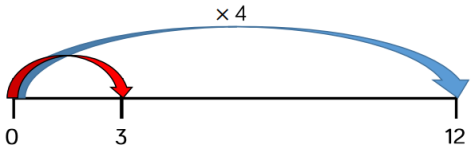
Method	Ways to use	Examples
Base Ten (addition)	Support with column addition. Write out calculations alongside using base ten to see the clear links. First add without an *exchange* before moving to *exchanging*. When adding, start with the smallest place value column. Place value counters better for larger numbers. Can be used for decimals by a one hundred square representing one.	 38 + 23 61 1  265 + 164 429 1
Base Ten (subtraction)	Support with column subtraction. Write out calculations alongside using base ten to see the clear links. First subtract without an *exchange* before moving to *exchanging*. Pupils should make the *minuend* using base ten, then subtract the *subtrahend*. When subtracting, start with the smallest place value column. Place value counters better for larger numbers.	 5 1 65 − 28 37  3 1 435 − 273 262

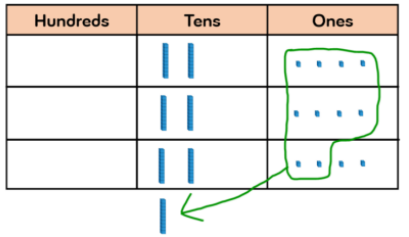
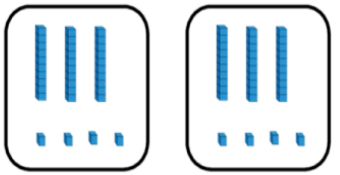
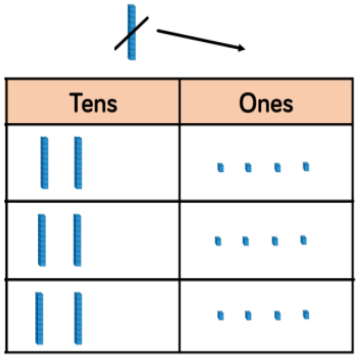
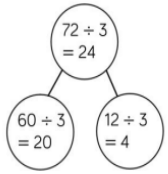
Method	Ways to use	Examples
Place Value Counters (addition)	Support with column addition. Write out calculations alongside using place value counters to see clear links. First add without an *exchange* before moving to *exchanging*. When adding, start with the smallest place value column. Non-value place value counters can be used with a place value chart.	 384 + 237 621 1 1  3.65 + 2.41 6.06 1
Place Value Counters (subtraction)	Support with column subtraction. Write out calculations alongside using base ten to see the clear links. First subtract without an *exchange* before moving to *exchanging*. Pupils should make the *minuend* using place value counters, then subtract the *subtrahend*. When subtracting, start with the smallest place value column. Non-value place value counters can be used with a place value chart.	 4 1 652 − 207 445  3 1 4357 − 2735 1622

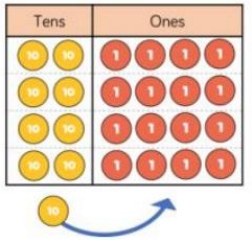
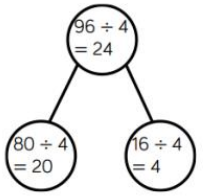
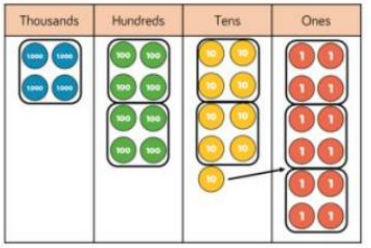
Methods – Multiplication and Division

Method	Ways to use	Examples
Bar Model	Use single bar model to represent multiplication as repeated addition. Can use counters, cubes or dots within the bar model to support calculation before moving on to placing digits. Division represented by showing the total of the bar model and dividing the bar into ewqual groups. *Scaling* questions use more than one vbar model to represent the type of problem. The multiple bar model allows you to compare the groups.	 $5 \times 5 = 25$  $3 \times 7 = 21$ $7 \times 3 = 21$  $21 \div 7 = 3$ 

Method	Ways to use	Examples
Numicon	Multiplication as repeated addition: Build multiplications in row using the Numicon. When adding odd numbers, pupils encouraged to interlock the shapes so there are no gaps in each row. Use to help discover patterns e.g. odd x odd = even, odd x even = odd, even x even = even Division: Pupils make the number they are dividing and then place the Numicon they are dividing by over the top of the number to find how many groups there are altogether.	
Number Tracks	Used to support counting in multiples, forwards and backwards. Moving counters/ cubes along the number track can support keeping track on counting. When multiplying, pupils place counters on 0 to start and then count to find the *product* of the numbers. When dividing, pupils place their counter on the number they are dividing and count in jumps of the number until they reach 0. Pupils record how many jumps they have made to find the answer of the division.	

Method	Ways to use	Examples
Number Lines (labelled)	Support counting multiples, forwards and backwards and calculating single digit multiplications. Multiplying: Pupils start at 0 then count to find the *product* of the numbers. Dividing: Start at the number they are dividing and then count back in jumps of the number by until they reach 0. Record how many jumps they made to find the answer of the division. Useful with small numbers.	  $4 \times 5 = 20$ $5 \times 4 = 20$  $20 \div 4 = 5$
Number Lines (blank)	Used to represent *scaling* as multiplication and division. Blank number lines with intervals can support with *scaling* accurately. Can label intervals with multiples to calculate *scaling* problems.	 A red car travels 3 miles. A blue car 4 times further. How far does the blue car travel?  A blue car travels 12 miles. A red car 4 times less. How far does the red car travel?

