

DNEAT Calculation Progression

This calculation progression is to support schools within DNEAT in writing their own calculation policy. This progression is not to replace calculation policies which are the responsibility of each school.



Diocese of Norwich
Education and
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Educator
Solutions 

This calculation progression has been created by subjects leaders within DNEAT and a dedicated team of maths ambassadors listed below.



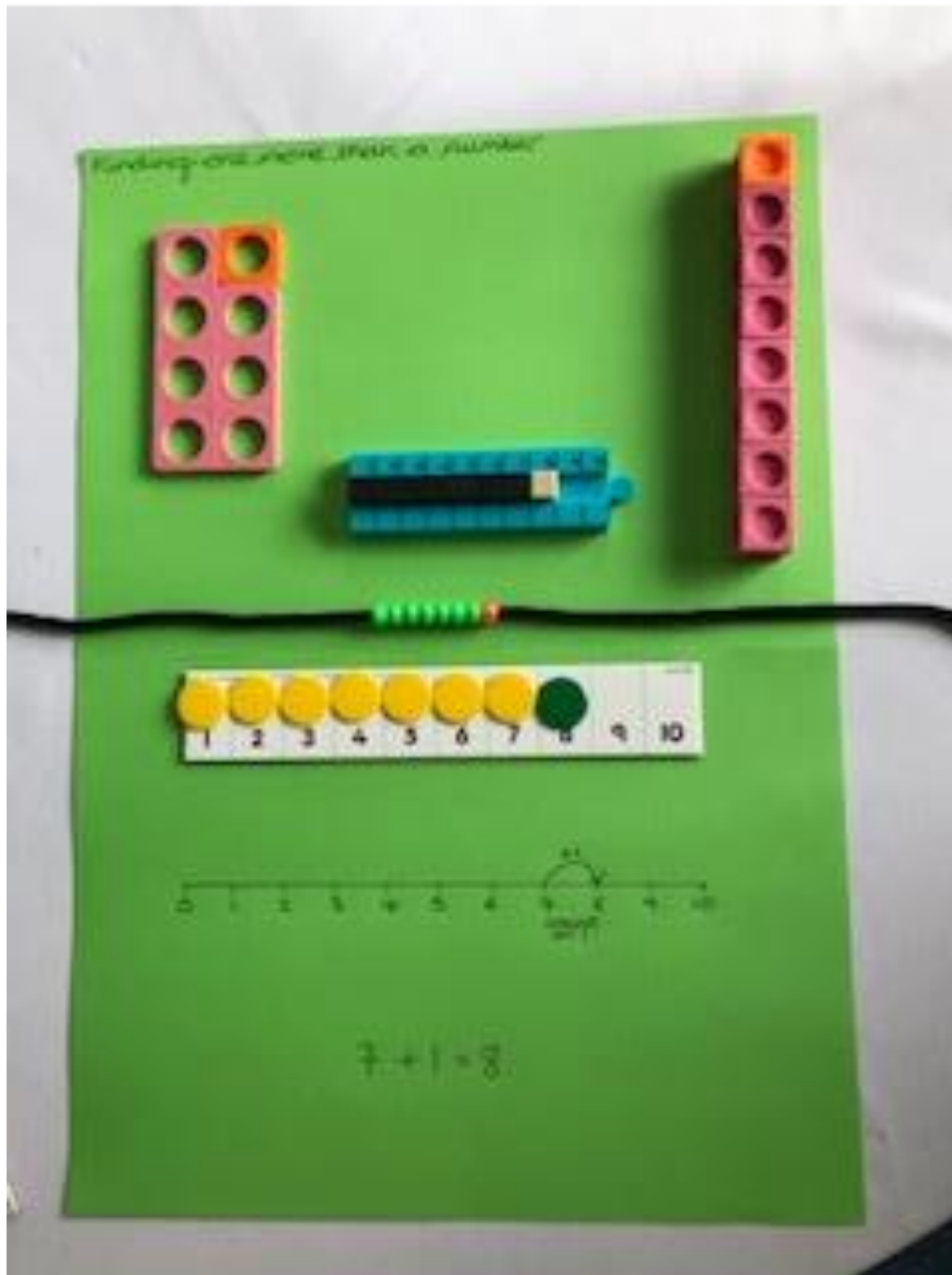
Name	School
Kalle Boyle *	The Bishop's C of E Primary Academy
Sharon Brett *	Cawston C of E Primary Academy
Becki Bunkle *	Dereham Church of England Junior Academy
Lee Frost	Swaffham C of E Junior School
Christina Maskell *	Nar Valley Federation
Andy Petersen	Hopton Church of England Primary Academy
Rebekah Smithee	St Michael's C of E Academy
Rebecca Tovell	Peterhouse C of E Primary Academy
Zoe Warren	Whitefriars C of E Primary Academy

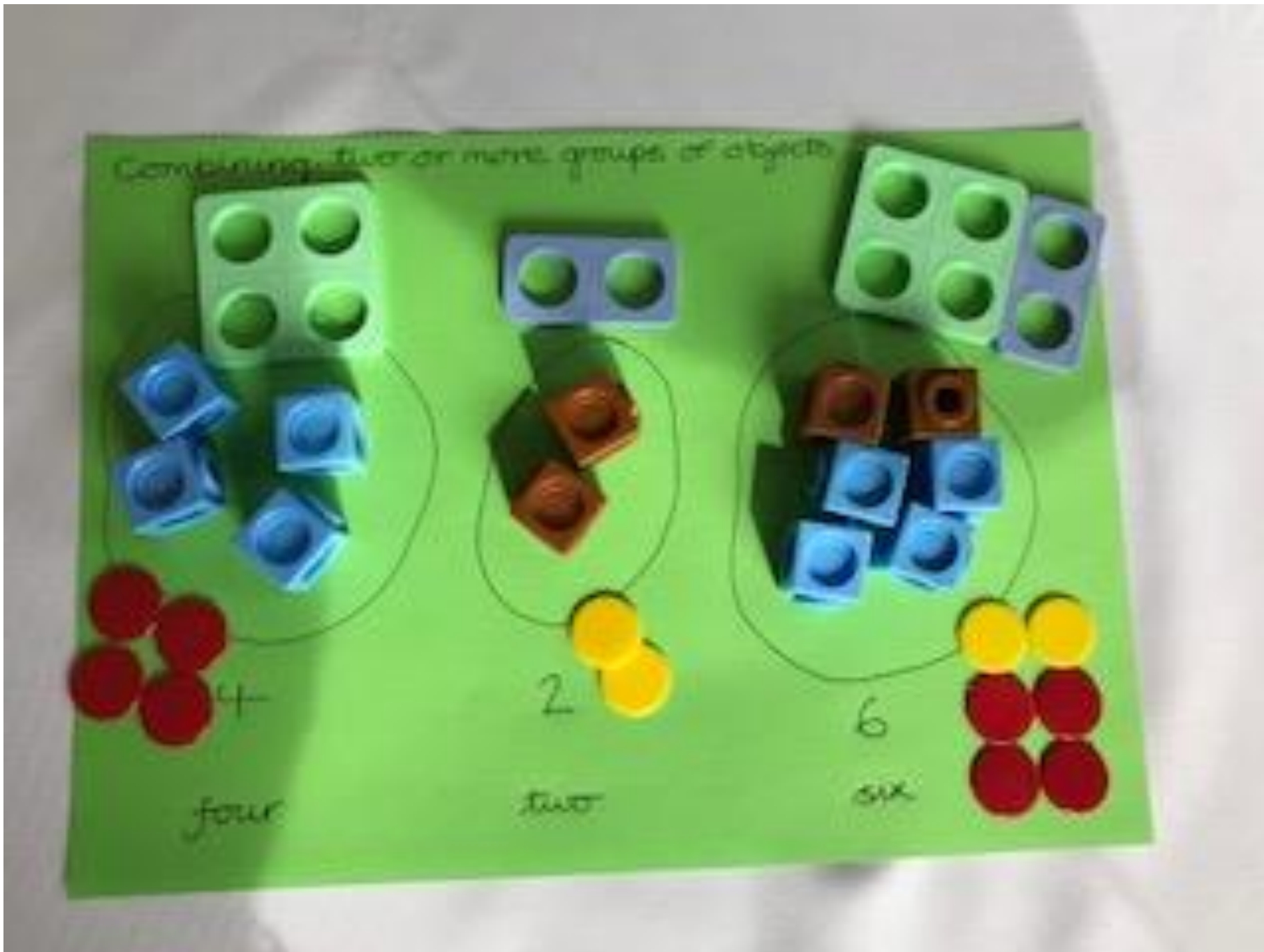
With thanks also to Mathematics Advisers, Anna Hogg and Sarah Jay from Educator Solutions who have provided knowledge, support and guidance throughout the creation of this progression.

* These ambassadors attended all twilight sessions working on the calculation progression.

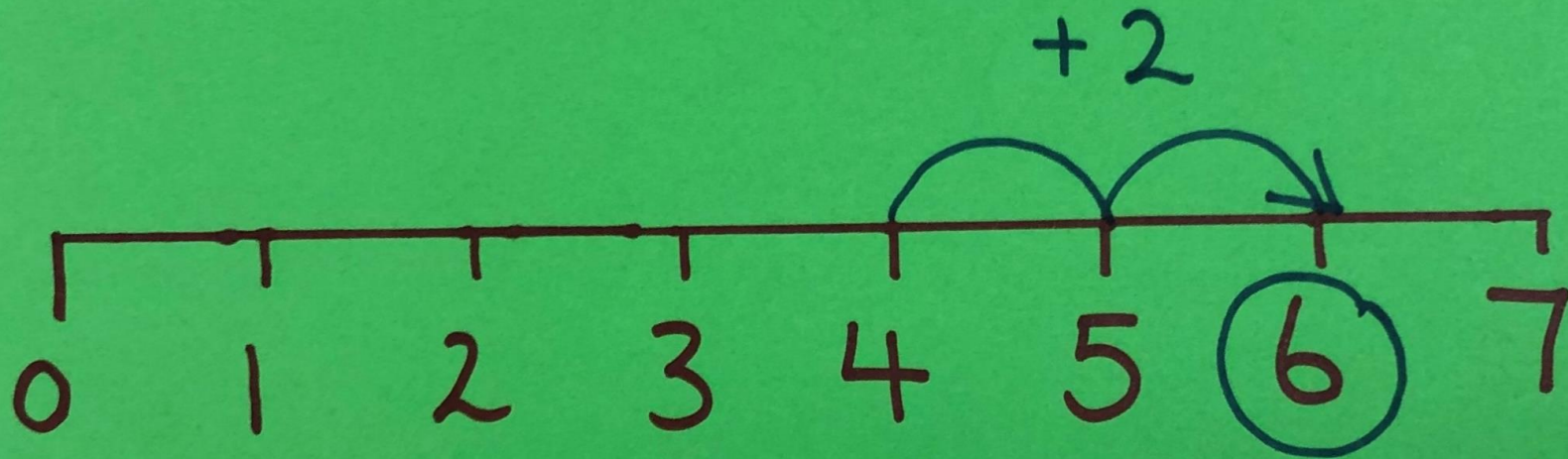


Addition

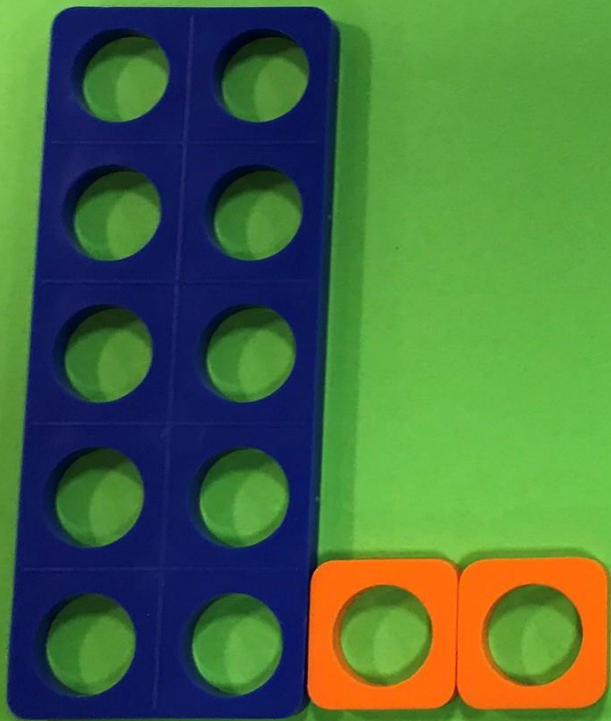




$$4 + 2$$



Making teen numbers

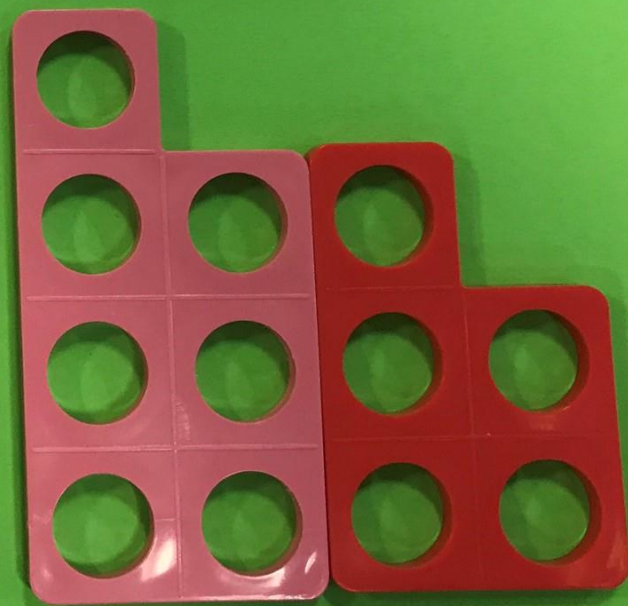


12 = 1 lot of 10
2 ones

or 6 + 6
2 lots of 6



or 7 + 5
1 lot of 7
1 lot of 5



making ten



$$6 + 4 = \square$$

$$6 + \square = 10$$

$$10 = \square + 4$$

$$10 = 6 + \square$$



0 1 2 3 4 5 6 7 8 9 10




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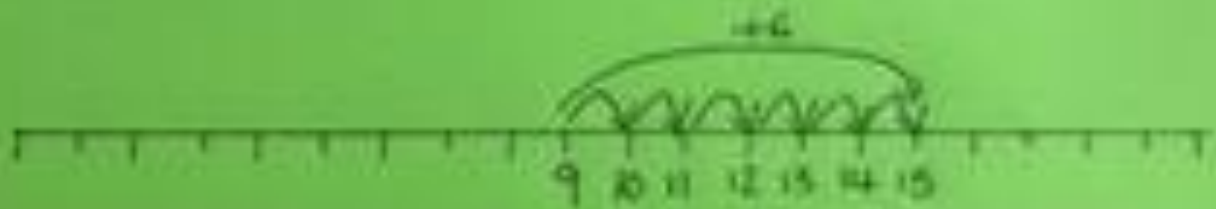
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Starting at the bigger number and counting on