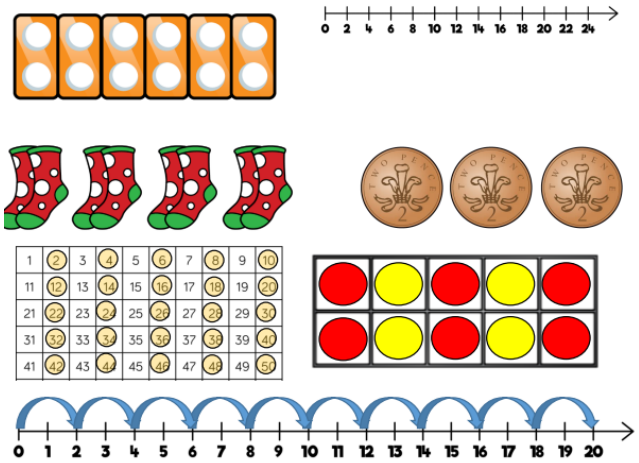
Method	Ways to use	Examples
Base Ten (multiplication)	Support with column multiplication. Pupils to write out their calculation alongside the equipment so they can see how the concrete and written representations match. Suitable for smaller numbers.	 24 × 3 72 1
Base Ten (division)	Support with division. When numbers become larger, can be effective to move pupils from representing numbers as ones towards representing them as tens and ones to divide. When sharing, pupils start with the larger place value and work from left to right. If there are any left in a column, they *exchange* e.g. one ten for ten ones.	 68 ÷ 2 = 34  72 ÷ 3 = 24 

Method	Ways to use	Examples
Place Value Counters (multiplication)	Support with column multiplication. Pupils to write out their calculation alongside the equipment so they can see how the concrete and written method match. Suitable for smaller numbers.	 34 × 5 = 170 (1 2) 44 × 32 = 8 + 80 + 120 + 1200 = 1408 (1)
Place Value Counters (division)	Support with understanding division. When working with smaller numbers, pupils use place value counters to share between groups. Start by sharing the larger place value column and work from left to right. Support understanding of short division by grouping the counters rather than sharing them.	   1223 remainder 1 (4 | 4892)

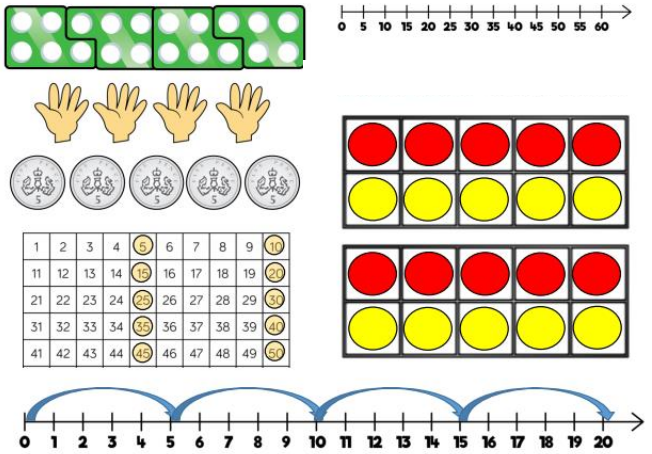
Skills

Times Tables

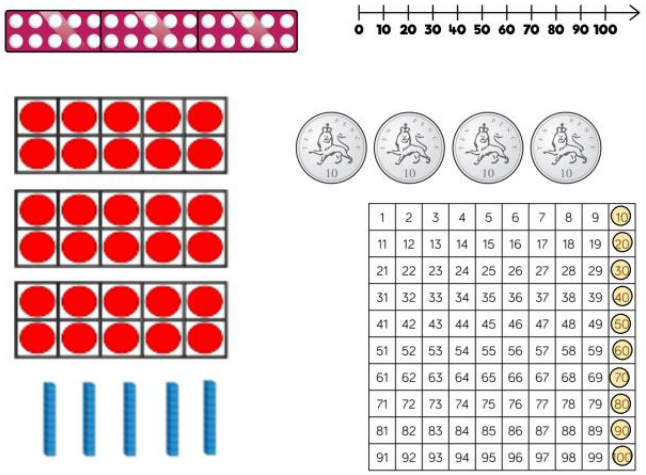
X2 (stage 2)



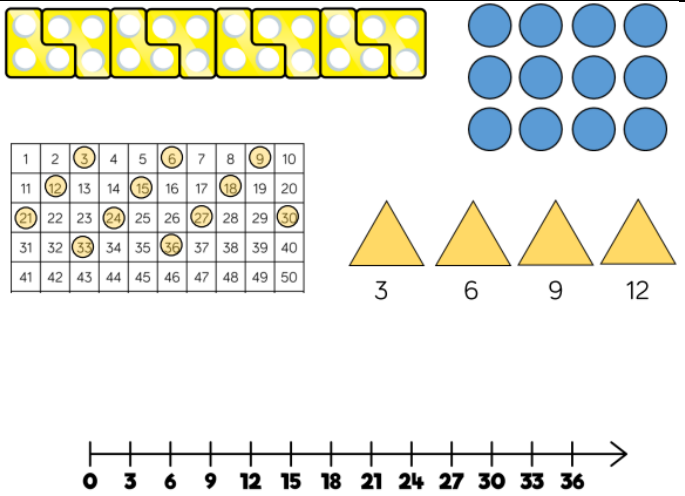
X5 (stage 2)



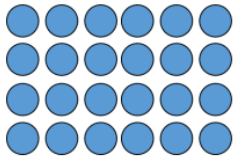
X10 (stage 2)

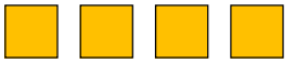


X3 (stage 3)

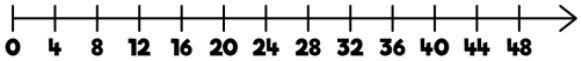


X4 (stage 3)

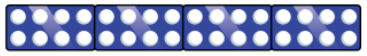


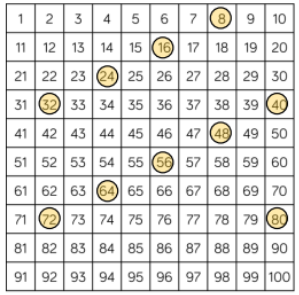


4	8	12	16	20
24	28	32	36	40
44	48	52	56	60

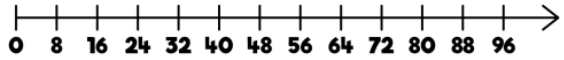


X8 (stage 3)