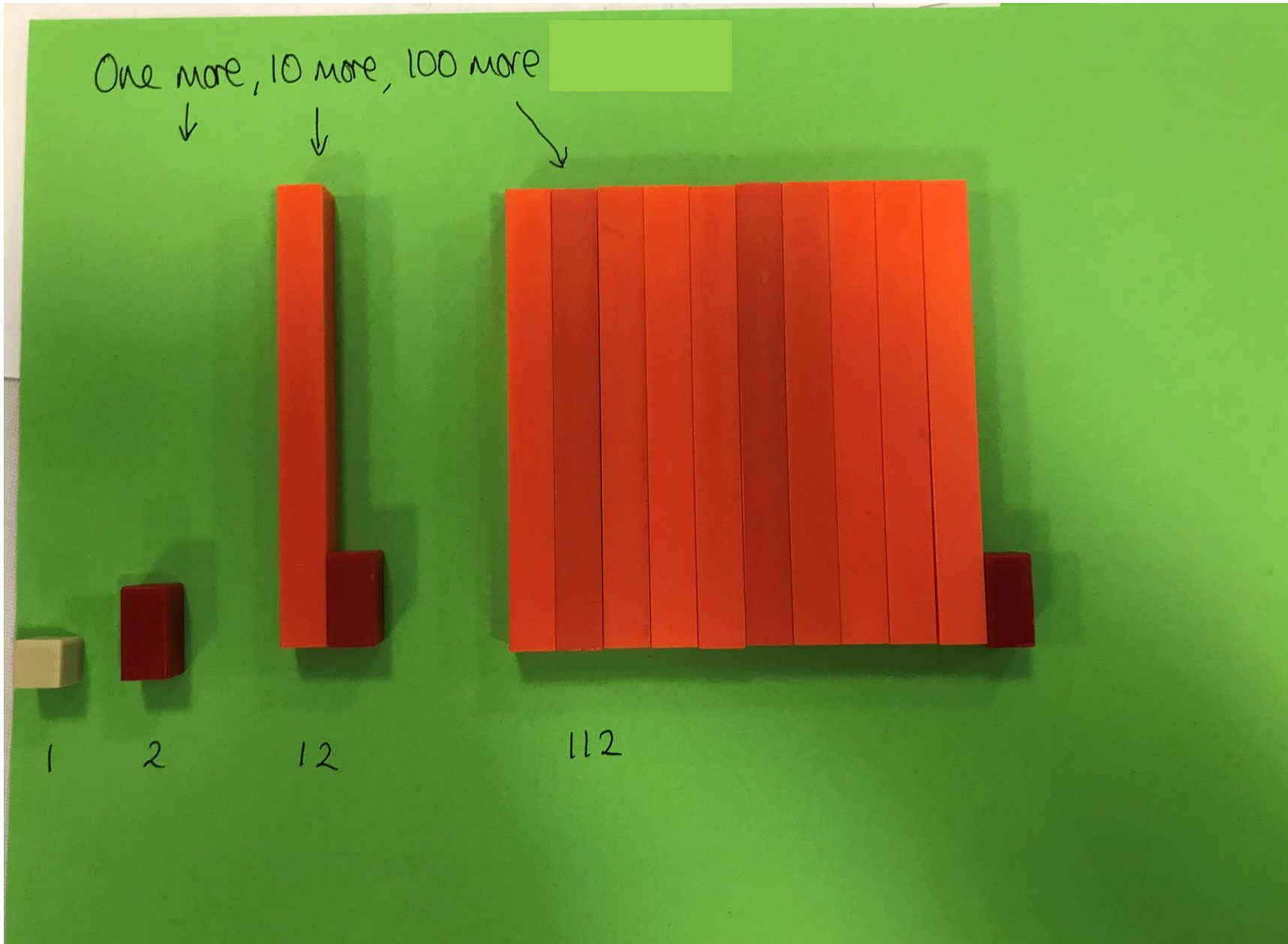
$9 + 6$



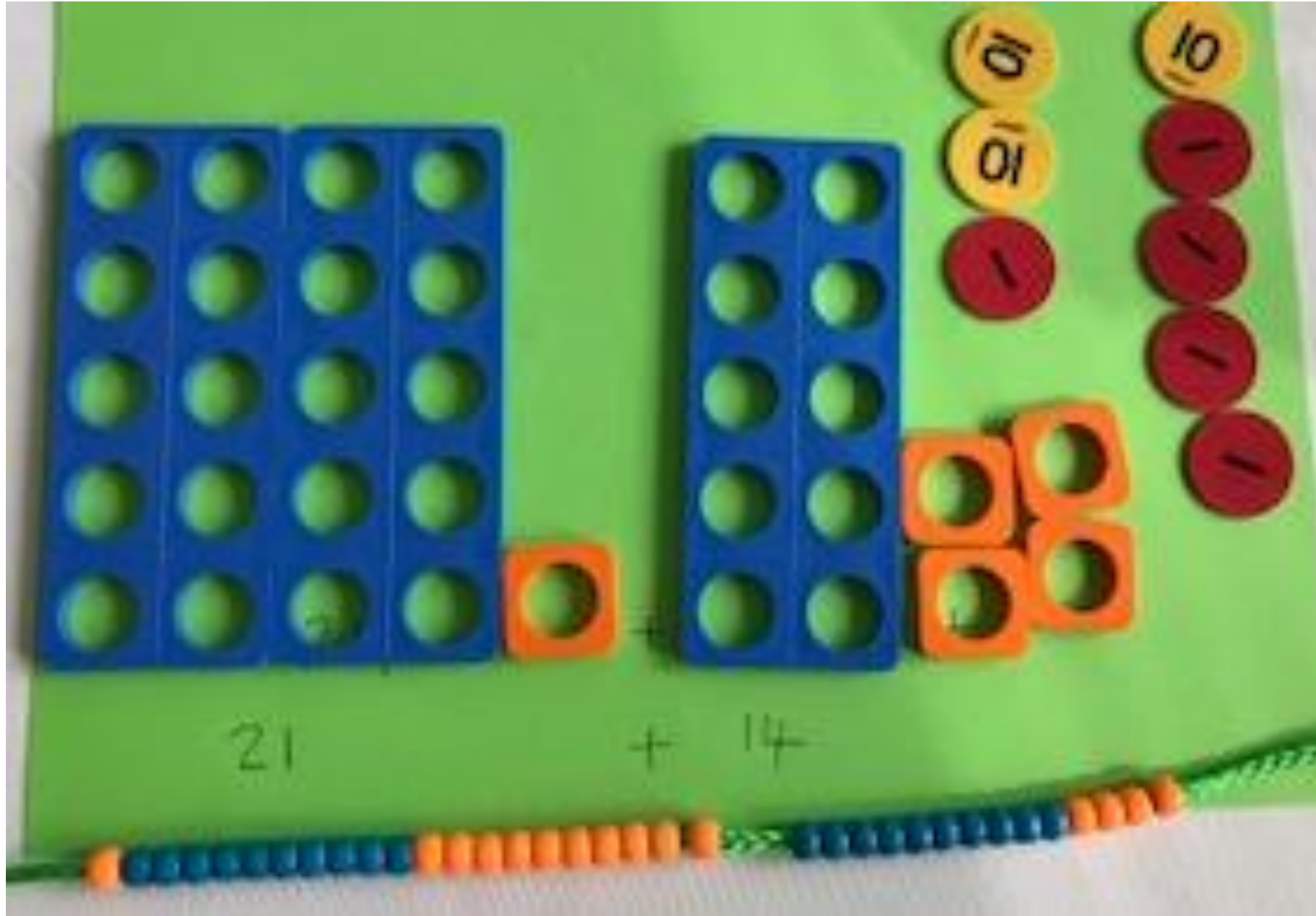
A blue ruler with a dark blue section is placed below the string.



A number line is drawn below the ruler, showing a jump from 9 to 15, with a curved arrow labeled '+6' above it.

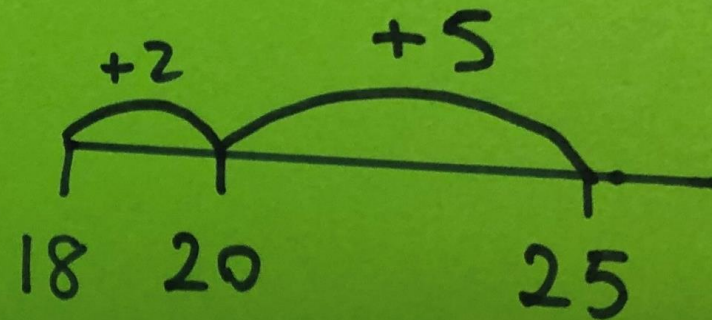
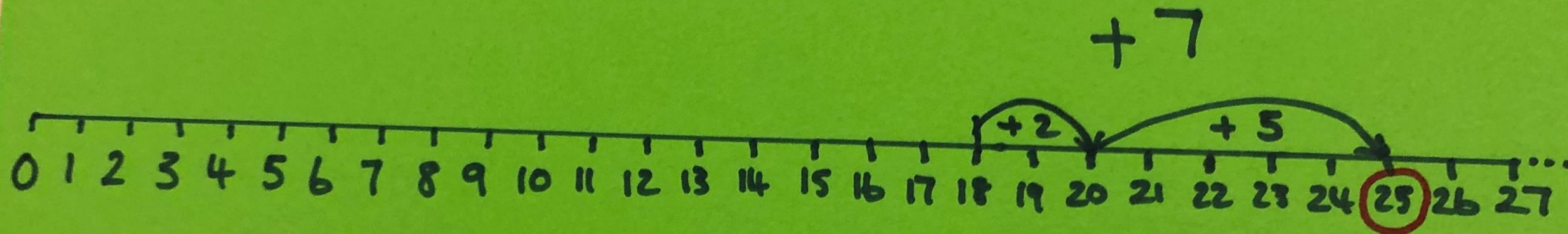


Place value: partition numbers into tens and ones

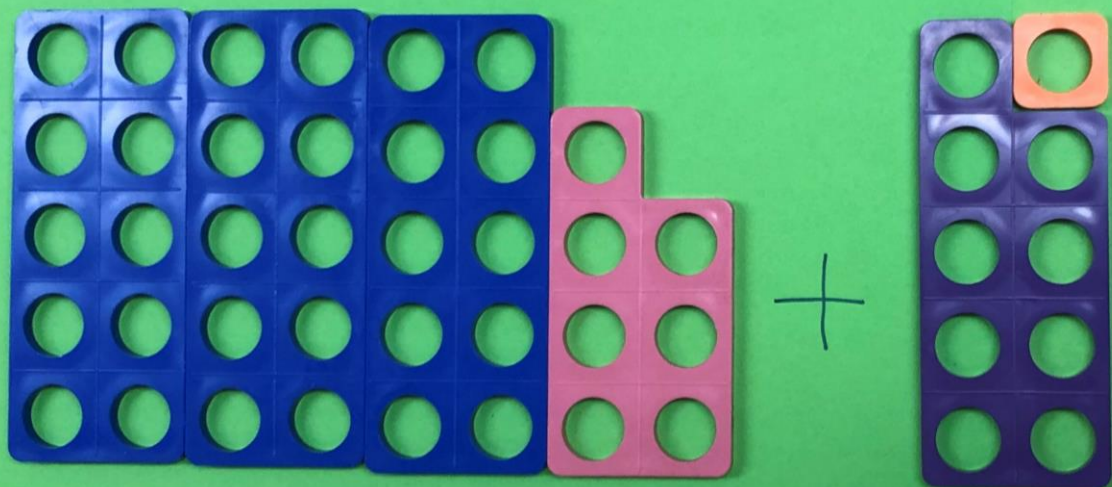




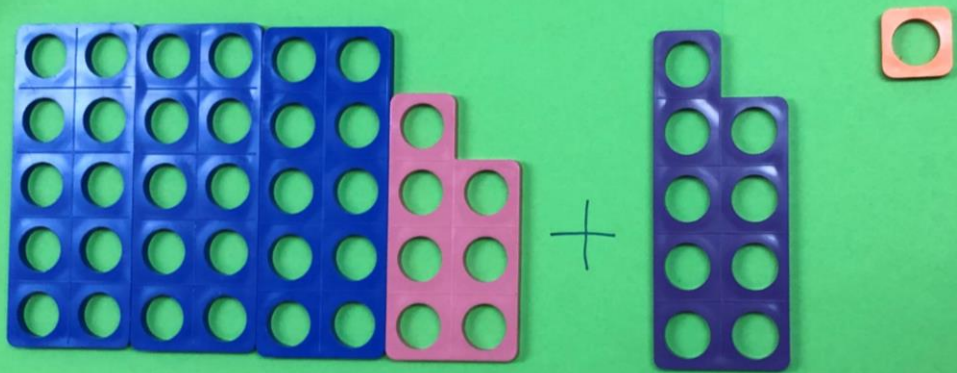
$$18 + 7 = 25$$



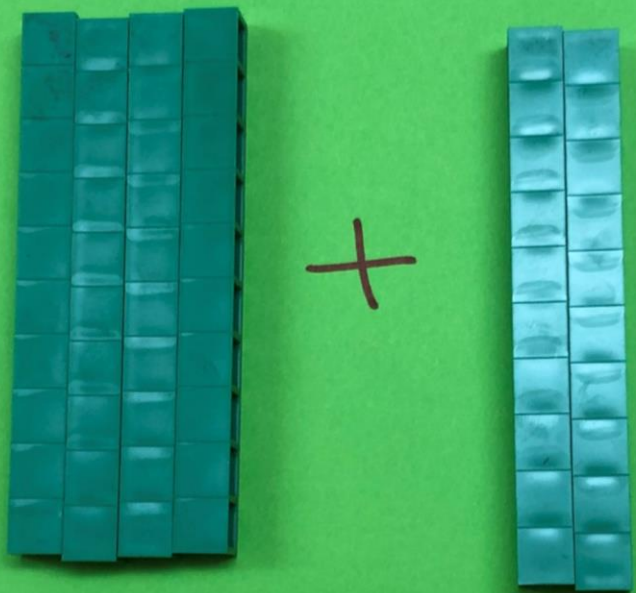
$$37 + 9 = 37 + (10 - 1)$$



$$37 + 9 = 37 + (10 - 1) = 46$$

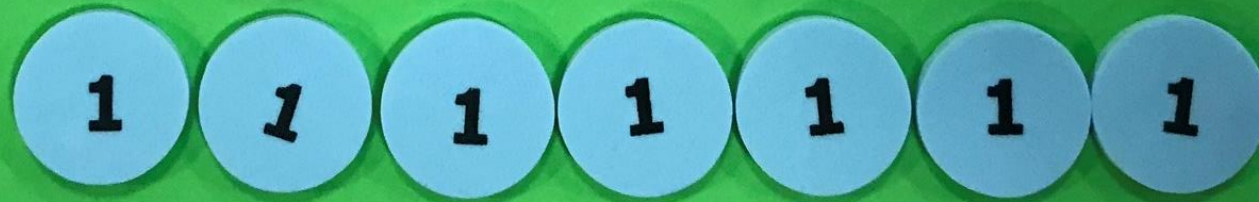


$$42 + 23$$



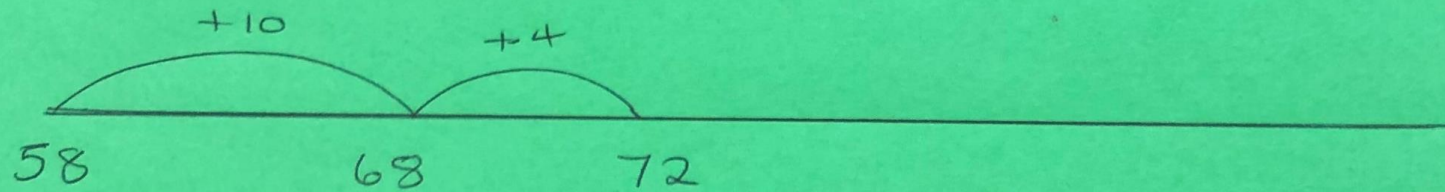
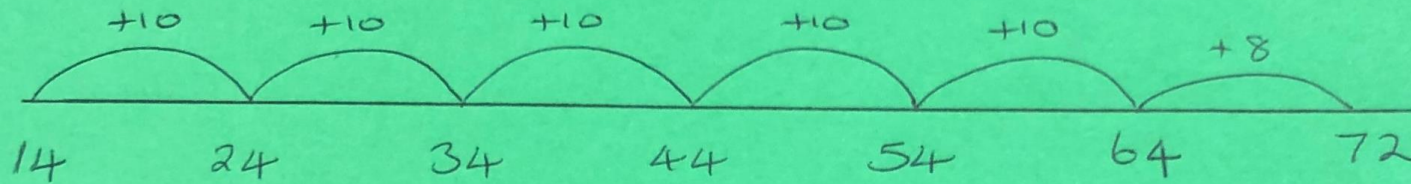
Expanded Column method with concrete representation

$$\begin{array}{r} 65 \\ + 27 \\ \hline \end{array}$$



Efficient number line v inefficient

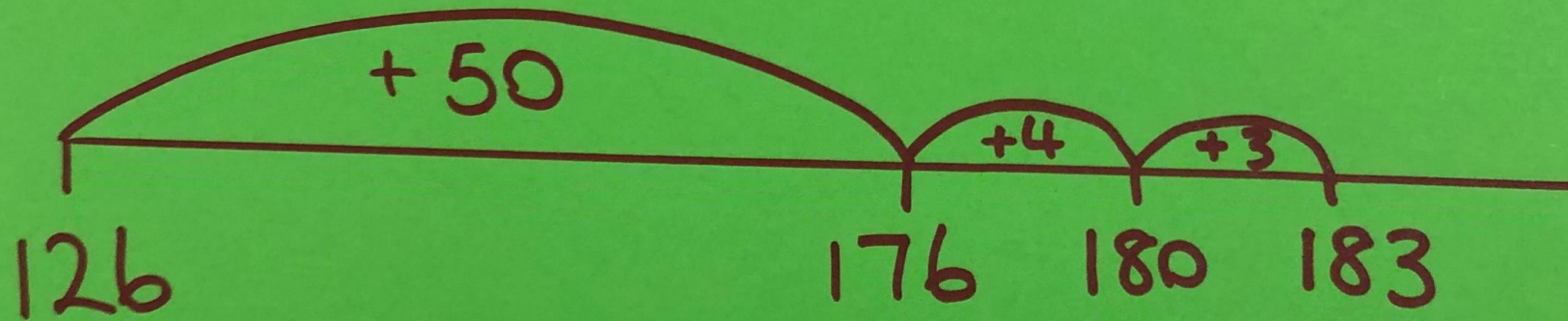
$$14 + 58 =$$



Which would you use?
And why?



$$126 + 57$$



$$\begin{array}{r} 65 \\ + 27 \\ \hline \end{array}$$



$$\begin{array}{r} + \quad 60 + 5 \\ \quad 20 + 7 \\ \hline \end{array}$$

Expanded Column method with concrete representation

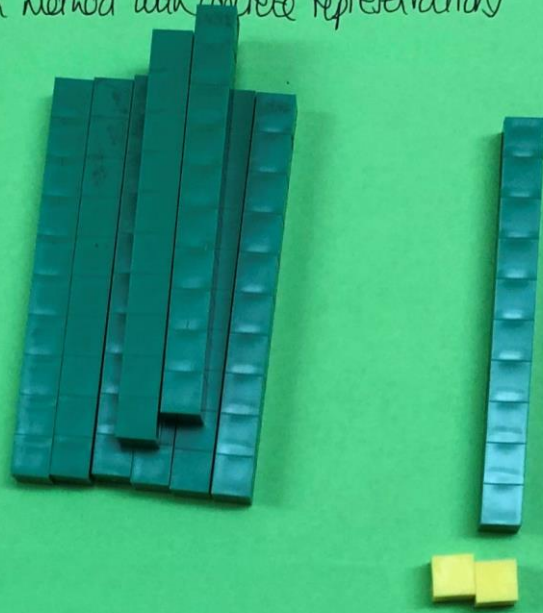
$$\begin{array}{r} 65 \\ + 27 \\ \hline \end{array}$$



$$\begin{array}{r} + \quad 60 + 5 \\ \quad 20 + 7 \\ \hline 80 + 12 \end{array}$$

Expanded Column method with concrete representation

$$\begin{array}{r} 65 \\ + 27 \\ \hline \end{array}$$



$$\begin{array}{r} 60 + 5 \\ 20 + 7 \\ \hline 80 + 12 \end{array}$$

Expanded Column method with concrete representation

$$\begin{array}{r} 65 \\ + 27 \\ \hline \end{array}$$



$$2 \text{ tens rods} = 20$$
$$2 \text{ units cubes} = 2$$
$$= 22$$

$$\begin{array}{r} 60 + 5 \\ 20 + 7 \\ \hline 80 + 12 \end{array}$$



$$137 + 348$$

$$100 + 300 = 400$$

$$30 + 40 = 70$$

$$7 + 8 = 15 = 10 + 5$$

$$400 + 70 + 10 + 5 \\ = 485$$



$$137 + 348$$

$$\begin{array}{r} 100 + 30 + 7 \\ + 300 + 40 + 8 \\ \hline \end{array}$$

$$400 + 70 + 15$$

$$= 485$$



$$137 + 348$$

$$\begin{array}{r} 137 \\ + 348 \\ \hline 15 \\ 70 \\ 400 \\ \hline 485 \end{array}$$

$$137 + 348$$

$$\begin{array}{r} 137 \\ + 348 \\ \hline 485 \end{array}$$

$$7.685\text{L} + 1038\text{ml}$$

$$\begin{array}{r} 7685 \\ + 1038 \\ \hline 8723 \end{array}$$

$$8723\text{ml}$$

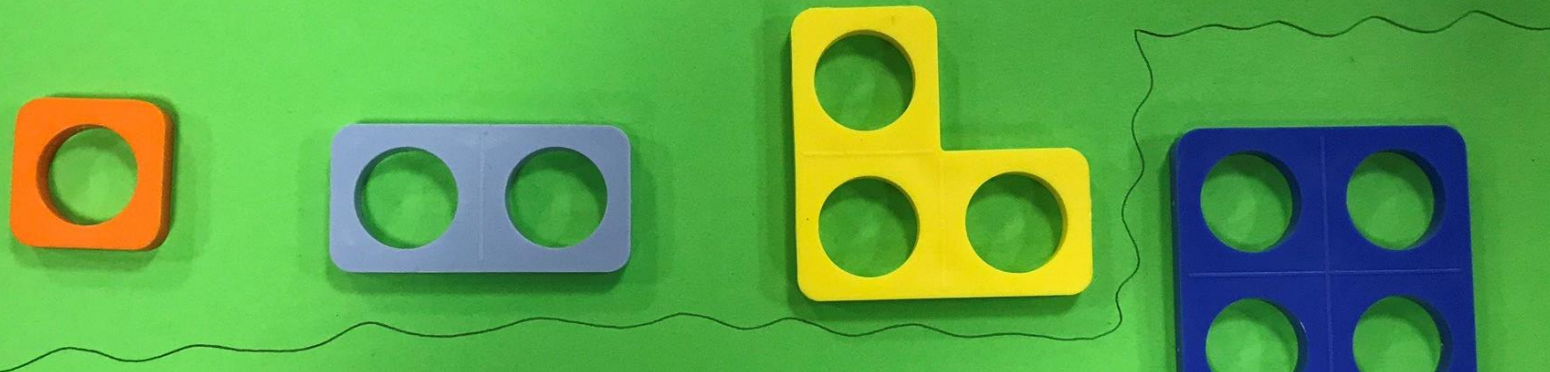
$$8.723\text{L}$$

Potential misconception!