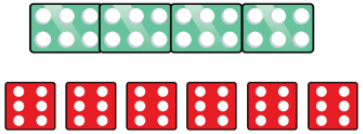


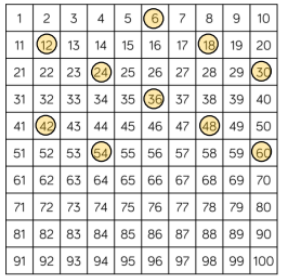


8	16	24	32	40
48	56	64	72	80

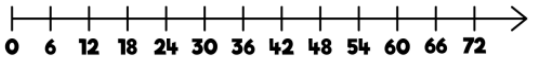


X6 (stage 4)

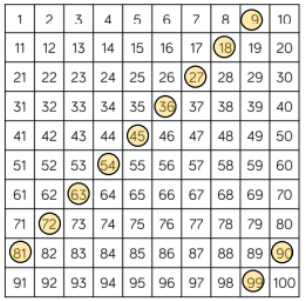




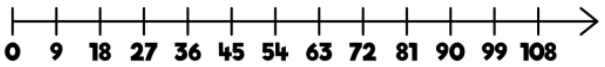
6	12	18	24	30
36	42	48	54	60
66	72	78	84	90



X9 (stage 4)



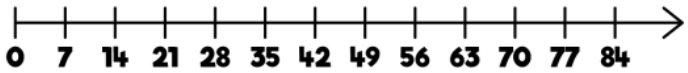
9	18	27	36	45
54	63	72	81	90



X7 (stage 4)

7	14	21	28	35
42	49	56	63	70

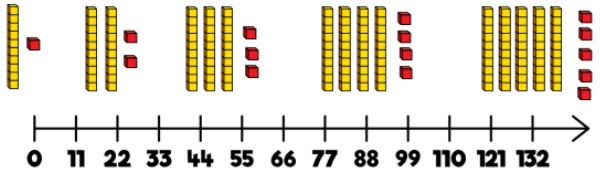
1	2	3	4	5	6	(7)	8	9	10
11	12	13	(14)	15	16	17	18	19	20
(21)	22	23	24	25	26	27	(28)	29	30
31	32	33	34	(35)	36	37	38	39	40
41	(42)	43	44	45	46	47	48	(49)	50
51	52	53	54	55	(56)	57	58	59	60
61	62	(63)	64	65	66	67	68	69	(70)
71	72	73	74	75	76	(77)	78	79	80
81	82	83	(84)	85	86	87	88	89	90
(91)	92	93	94	95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



X11 (stage 4)

11	22	33	44	55	66
77	88	99	110	121	132

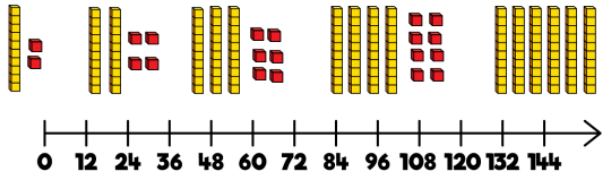
1	2	3	4	5	6	7	8	9	10
(11)	12	13	14	15	16	17	18	19	20
21	(22)	23	24	25	26	27	28	29	30
31	32	(33)	34	35	36	37	38	39	40
41	42	43	(44)	45	46	47	48	49	50
51	52	53	54	(55)	56	57	58	59	60
61	62	63	64	65	(66)	67	68	69	70
71	72	73	74	75	76	(77)	78	79	80
81	82	83	84	85	86	87	(88)	89	90
91	92	93	94	95	96	97	98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



X12 (stage 4)

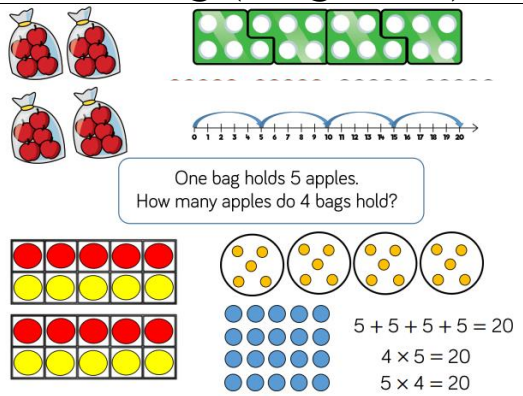
12	24	36	48	60
72	84	96	108	120
132	144			

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

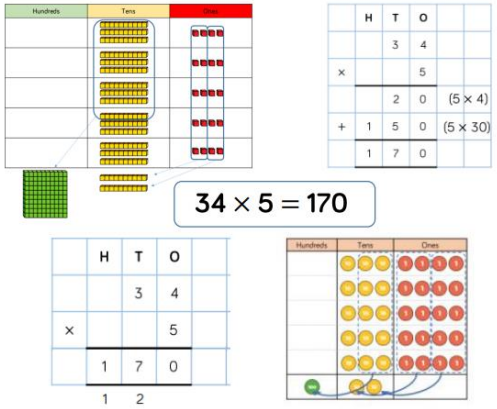


Multiplication

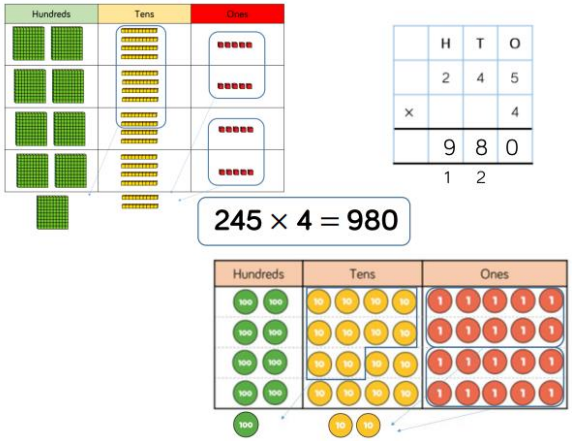
Solve 1-step problems using multiplication – sharing (stage 1/2)