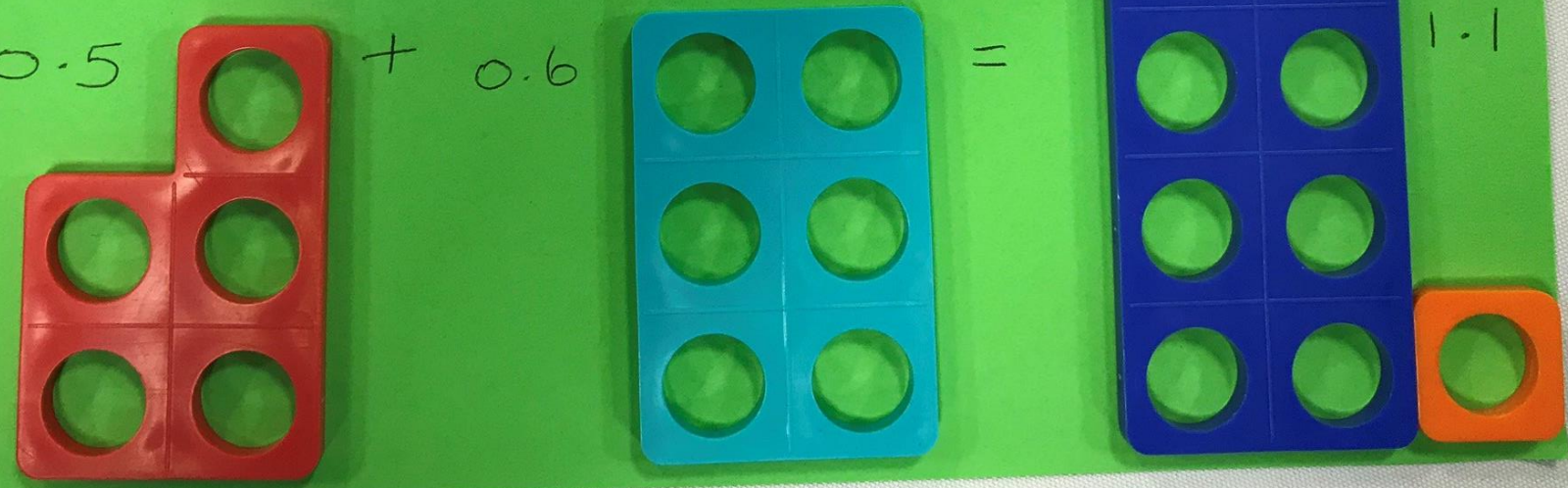
$$\begin{array}{r} + 7.685 \\ \hline 1038 \end{array}$$

Adding Decimals

$$0.1 + 0.2 = 0.3$$



$$0.5 + 0.6 = 1.1$$



$$325.8 + 268.7$$

$$\begin{array}{r} 325.8 \\ + 268.7 \\ \hline \end{array}$$

$$1.5$$

$$13.0$$

$$80.0$$

$$500.0$$

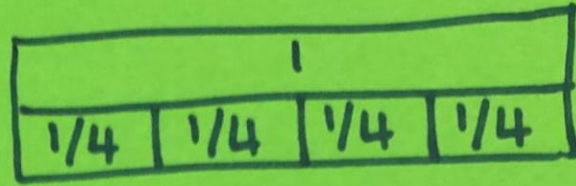
$$\begin{array}{r} 500.0 \\ + 80.0 \\ + 13.0 \\ + 1.5 \\ \hline 594.5 \end{array}$$

$$147.28 + 259.76$$

$$\begin{array}{r} 147.28 \\ + 259.76 \\ \hline 407.04 \end{array}$$

$$\frac{1}{3} + \frac{1}{3} + \frac{1}{3} = 1 \text{ whole}$$

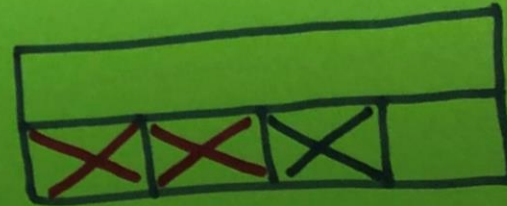




$$\frac{2}{4} + \frac{1}{4} =$$




$$\frac{3}{4}$$





True or False?

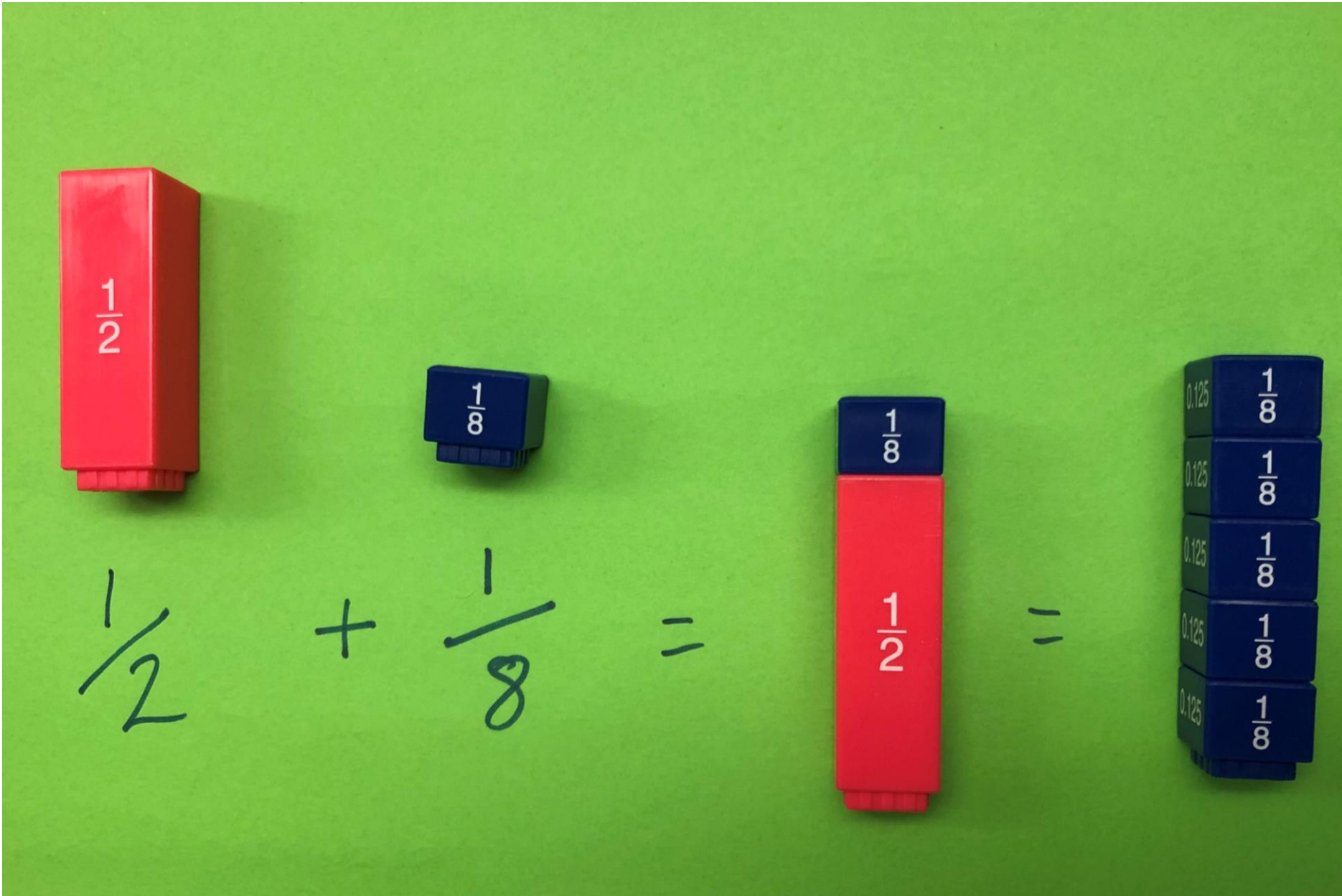
$$\frac{1}{4} + \frac{1}{4} + \frac{1}{4} = 1$$



False!



$$\frac{1}{2} + \frac{1}{4} = \frac{3}{4}$$

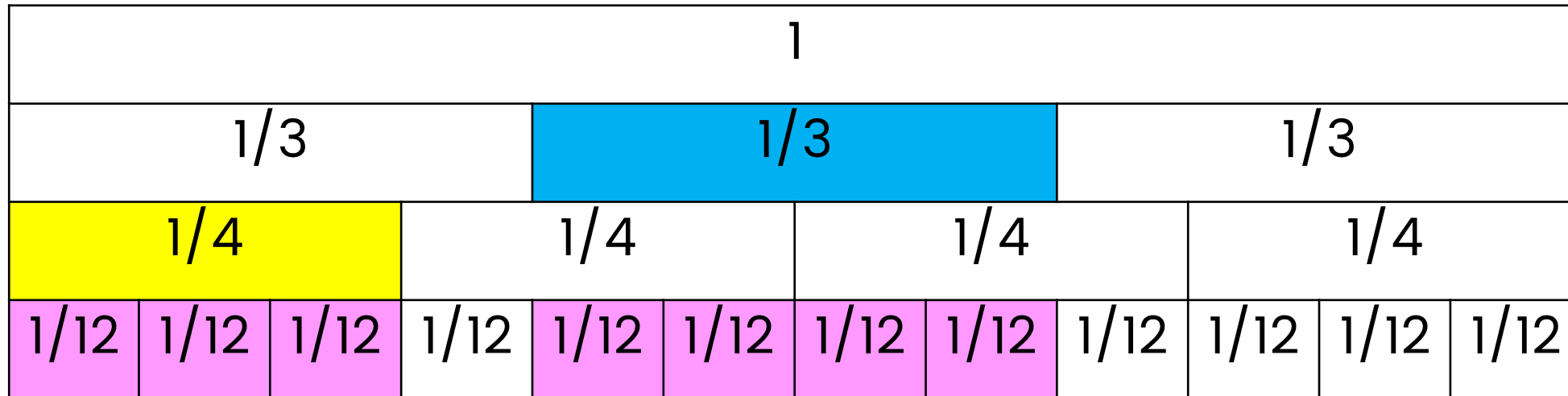


$\frac{1}{2} + \frac{1}{8} =$

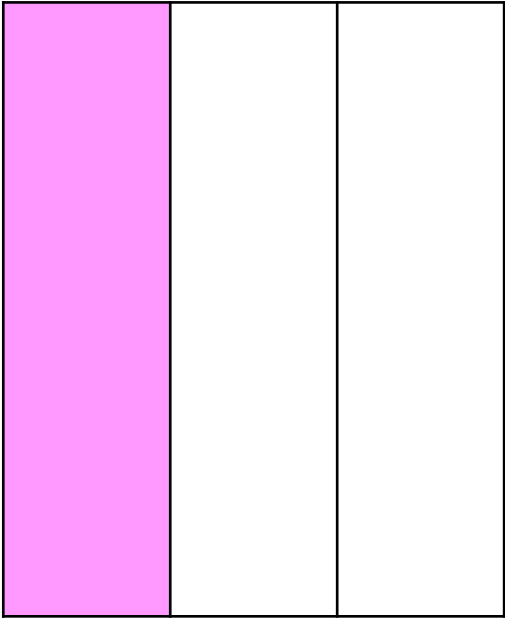
$\frac{1}{2} =$

$\frac{1}{8}$

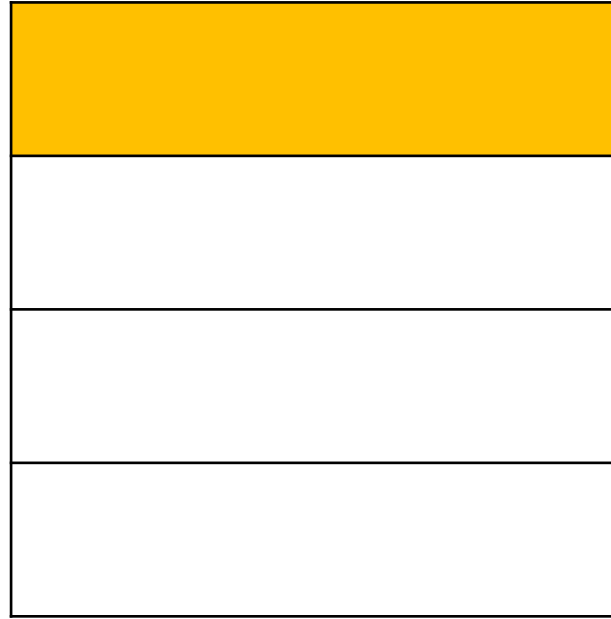
$$\frac{1}{3} + \frac{1}{4} = \frac{4}{12} + \frac{3}{12} = \frac{7}{12}$$



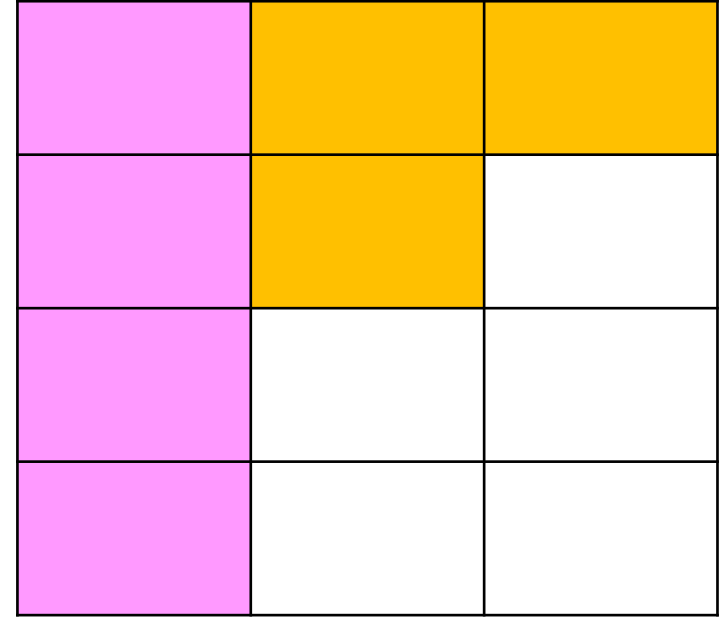
$$\frac{1}{3} + \frac{1}{4} = \frac{7}{12}$$



+



=



Subtraction

One less than
four cubes is
three cubes.

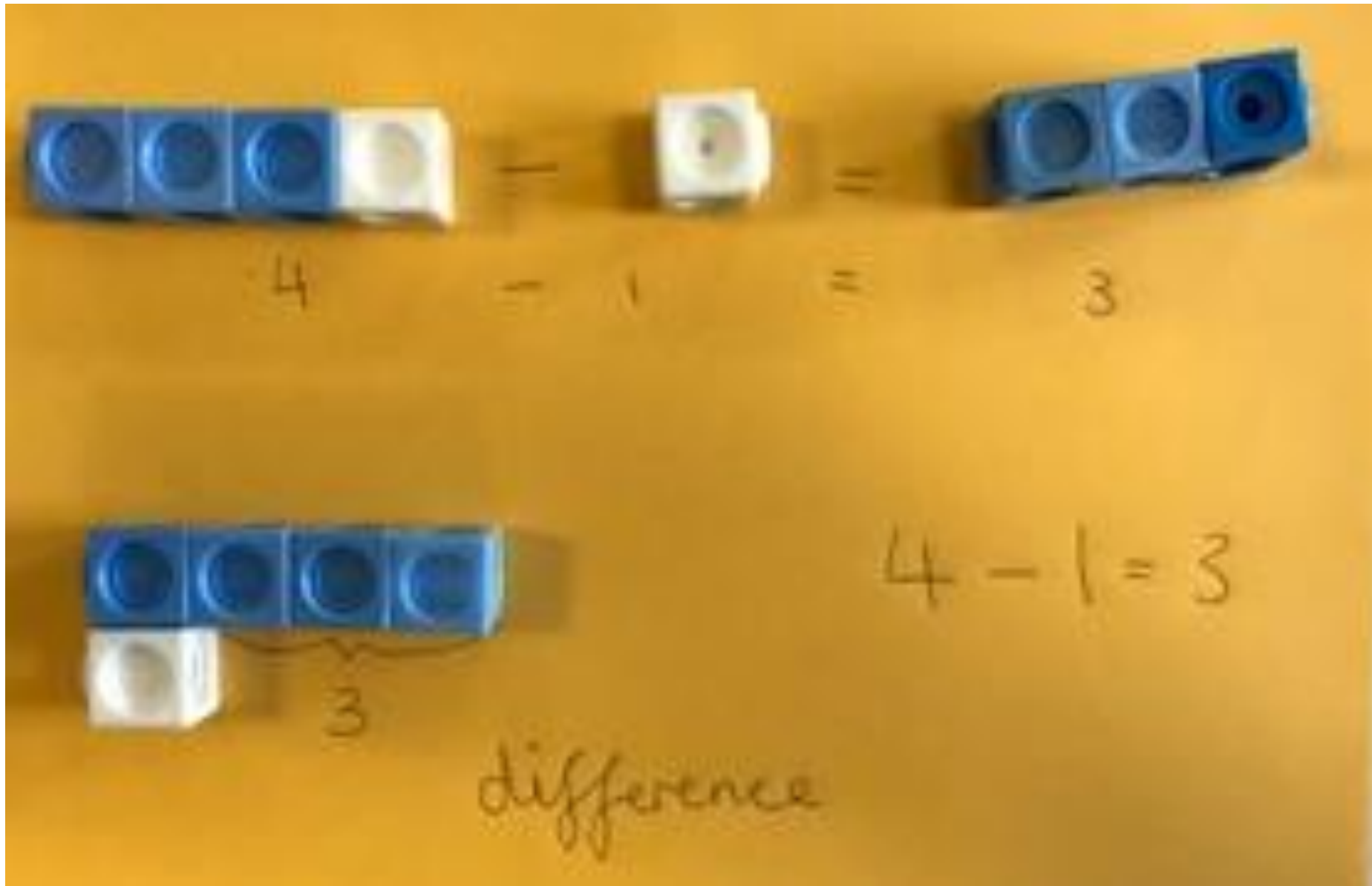
Four cubes take
away one cube is
three cubes.



$$4 - 1 = 3$$

Counting back using
concrete objects and
a number track



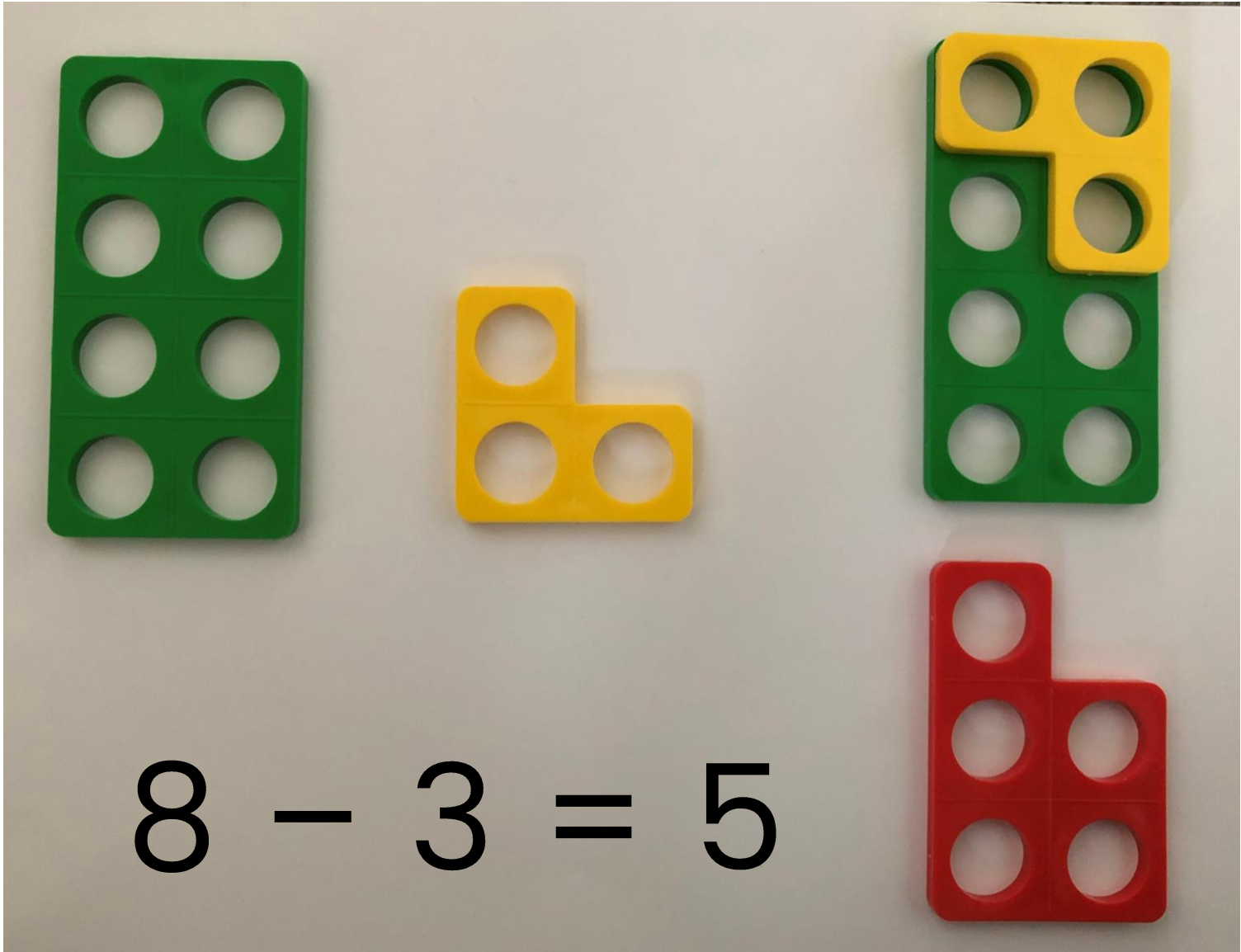


4 - 1 = 3

3

difference

$4 - 1 = 3$



$8 - 3 = 5$

Introducing partitioning in a concrete way



24

-



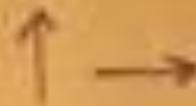
12 = 12



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

$$45 - 9$$

$$-10 + 1$$



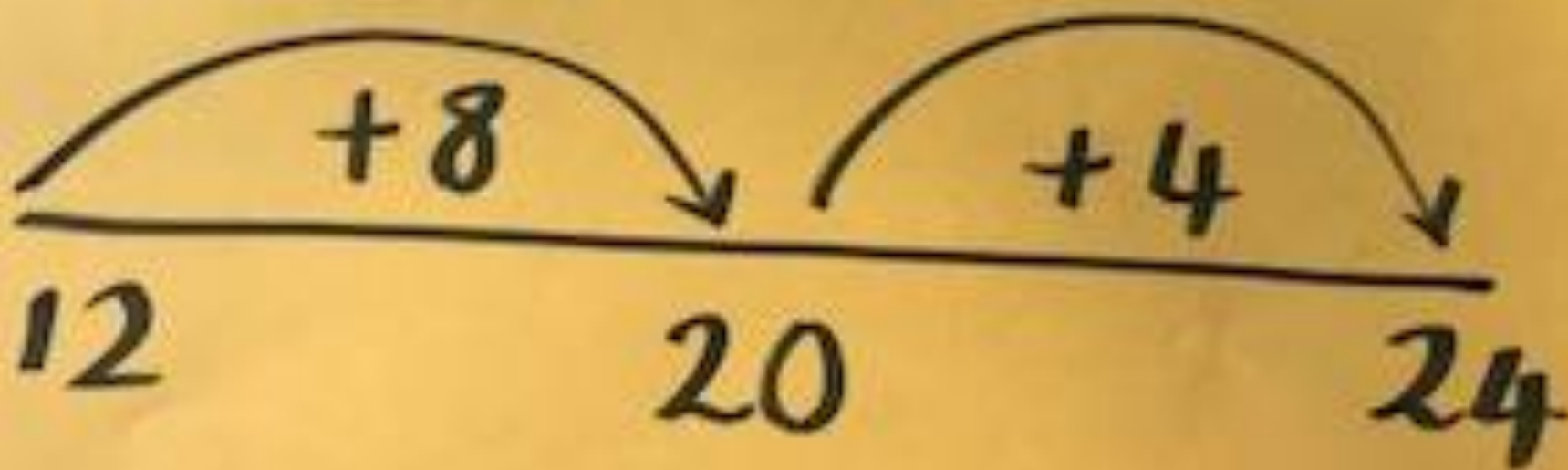
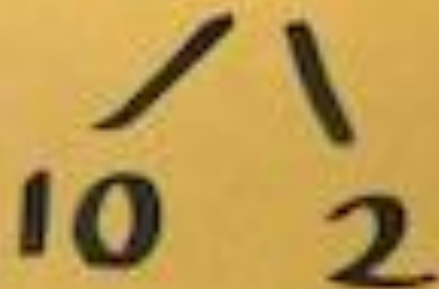
35	36
45	

visualise

subtract
near multiples
of ten

Subtraction approaches using written methods, counting on, counting back.

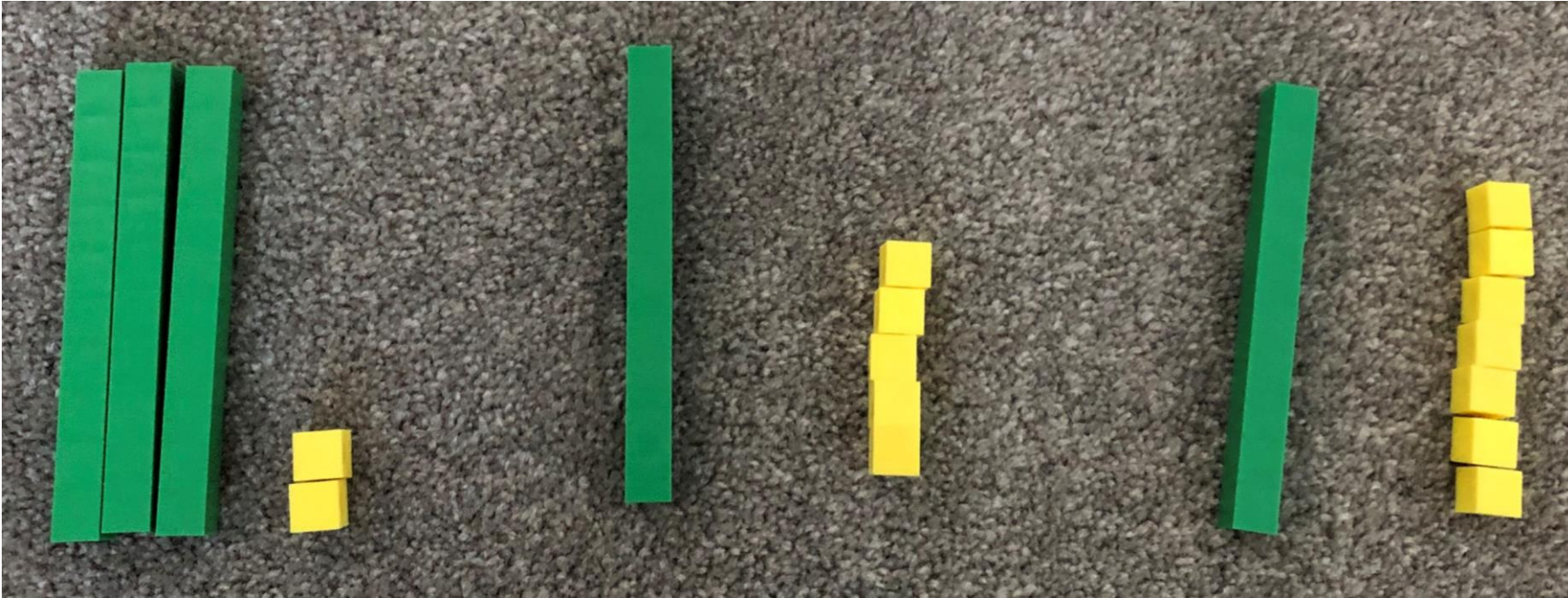
$$24 - 12 = 12$$




$$30 - 14 = 16$$



$$32 - 15 = 17$$

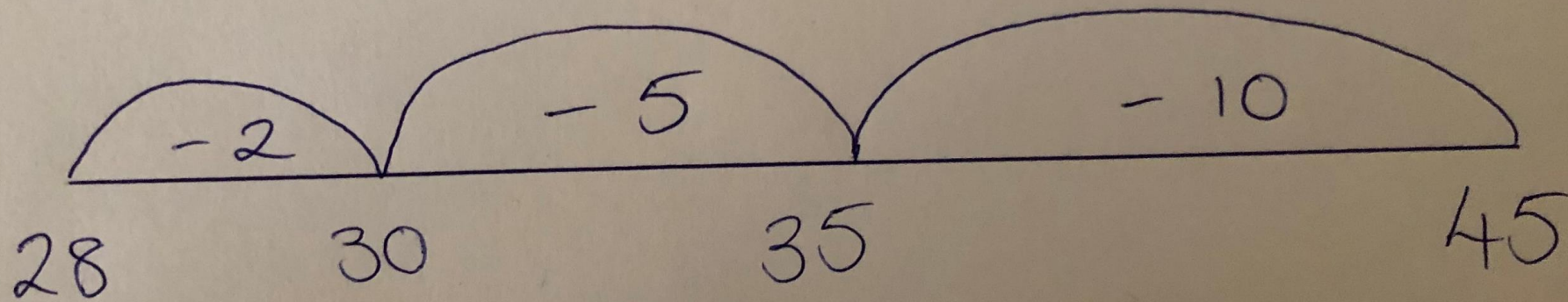


$55 - 28 =$
 27



$10 + 10 + 5 + 2 = 27$

$$45 - 17 = 28$$



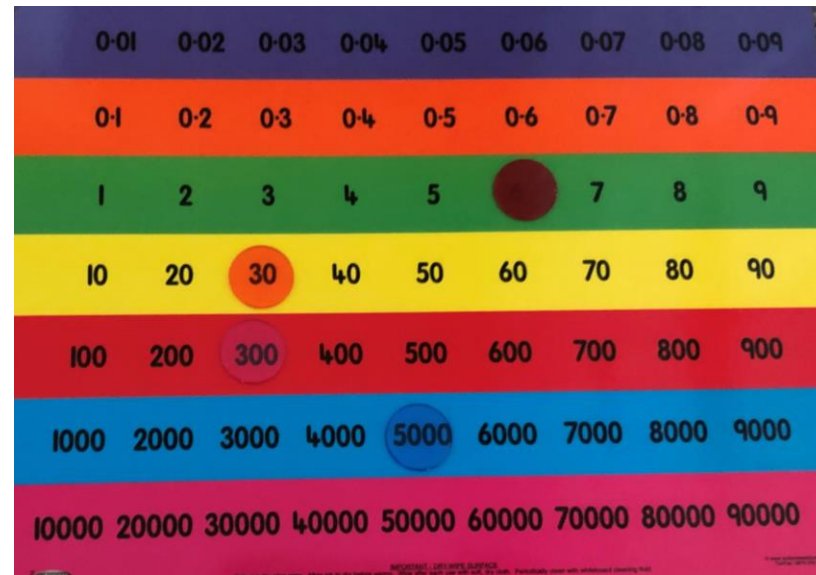
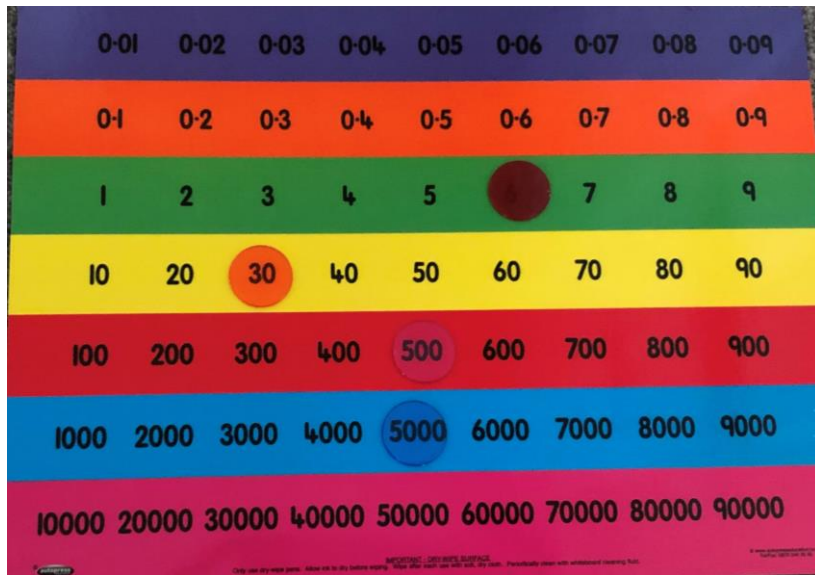


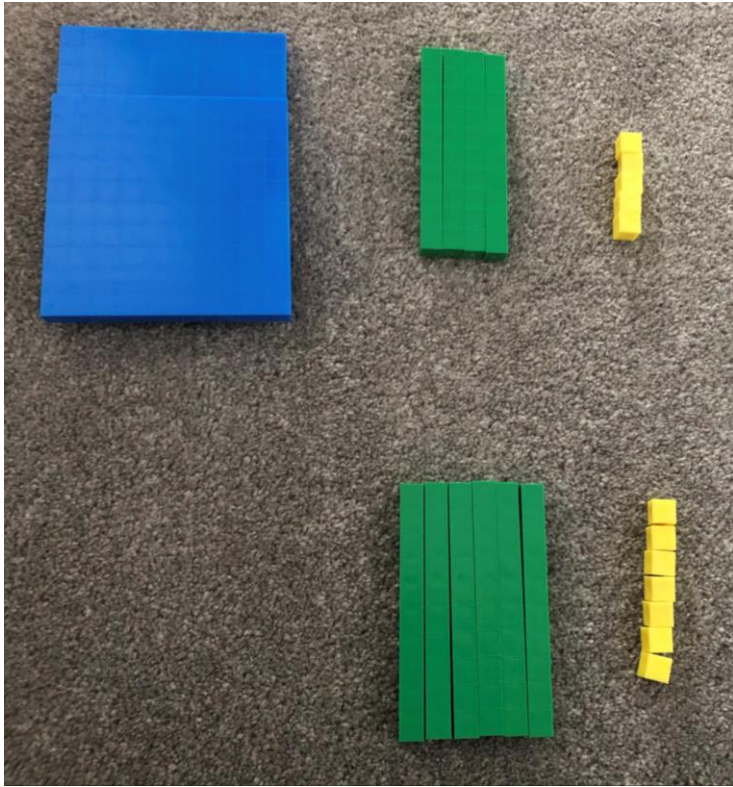
$$150 - 80$$
$$= 150 - 50 - 30$$

The diagram shows the number 80 in the first equation being decomposed into 50 and 30 in the second equation. An arrow points from the 80 in the first line down to the 50 and 30 in the second line.