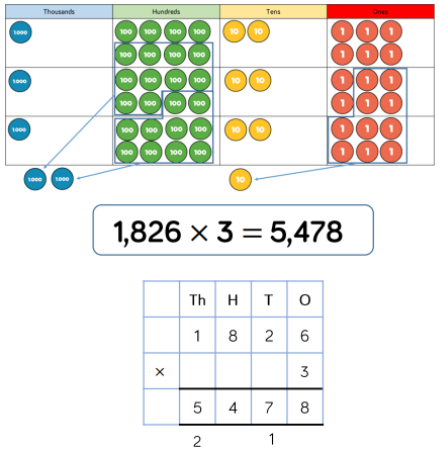
Multiply 2-digit numbers by 1-digit numbers (stage 3/4)



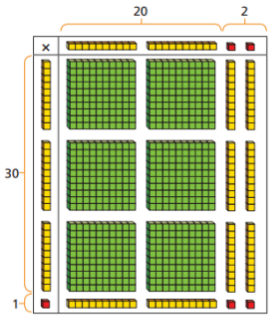
Multiply 2-digit numbers by 1-digit numbers (stage 3/4)



Multiply 4-digit numbers by 1-digit numbers (stage 5)



Multiply 2-digit numbers by 2-digit numbers (stage 5)

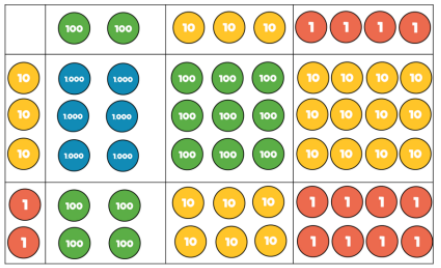


×	20	2
30	600	60
1	20	2

	H	T	O
		2	2
×		3	1
		2	2
	6	6	0
	6	8	2

$22 \times 31 = 682$

Multiply 3-digit numbers by 2-digit numbers (stage 5)



Th	H	T	O
	2	3	4
×		3	2
	4	6	8
1 7	1 0	2	0
7	4	8	8

×	200	30	4
30	6,000	900	120
2	400	60	8

$234 \times 32 = 7{,}488$

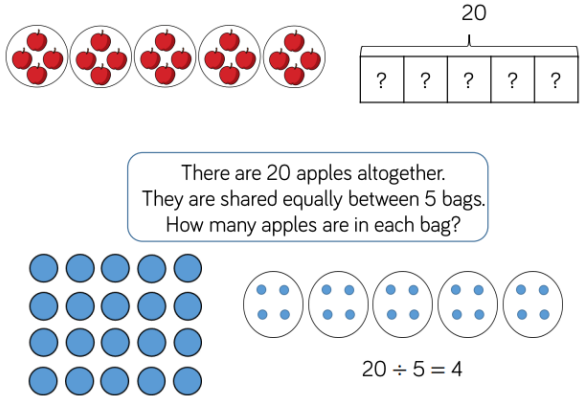
Multiply 4-digit numbers by 2-digit numbers (stage 5)

TTh	Th	H	T	O
	2	7	3	9
×			2	8
2 2	1 5	9 3	1 7	2
5 1	4	7 1	8	0
7	6	6	9	2
		1		

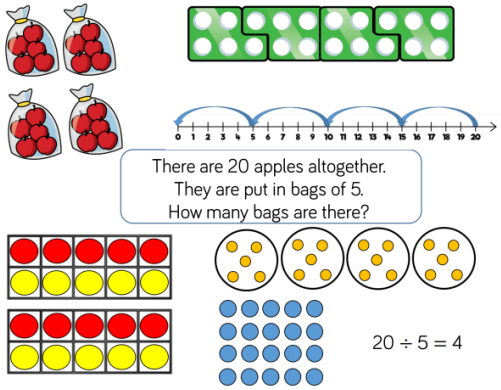
$2{,}739 \times 28 = 76{,}692$

Division

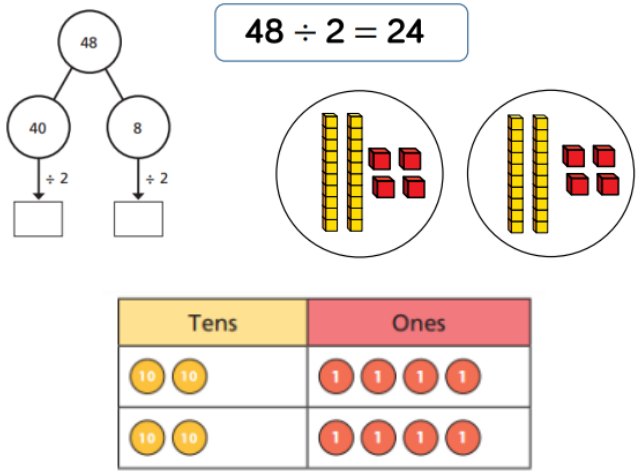
Solve 1-step problems using multiplication - sharing (stage 1/2)



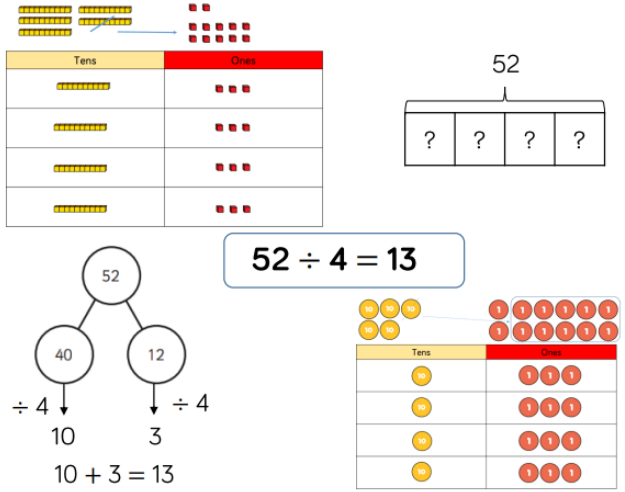
Solve 1-step problems using division - grouping (stage 1/2)