Partitioning

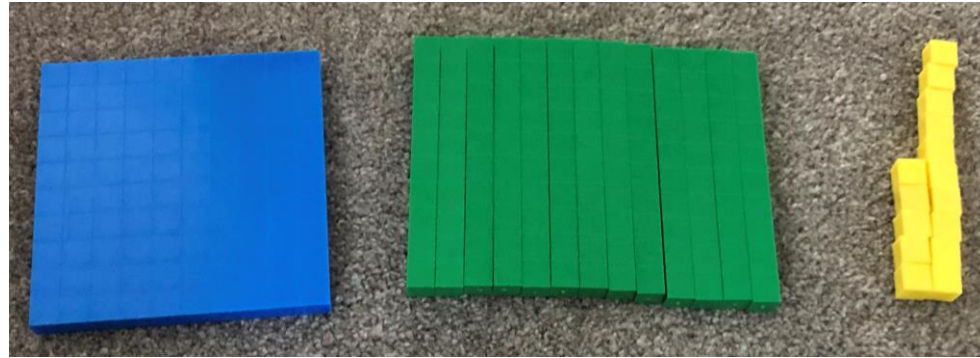
$$5,536 - 200$$





$$245 - 67$$

=

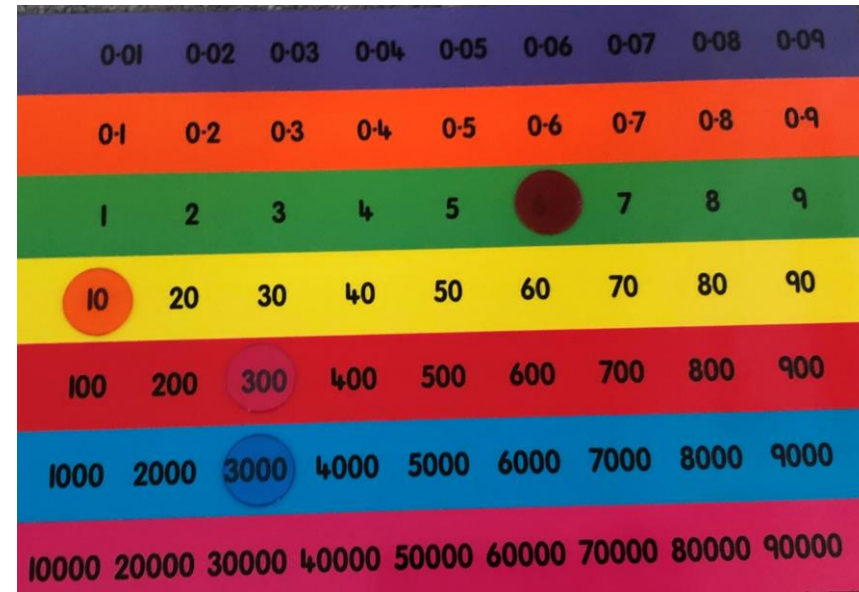


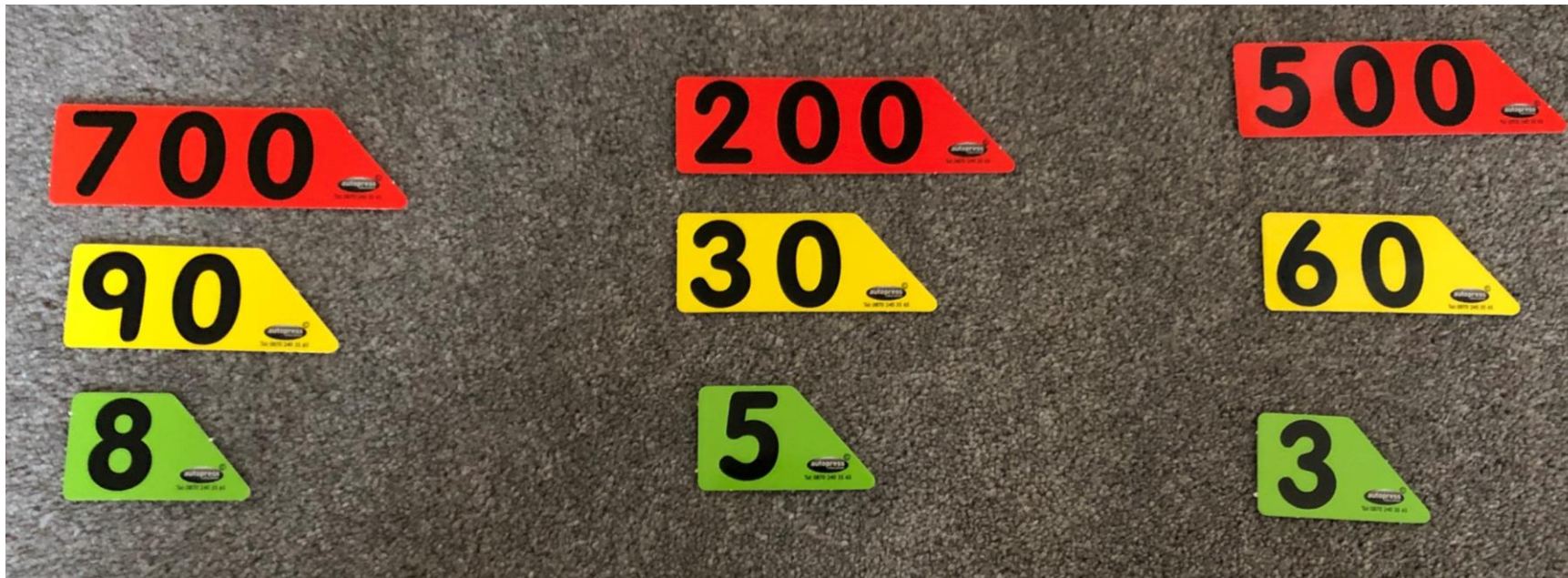
$$(100 + 130 + 15) - 67$$

$$245 - 67 = 178$$

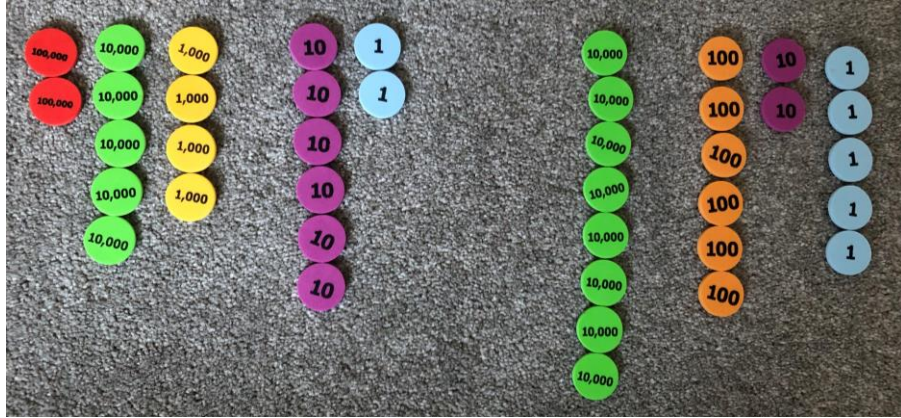


$$5,516 - 2,000$$

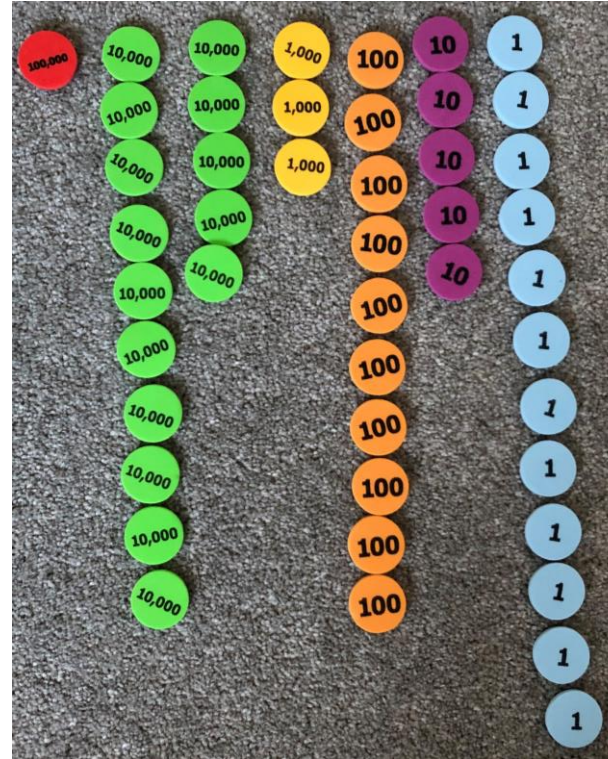




$$798 - 235 = 563$$



=



$$254,062 - 80,625$$

$$(100,000 + 150,000 + 3,000 + 1,000 + 50 + 12) - 80,625$$

$$254,062 - 80,625 = 173,437$$



$$\begin{array}{r} 400 + 60 + 7 \\ - 200 + 20 + 2 \\ \hline 200 + 40 + 5 \end{array}$$

$$\begin{array}{r} 467 \\ - 222 \\ \hline 245 \end{array}$$

$$\begin{array}{r} 754 \\ - 86 \\ \hline \end{array}$$

Partitioning and decomposition

$$\begin{array}{r} 700 + 50 + 4 \\ - \quad \quad 80 + 6 \\ \hline \end{array} \quad \text{step 1}$$

$$\begin{array}{r} 700 + 40 + 14 \\ - \quad \quad 80 + 6 \\ \hline \end{array} \quad \text{step 2}$$

$$\begin{array}{r} 600 + 140 + 14 \\ - \quad \quad 80 + 6 \\ \hline \end{array} \quad \text{step 3}$$

$$600 + 60 + 8 = 668$$



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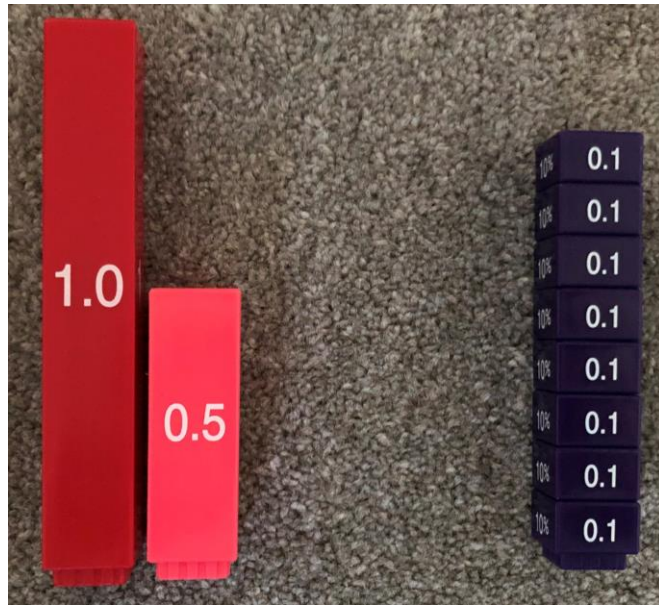
$$\begin{array}{r} 124,213 \\ - 11,999 \\ \hline \end{array} = \begin{array}{r} 124,213 \\ - 12,000 (+1) \\ \hline 112,213 \end{array}$$

$$112,213 + 1 = 112,214$$

Decomposition

$$\begin{array}{r} \overset{6}{\cancel{7}} \quad \overset{14}{\cancel{5}} \quad 14 \\ \hline 2 \quad 8 \quad 6 \\ \hline 4 \quad 6 \quad 8 \\ \hline \end{array}$$

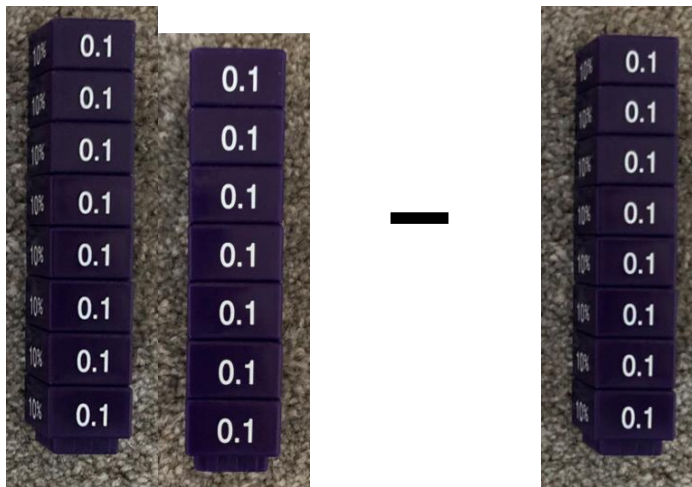
$$1.5 - 0.8$$



=



0.7

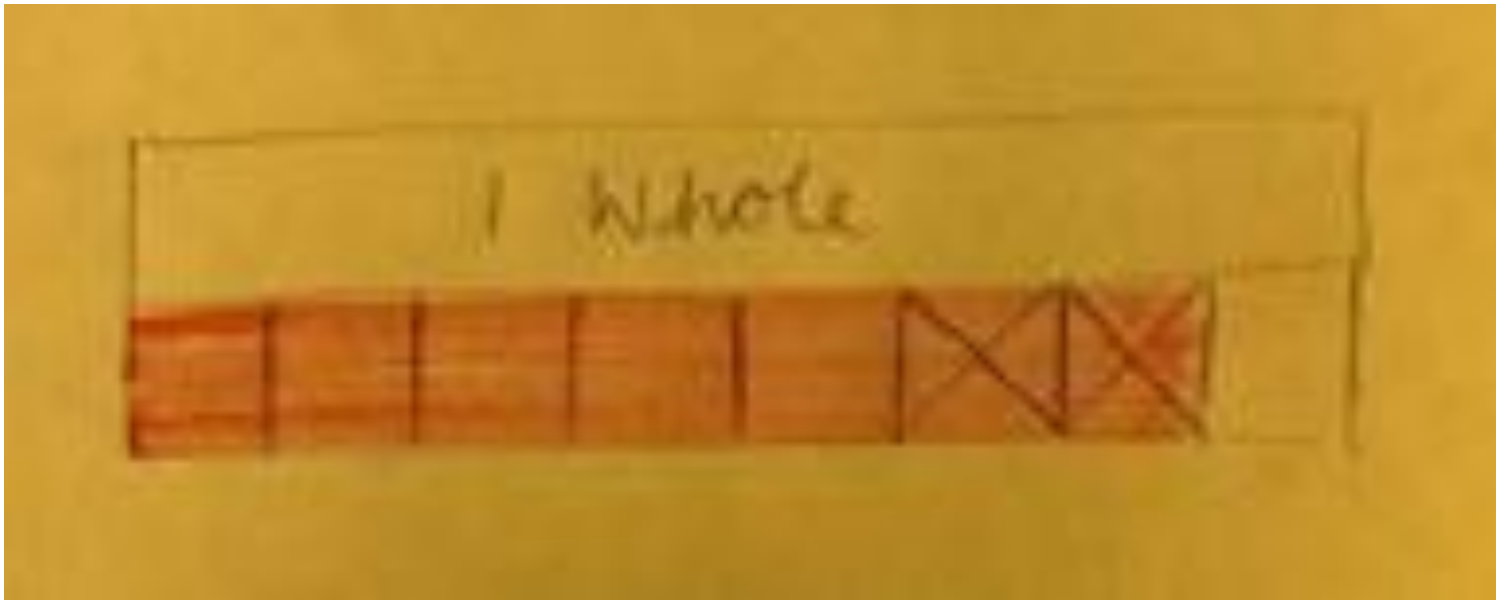


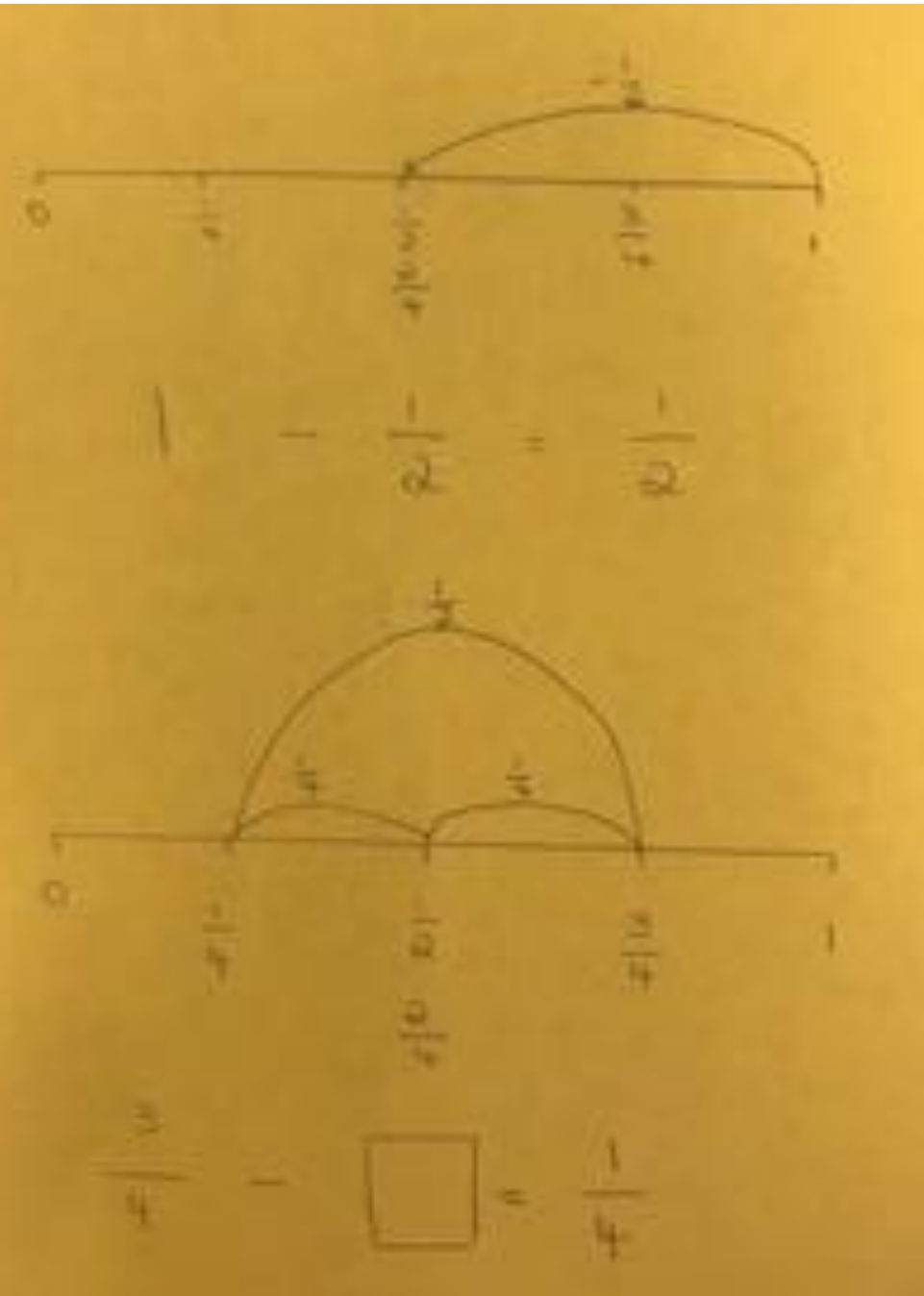
$$10/10 - 1/10 = 9/10$$

Using a beadstring



$$7/8 - 2/8 = 5/8$$





Subtraction of Fractions



1 whole
2 halves
4 quarters

$$\frac{1}{1} - \frac{1}{4}$$



$$= \frac{3}{4}$$



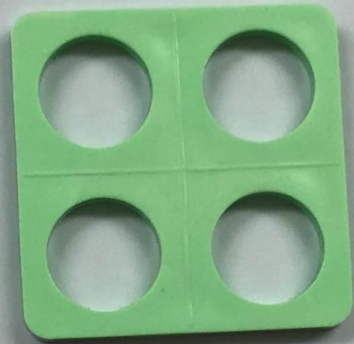


$$\frac{4}{4} - \frac{1}{4} = \frac{3}{4}$$

(1 whole)

Multiplication

$$4 \times 1 = 4$$



$$1 \times 4 = 4$$



$$6 \times 5 = 30$$

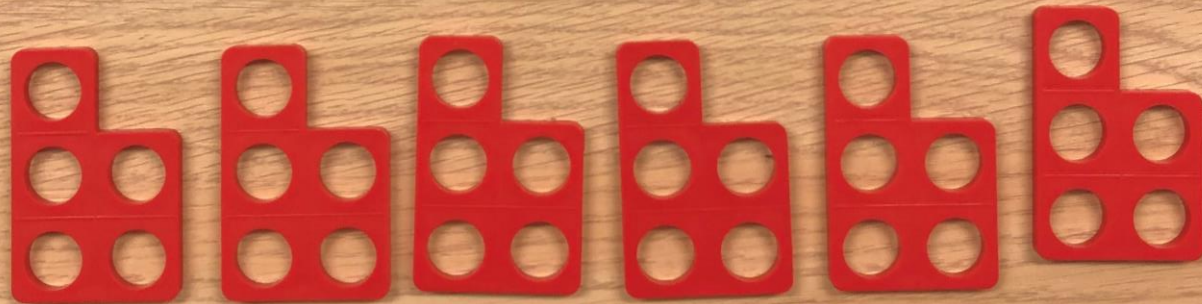
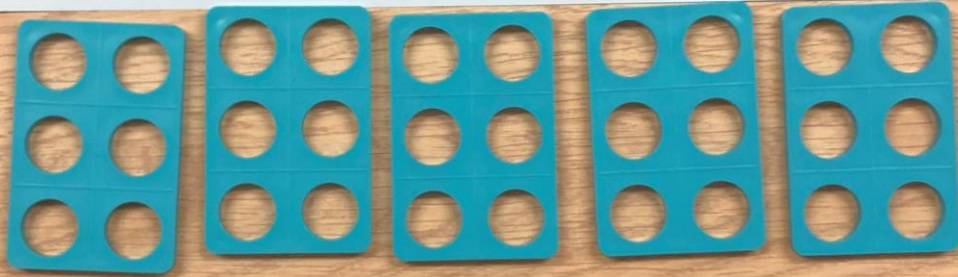
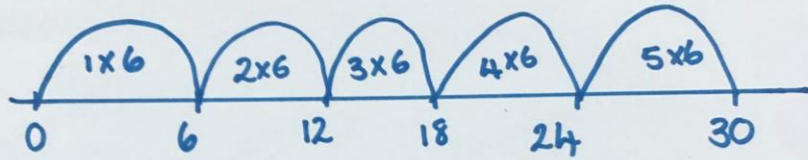
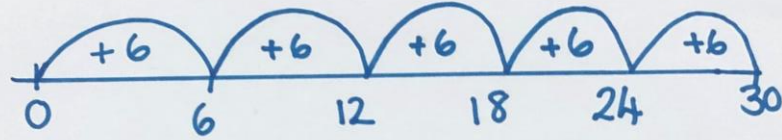


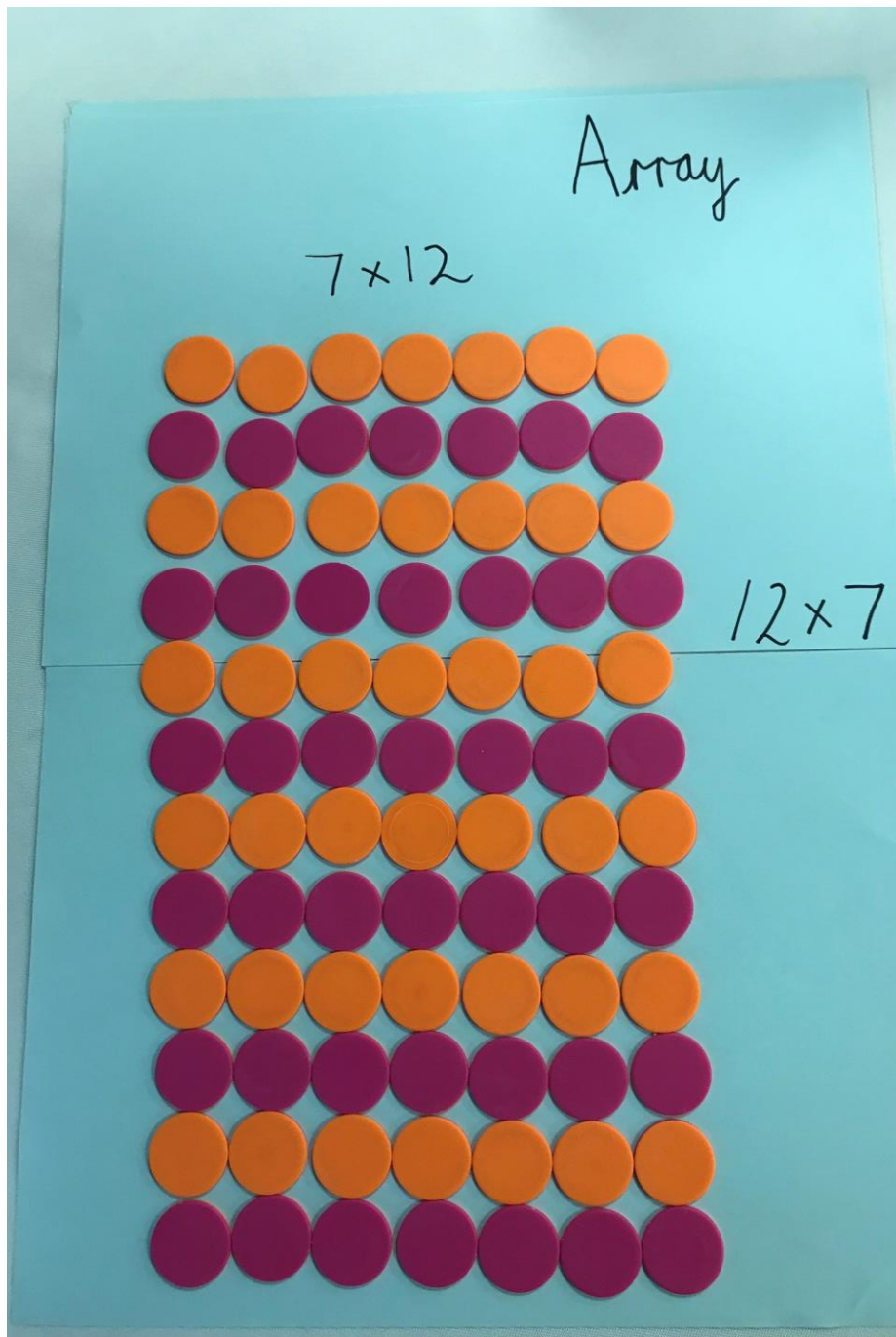
$$5 \times 6 = 30$$

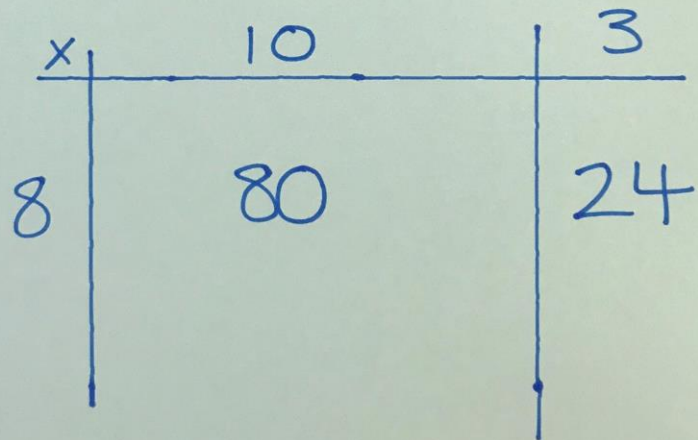
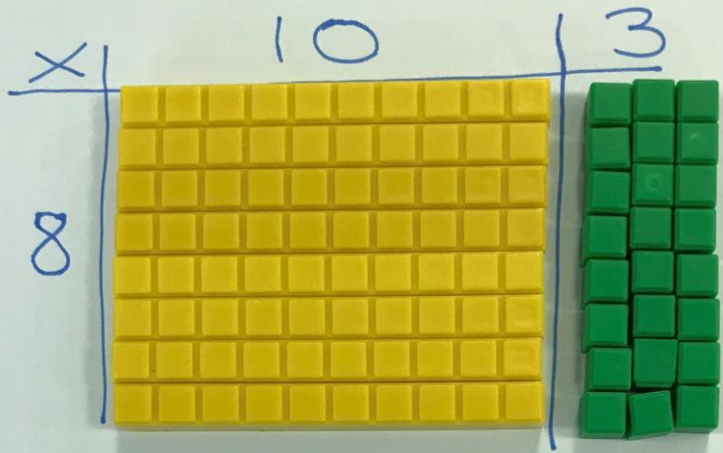


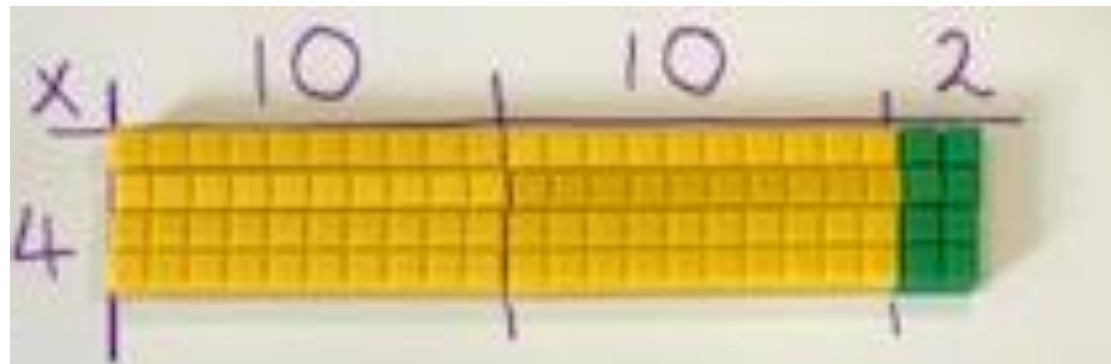


$$6 \times 5 = 30$$







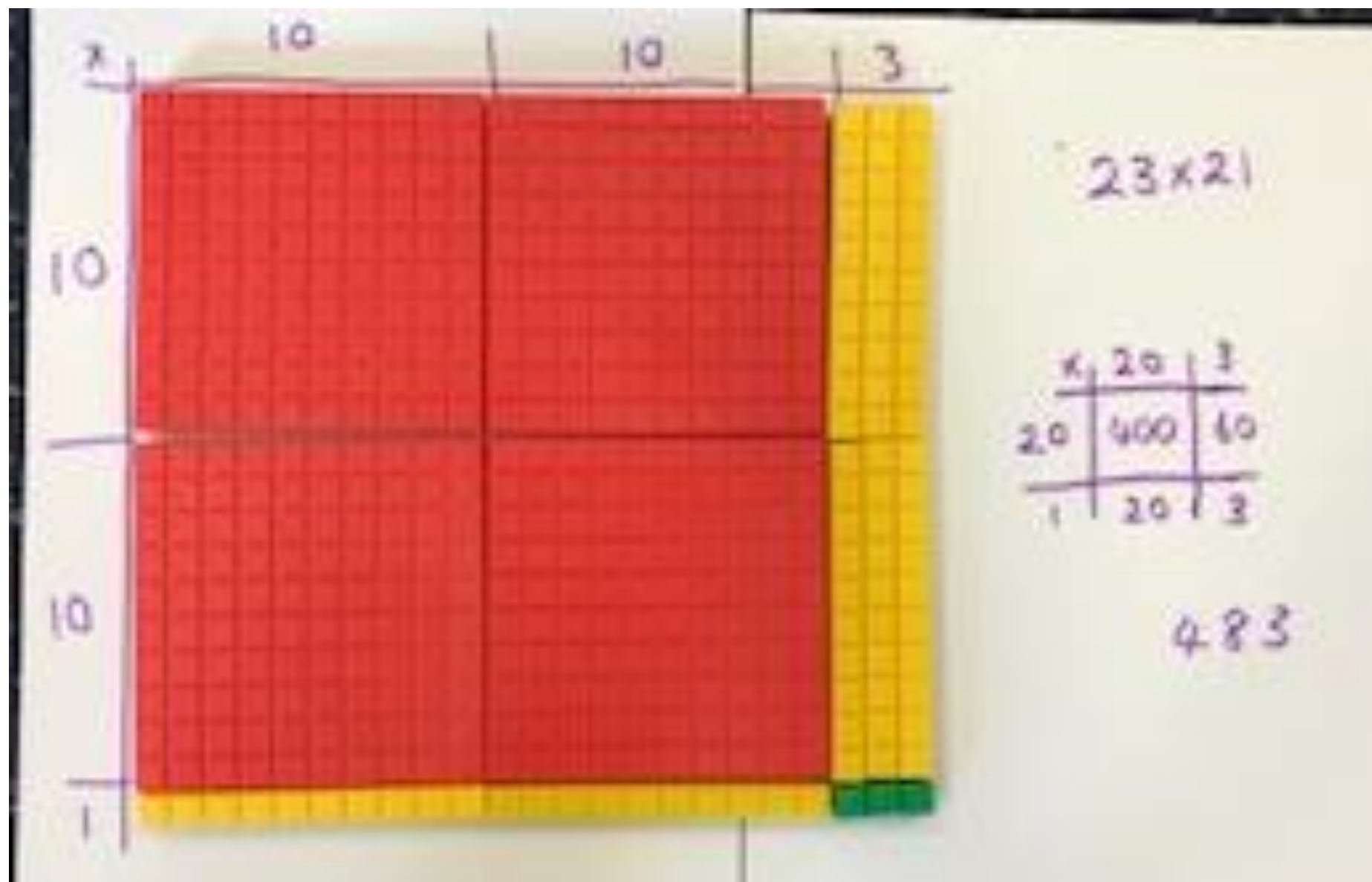


$$22 \times 4 = 88$$

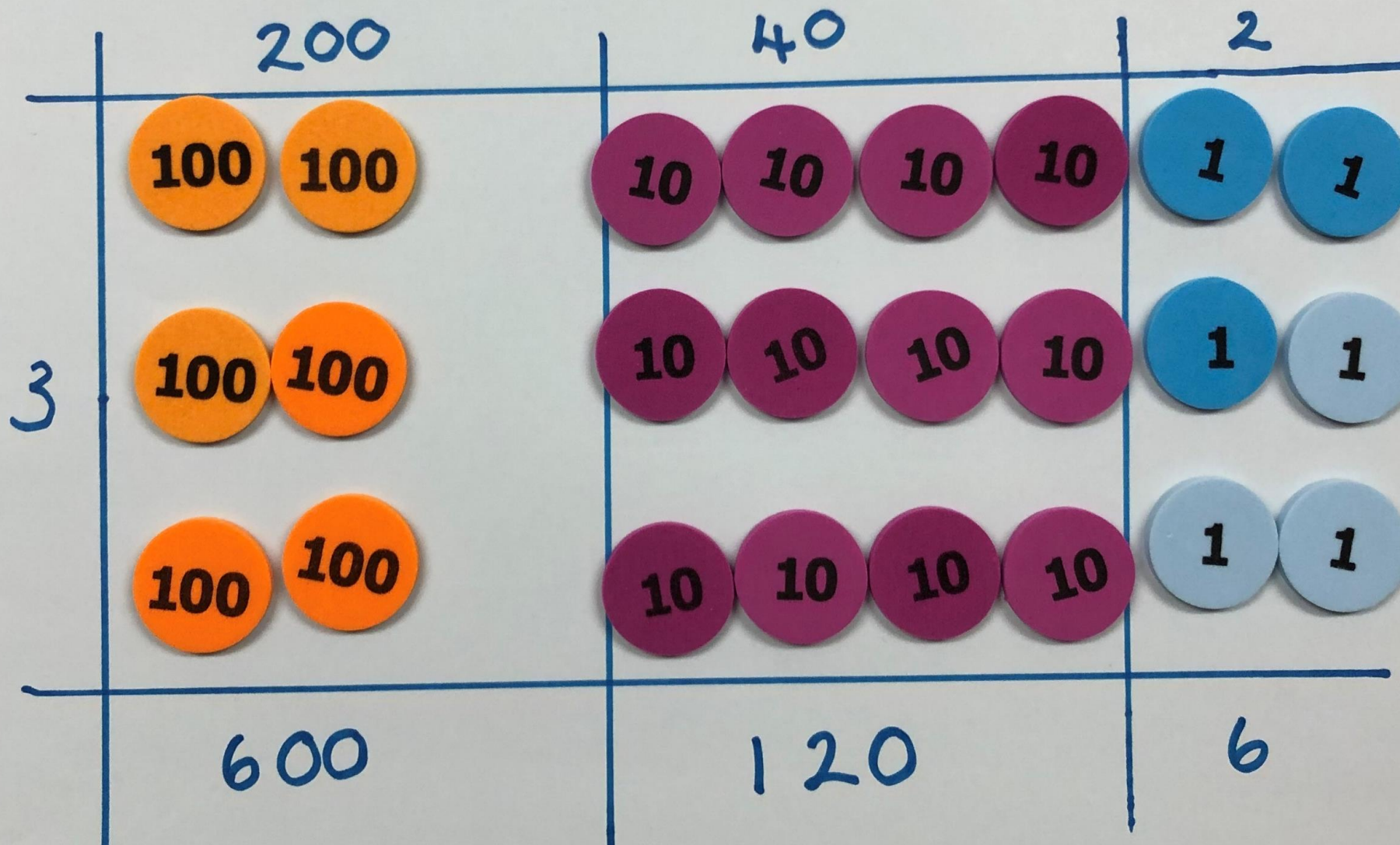
x	10	10	2
4	40	40	8

x	20	2
4	80	8

Proportional grid method



$$242 \times 3 = 726$$





$$326 \times 7 = 2289$$

x	300	20	7
7	2,100	140	49

$$12.5 \times 2.3 = 28.75$$

x	10	2	0.5
2	20	4	1
0.3	3	0.6	0.15

The playground measures 30 metres by 164 metres. Calculate the area of the playground.