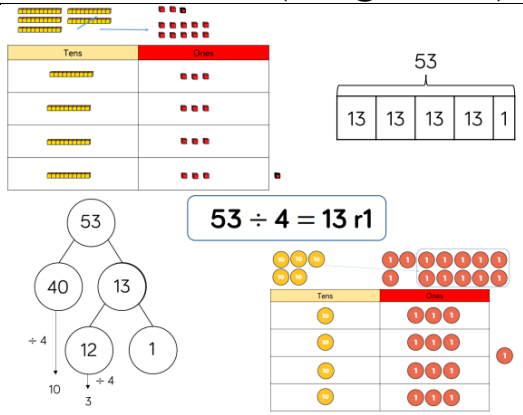
Divide 2-digits by 1-digit – sharing with no exchange (stage 1/2)



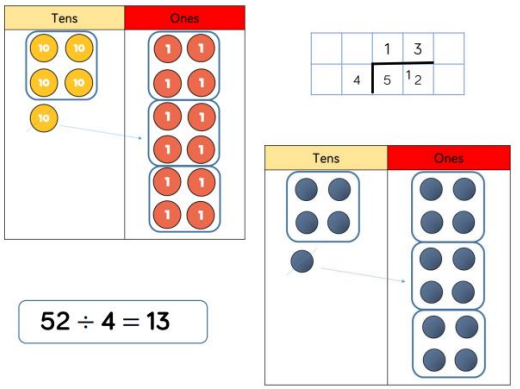
Divide 2-digits by 1-digit – sharing with exchange (stage 3/4)



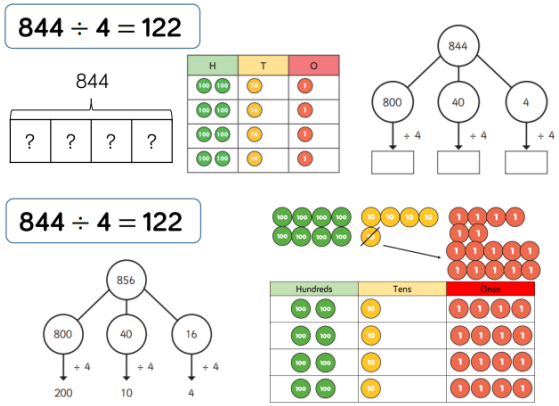
Divide 2-digits by 1-digit – sharing with remainders (stage 3/4)



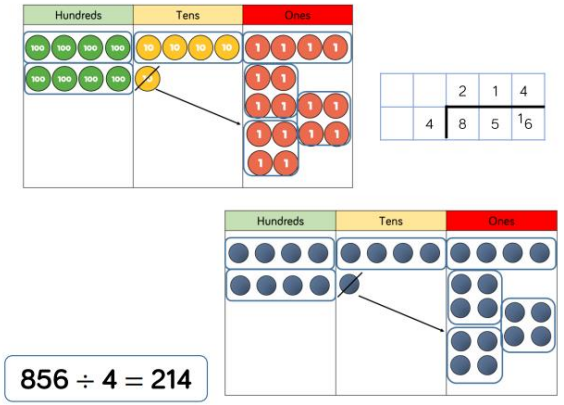
Divide 2-digits by 1-digit – grouping (stage 4/5)



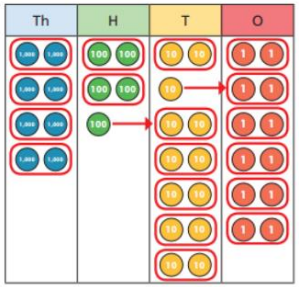
Divide 3-digits by 1-digit – sharing (stage 4)



Divide 3-digits by 1-digit – grouping (stage 5)



Divide 4-digits by 1-digit – grouping (stage 5)

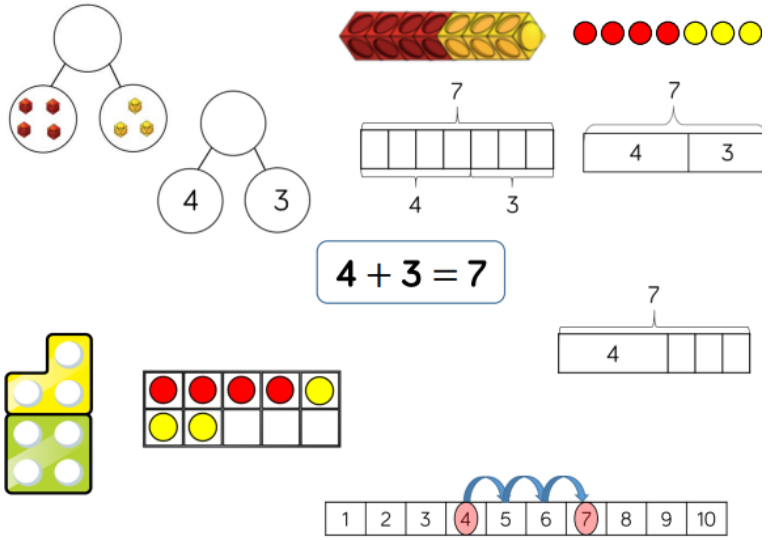


	4	2	6	6
2	8	5	$^{1}3$	$^{1}2$

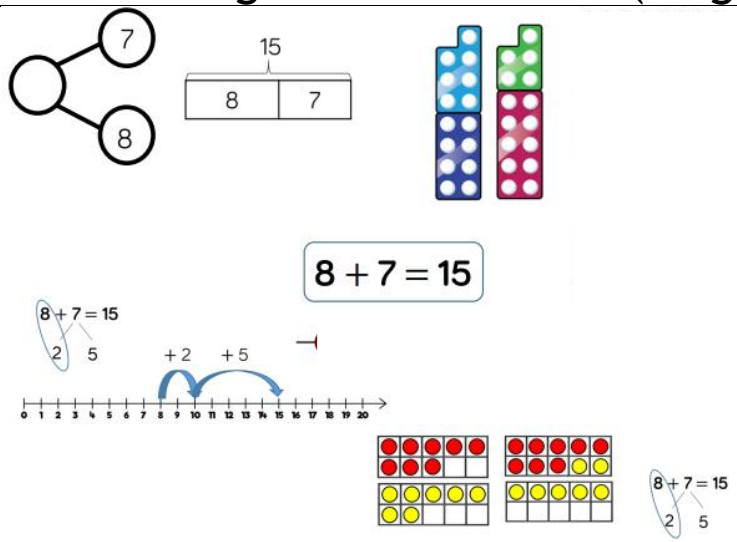
8,532 ÷ 2 = 4,266

Addition

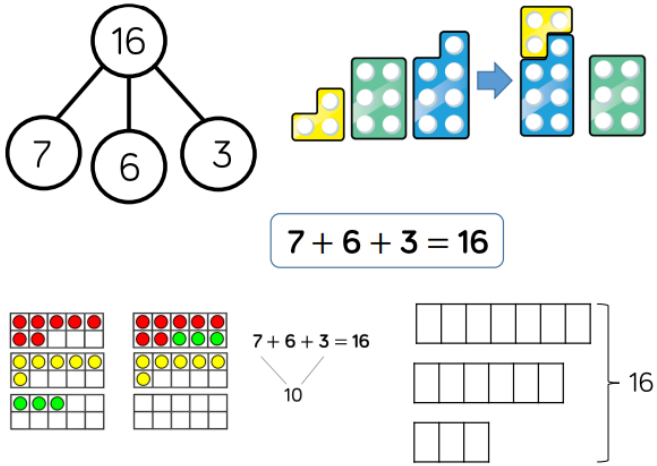
Add two 1-digt numbers to 10 (stage 1)



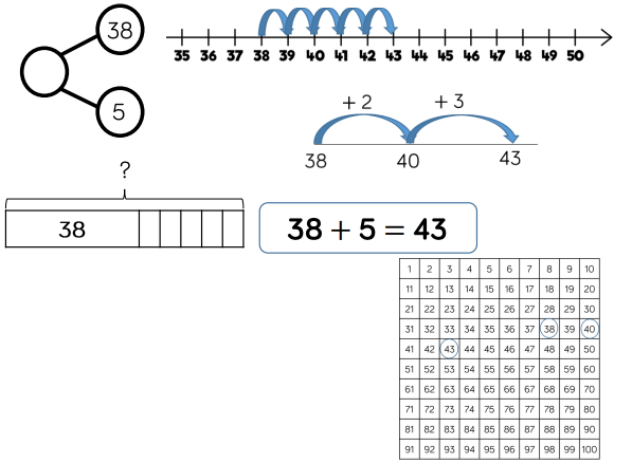
Add 1 and 2-digit numbers to 20 (stage 1)



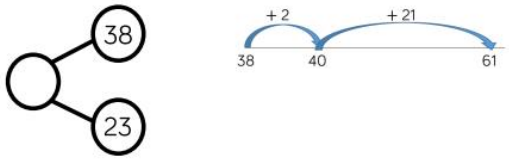
Add three 1-digit numbers (stage 2)

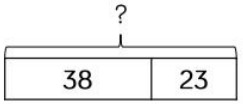


Add 1 and 2-digit numbers to 100 (stage 2)

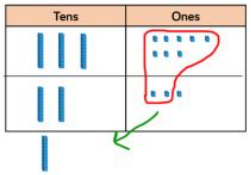


Add two 2-digit numbers (stage 2)

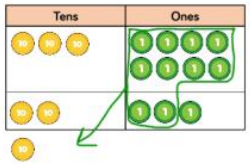




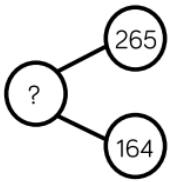
$38 + 23 = 61$

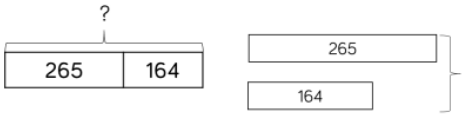


$$\begin{array}{r} 38 \\ +\ 23 \\ \hline 61 \\ \scriptstyle 1 \end{array}$$

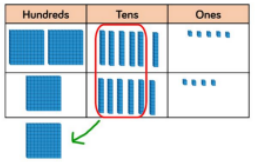


Add with up to 3-digits (stage 3)

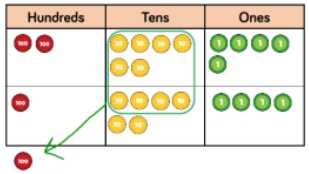




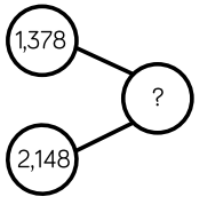
$265 + 164 = 429$

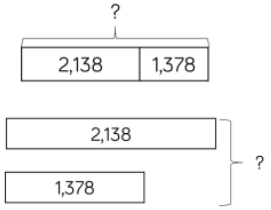


$$\begin{array}{r} 265 \\ +\ 164 \\ \hline 429 \\ \scriptstyle 1 \end{array}$$



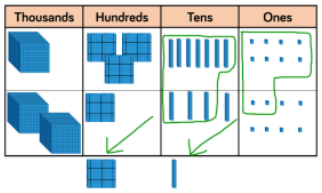
Add with up to 4-digits (stage 4)

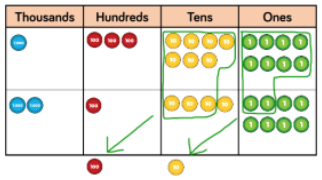




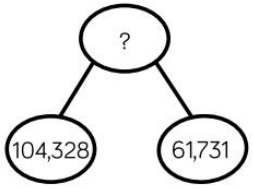
$$\begin{array}{r} 1\,3\,7\,8 \\ +\ 2\,1\,4\,8 \\ \hline 3\,5\,2\,6 \\ \scriptstyle 1\ 1 \end{array}$$

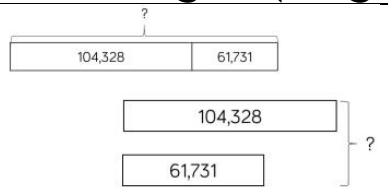
$1,378 + 2,148 = 3,526$



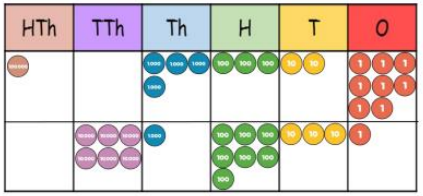


Add with more than 4 digits (stage 5)