$$164\text{m} \times 30\text{m}$$

x	100	60	4
30	3000	1800	120

$$\text{Area} = 4920\text{m}^2$$

$$\begin{array}{r} \times \quad 242 \\ \quad \quad 3 \\ \hline 726 \\ \hline 1 \end{array}$$



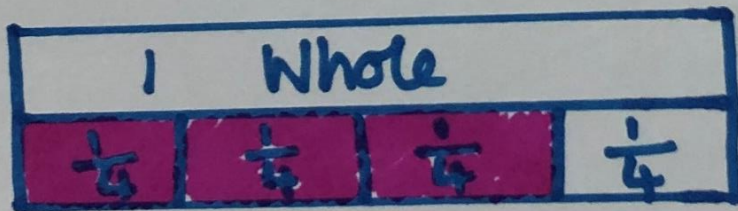
$$\begin{array}{r} 1242 \\ x 43 \\ \hline 3726 \\ 49680 \\ \hline 53406 \\ \hline \end{array}$$

Handwritten multiplication problem showing the calculation of 1242×43 . The result is 53406 . The work is done in blue ink on a grey background. The multiplier 43 is written below the multiplicand 1242. A horizontal line separates the two numbers. The first partial product, 3726, is calculated by multiplying 1242 by 3, with a small vertical tick mark under the 7. The second partial product, 49680, is calculated by multiplying 1242 by 40, with a small vertical tick mark under the 9. A second horizontal line separates the two partial products. The final product, 53406, is the sum of the two partial products. Below the final product, there are three small vertical tick marks under the digits 1, 2, and 4 of the original multiplicand.

$$\frac{1}{4} \times 3 = \frac{3}{4}$$



$$\frac{1}{4} \times 3 = \frac{3}{4}$$



Multiplying fractions



1 whole

$\frac{2}{4}$

\times

$\frac{2}{4}$

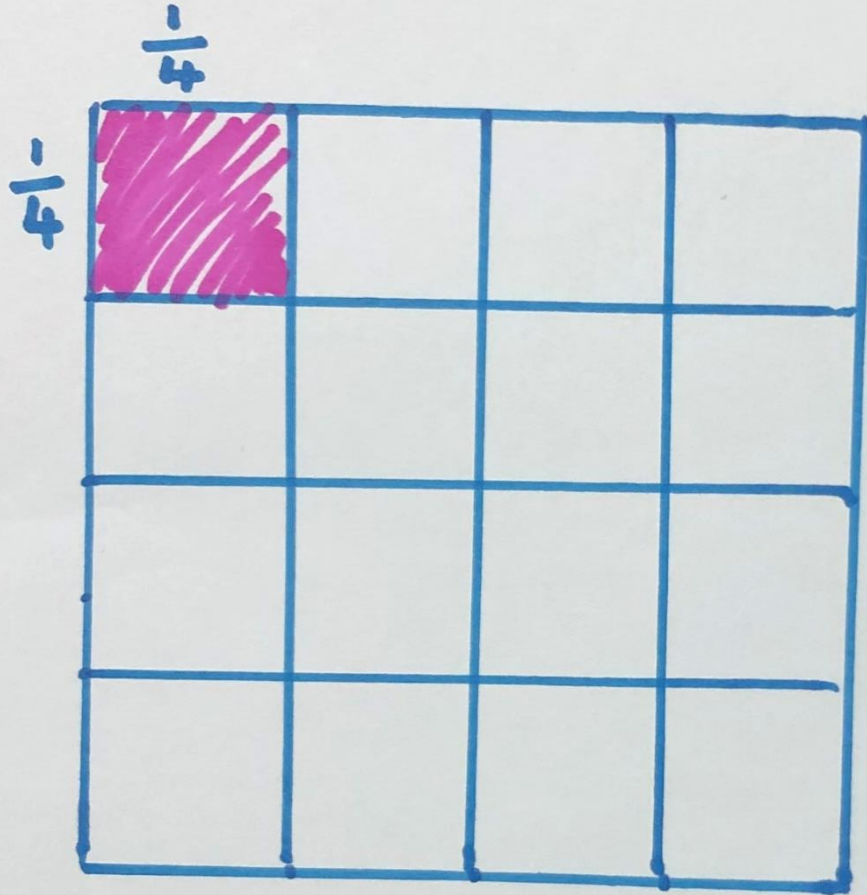


$=$

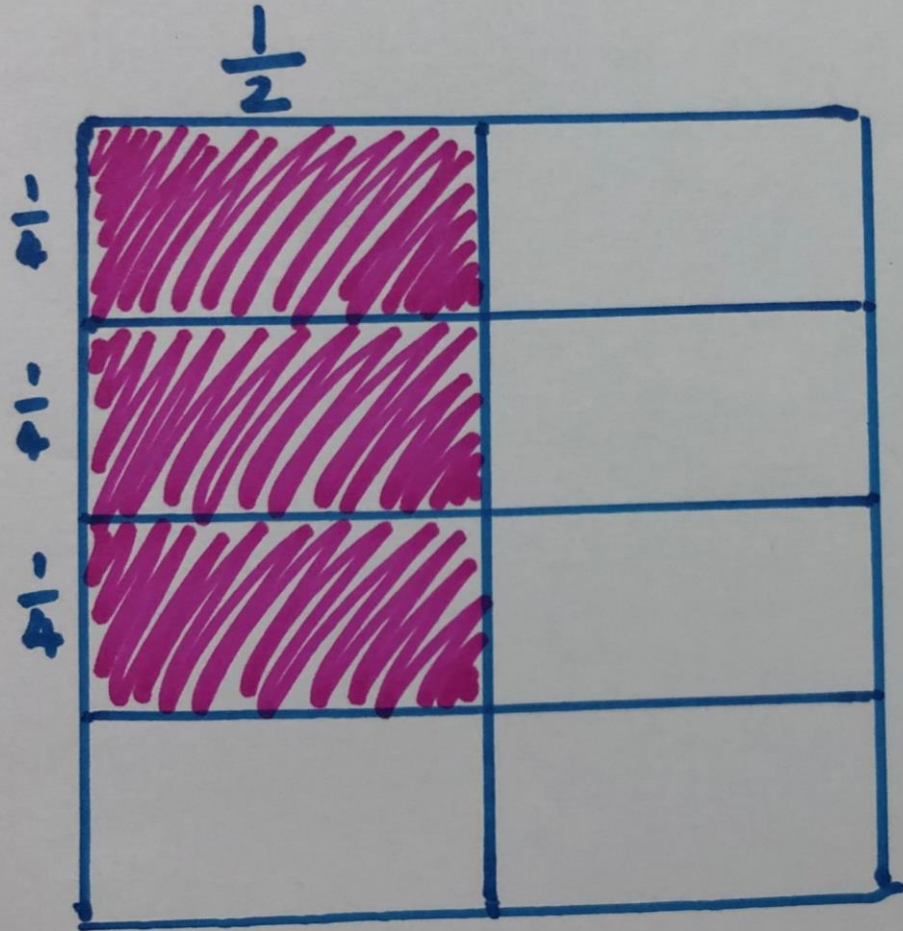
$\frac{2}{4}$



$$\frac{1}{4} \times \frac{1}{4} = \frac{1}{16}$$



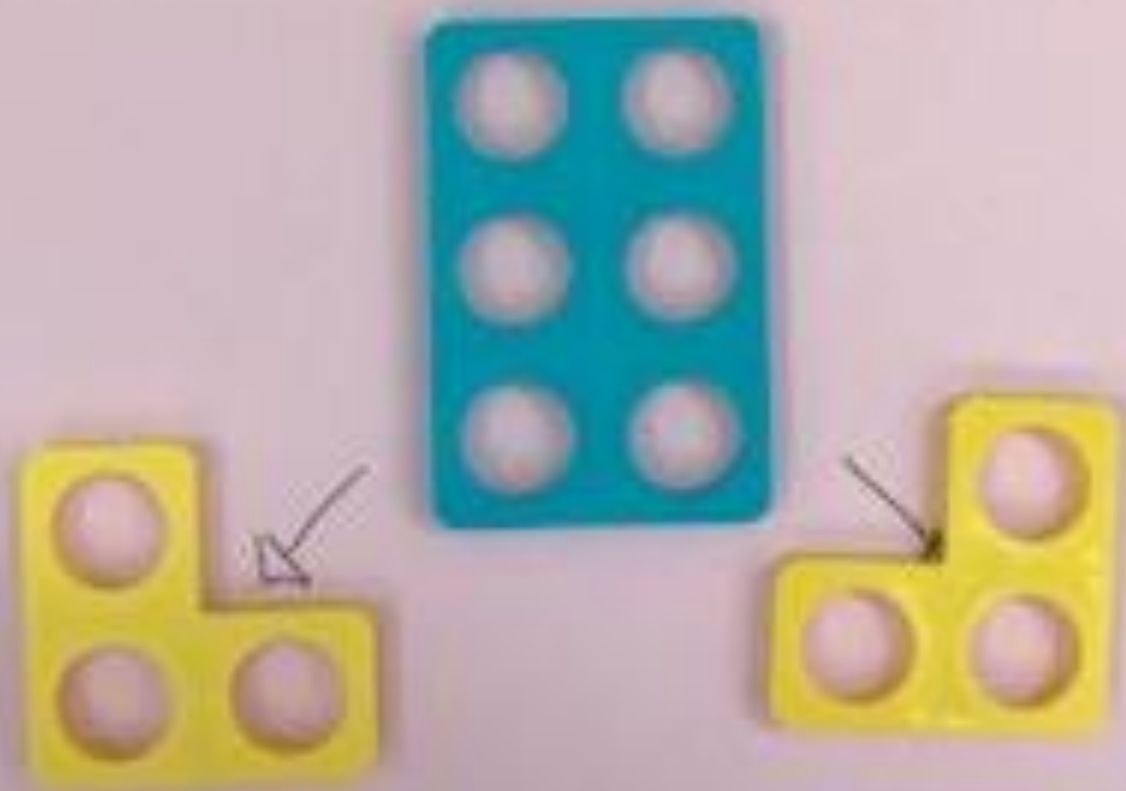
$$\frac{1}{2} \times \frac{3}{4} = \frac{3}{8}$$