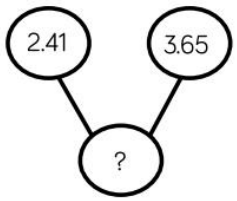


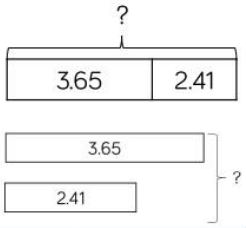
$104,328 + 61,731 = 166,059$



$$\begin{array}{r} 1\,0\,4\,3\,2\,8 \\ +\ 6\,1\,7\,3\,1 \\ \hline 1\,6\,6\,0\,5\,9 \\ \scriptstyle 1 \end{array}$$

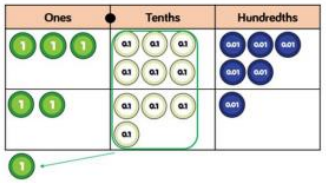
Add with up to 3 decimal places (stage 5)

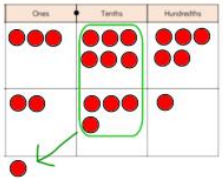




$$\begin{array}{r} 3.65 \\ +\ 2.41 \\ \hline 6.06 \\ \hline 1 \end{array}$$

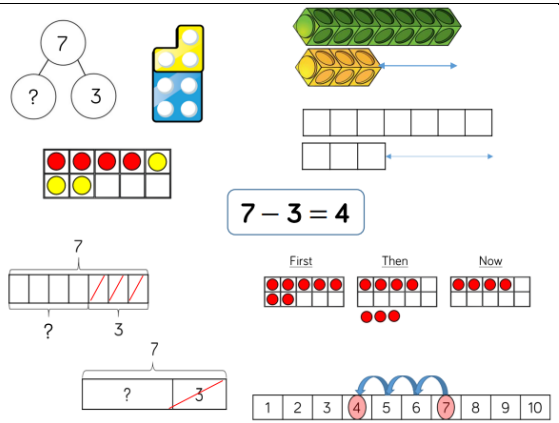
$$3.65 + 2.41 = 6.06$$



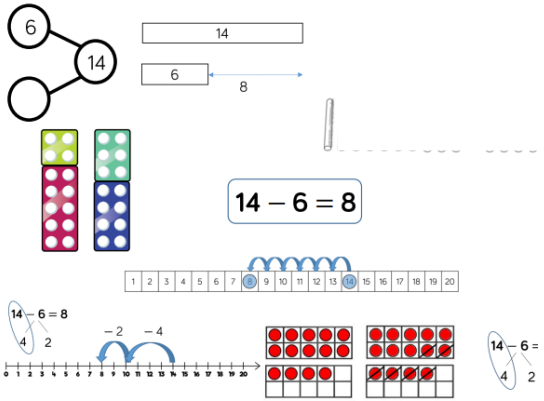


Subtraction

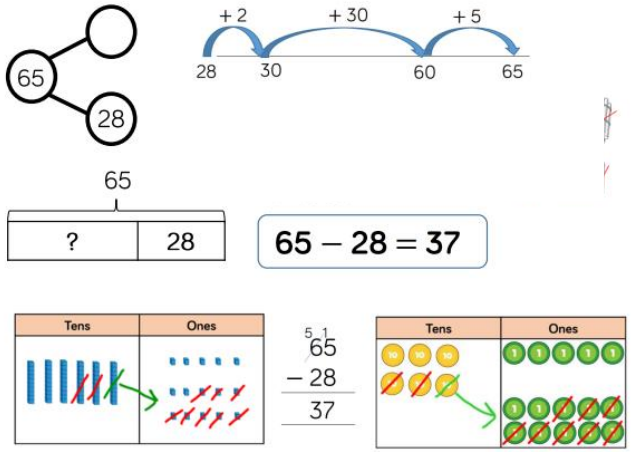
Subtract two 1-digit numbers to 10 (stage 1)



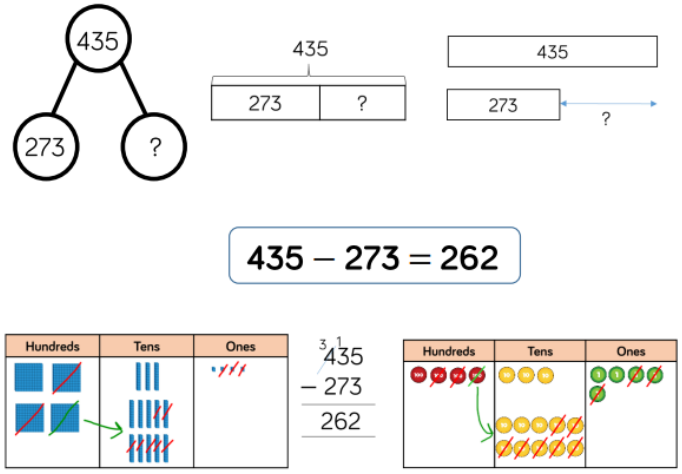
Subtract 1 and 2-digit numbers to 20 (stage 1)



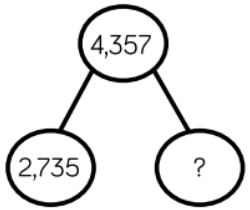
Subtract 1 and 2-digit numbers to 100 (stage 2)

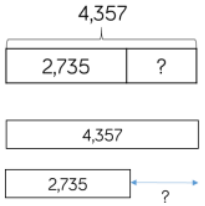


Subtract with up to 3-digits (stage 3)



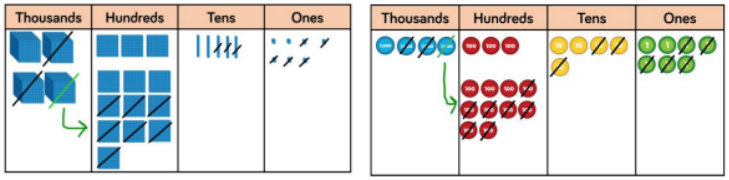
Subtract with up to 4-digits (stage 4)



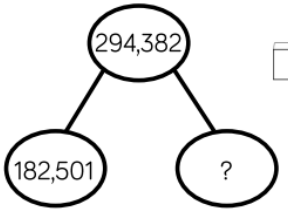


$$\begin{array}{r} {}^{3}\cancel{4}\,{}^{1}\cancel{3}\,5\,7 \\ -\ 2\,7\,3\,5 \\ \hline 1\,6\,2\,2 \end{array}$$

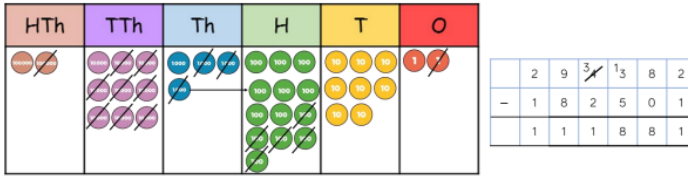
4,357 − 2,735 = 1,622



Subtract with more than 4 digits (stage 5)

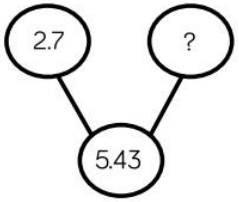


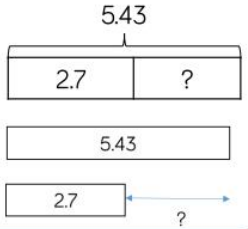
294,382 − 182,501 = 111,881



	2	9	$^{3}\cancel{4}$	$^{1}3$	8	2
−	1	8	2	5	0	1
	1	1	1	8	8	1

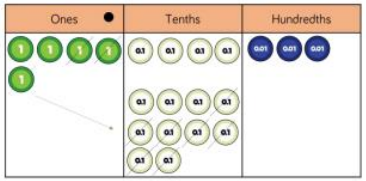
Subtract up to 3 decimal places (stage 5)

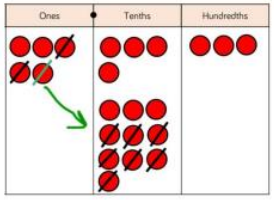


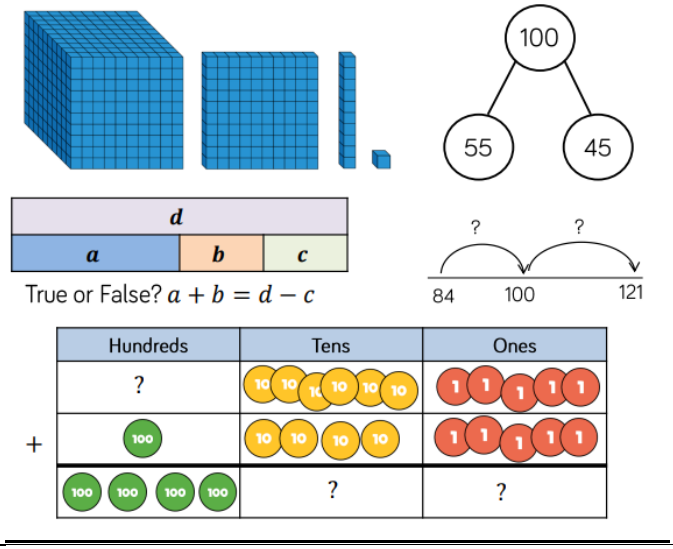
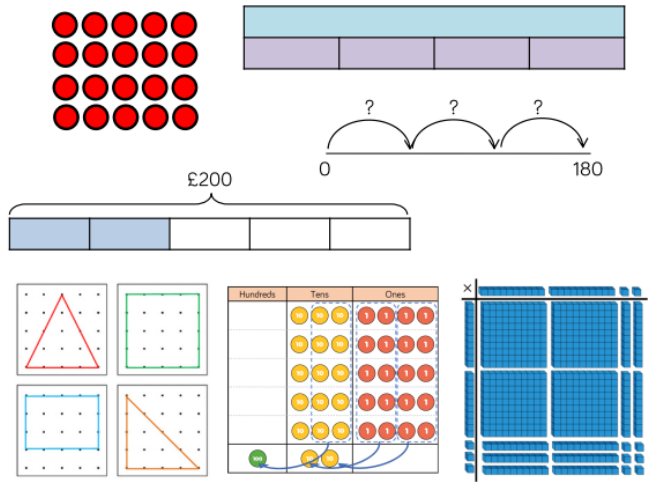


$$\begin{array}{r} {}^{4}\,{}^{1}\cancel{5}.43 \\ -\ 2.7 \\ \hline 2.73 \end{array}$$

5.43 − 2.7 = 2.73





Stage 7		
Addition and Subtraction	Numbers lines are useful. Linking formal methods using place value counters/ base 10 illustrating exchanges is very useful.	
Multiplication and Division	*Arrays* of counters are useful. Number lines are useful to illustrate links between multiplication and repeated addition, and division and repeated subtraction. Linking formal methods to using place value counters/ base 10 blocks illustrating the result of increasing factors by 10.	

Glossary **Addition and Subtraction**

Aggregation	Combining two or more quantities to find a total.
Augmentation	Increasing a quantity or measure by another quantity.
Difference	The numerical difference between two numbers is found by comparing the quantity in each group.
Exchange	Change a number or expression for another of an equal value.
Minuend	A quantity or number from which another is subtracted.
Partitioning	Splitting a number into its component parts.
Reduction	Subtraction as take away.
Subitise	Instantly recognise the number of objects in a small group without needing to count.
Subtrahend	A number to be subtracted from another.
Total	The aggregate or the sum found by addition.

Multiplication and Division

Array	An ordered collection of counters, cubes or other item in rows and columns.
Exchange	Change a number or expression for another of an equal value.
Partitioning	Splitting a number into its component parts.
Product	The result of multiplying one number by another.
Remainder	The amount left over after a division when the divisor is not a factor of the dividend.
Scaling	Enlarging or reducing a number by a given amount, called the scale factor.