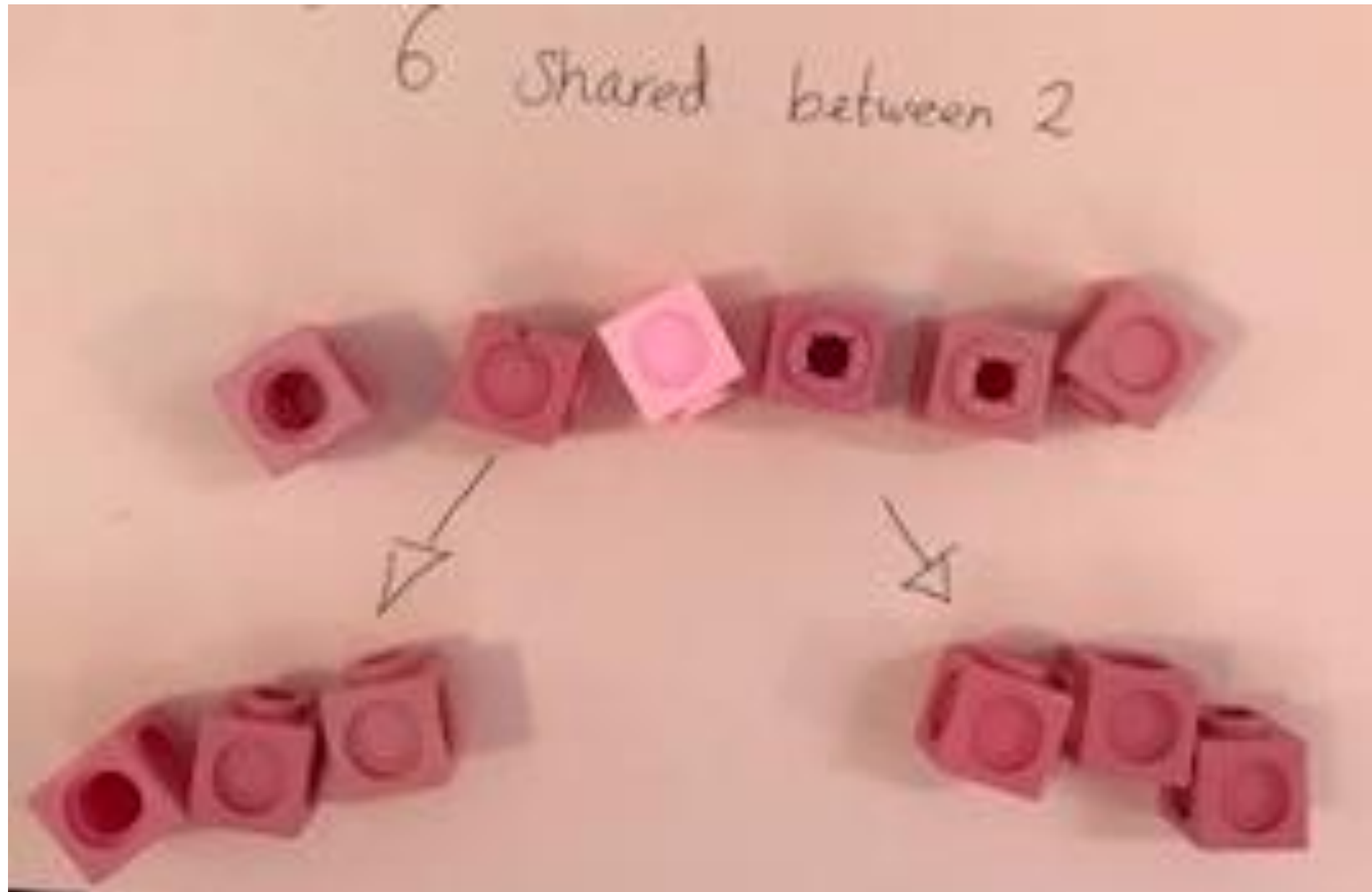


Division

Sharing

6 shared between 2





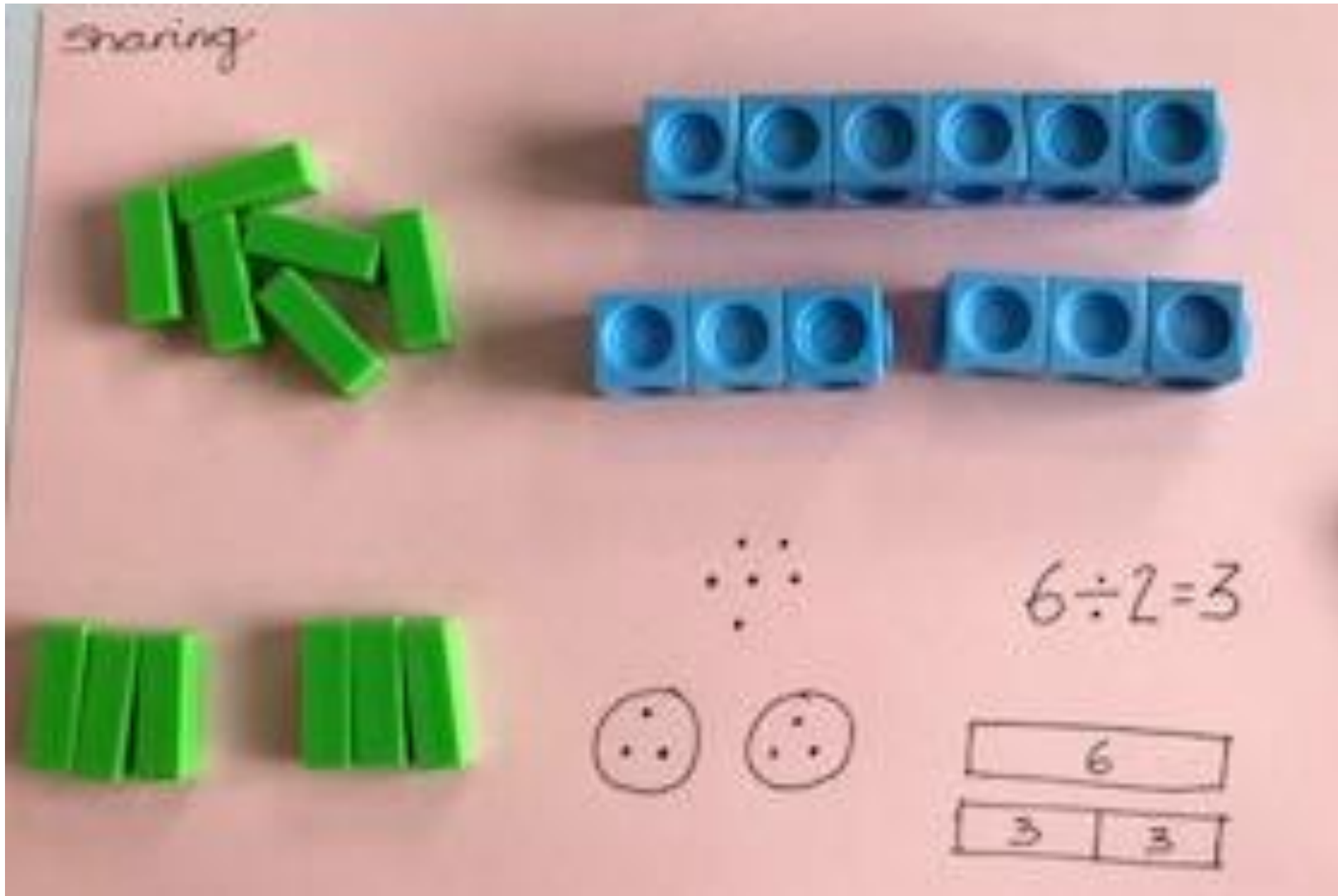
Sharing

6 shared between 2



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Sharing



6 ÷ 2 = 3

6	
3	3

Grouping

$$6 = 2 = 3$$



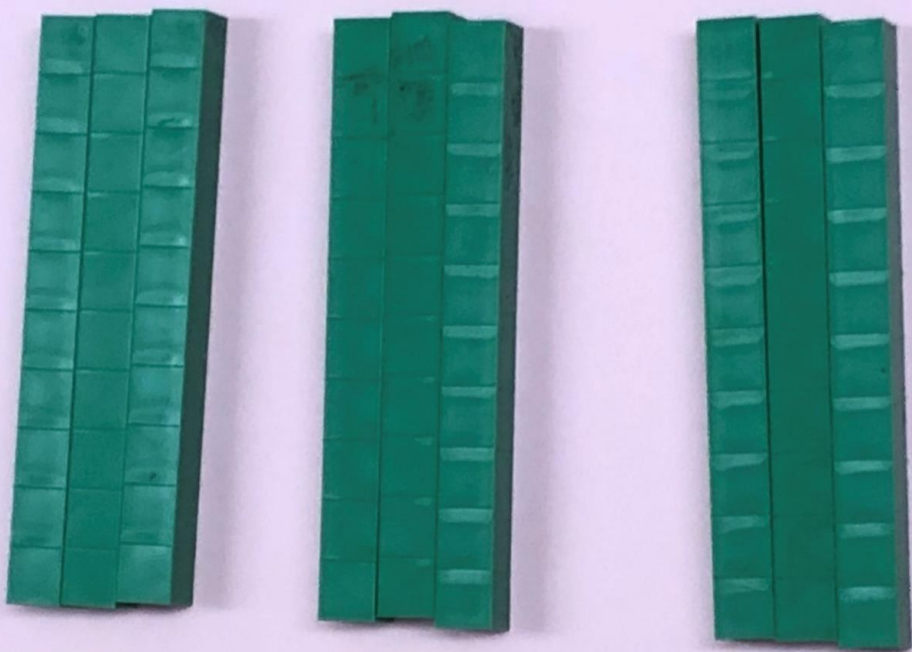
Grouping

$$8 \div 4 =$$



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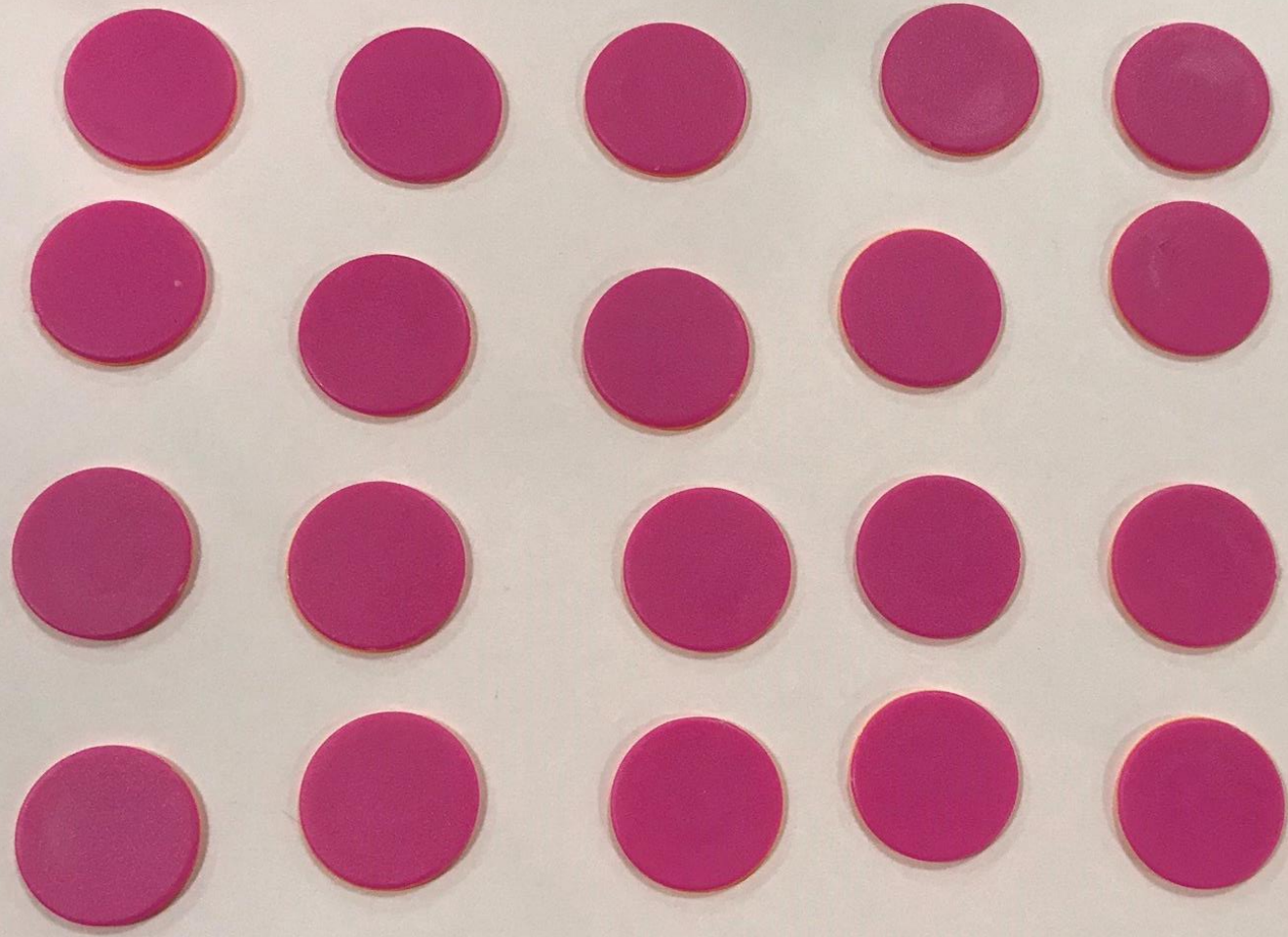
$$96 \div 3 \quad (\text{sharing})$$





15 ÷ 3 = 5
15 ÷ 5 = 3

3 × 5 = 15
5 × 3 = 15



Look at this array. How many different
division calculations can you create?



$24 \div 4 = 6$
 $4 \times 6 = 24$

Array sharing
(grouping)

$24 \div 4 = 6$
 $6 \times 4 = 24$

Array
(grouping)

←
4 ones

Repeated addition

$$24 \div 4 = 6$$

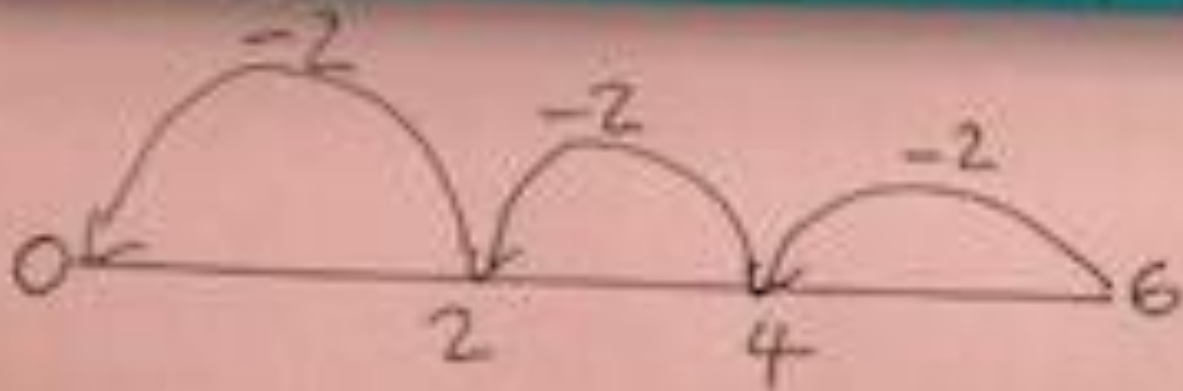


$$17 \div 5 = 3 \text{ r. } 2$$



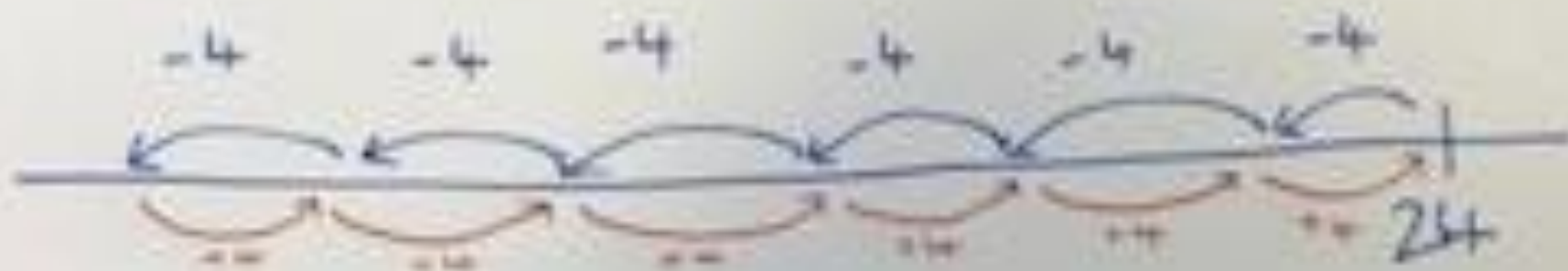
Repeated subtraction

$$6 \div 2 = 3$$





repeated subtraction

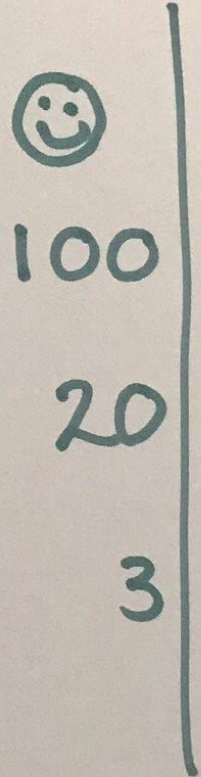
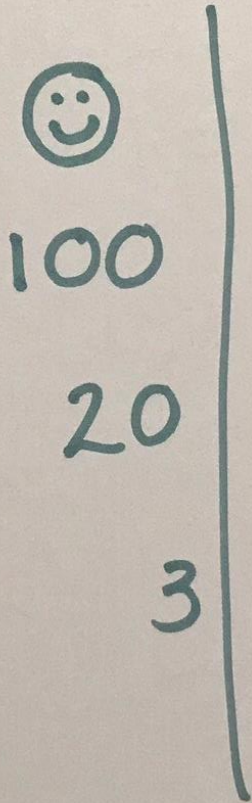
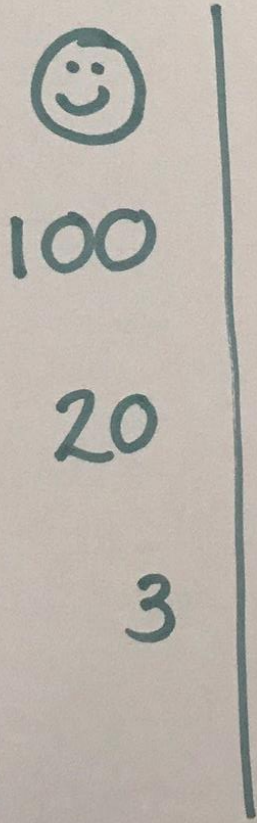
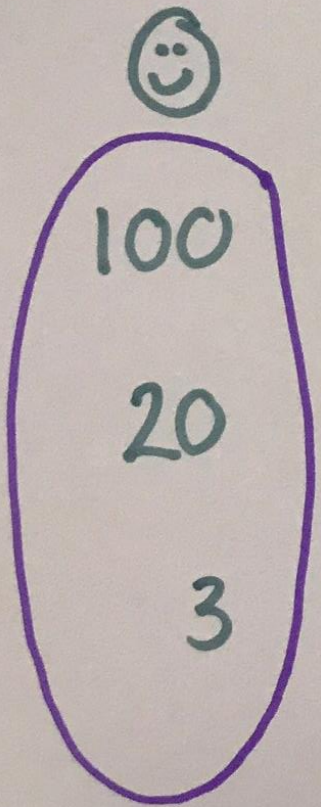


repeated addition



Pictorial sharing

$$593 \div 4 = 123 \text{ r } 1$$



r 1

$$123 \frac{1}{4}$$
$$123 \cdot 25$$

400

80

(480)

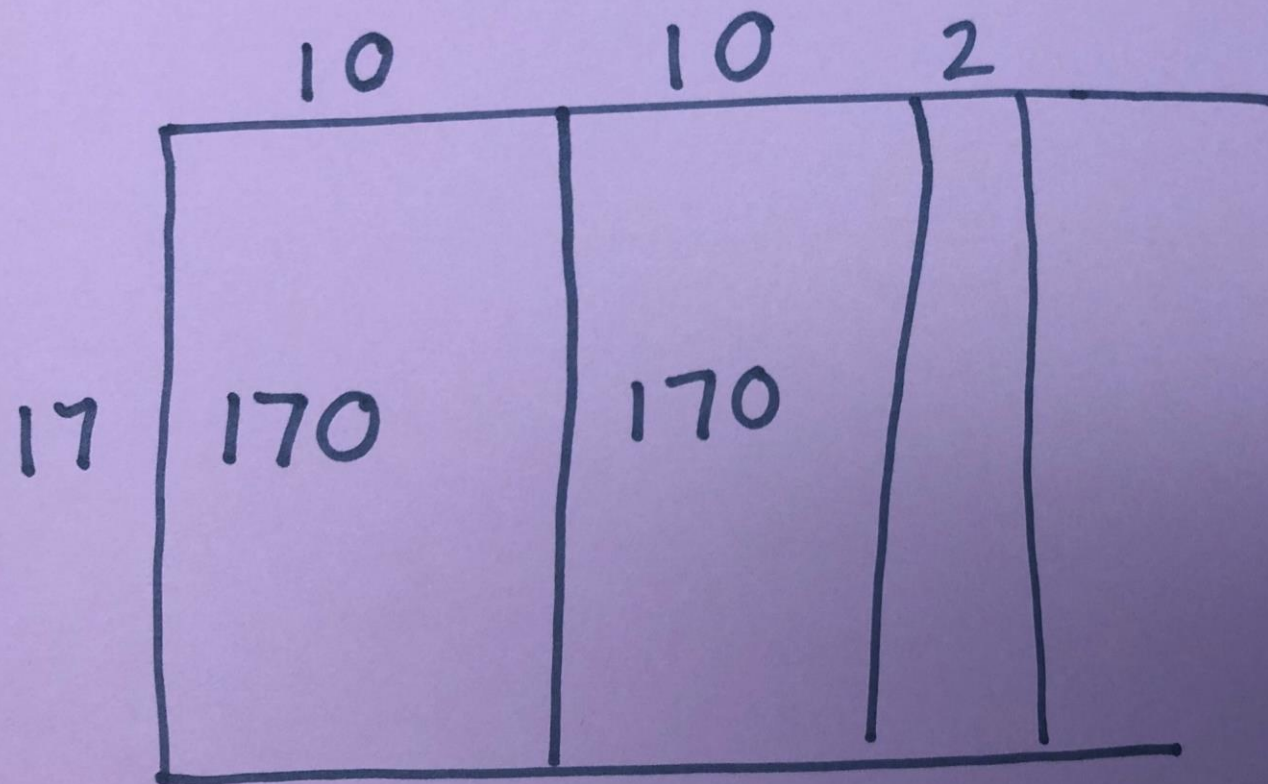
12

(492)



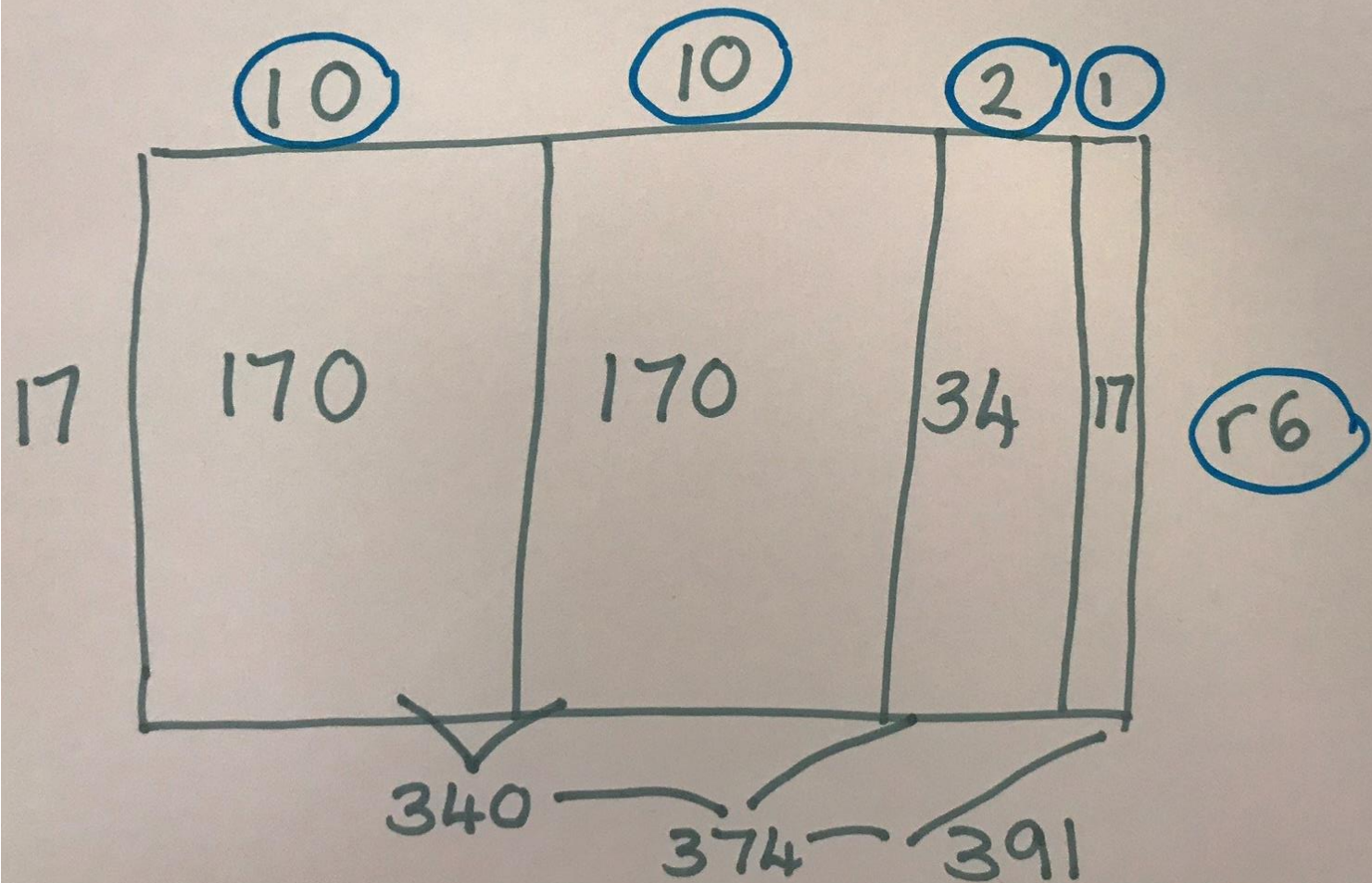
Reverse Proportional grid

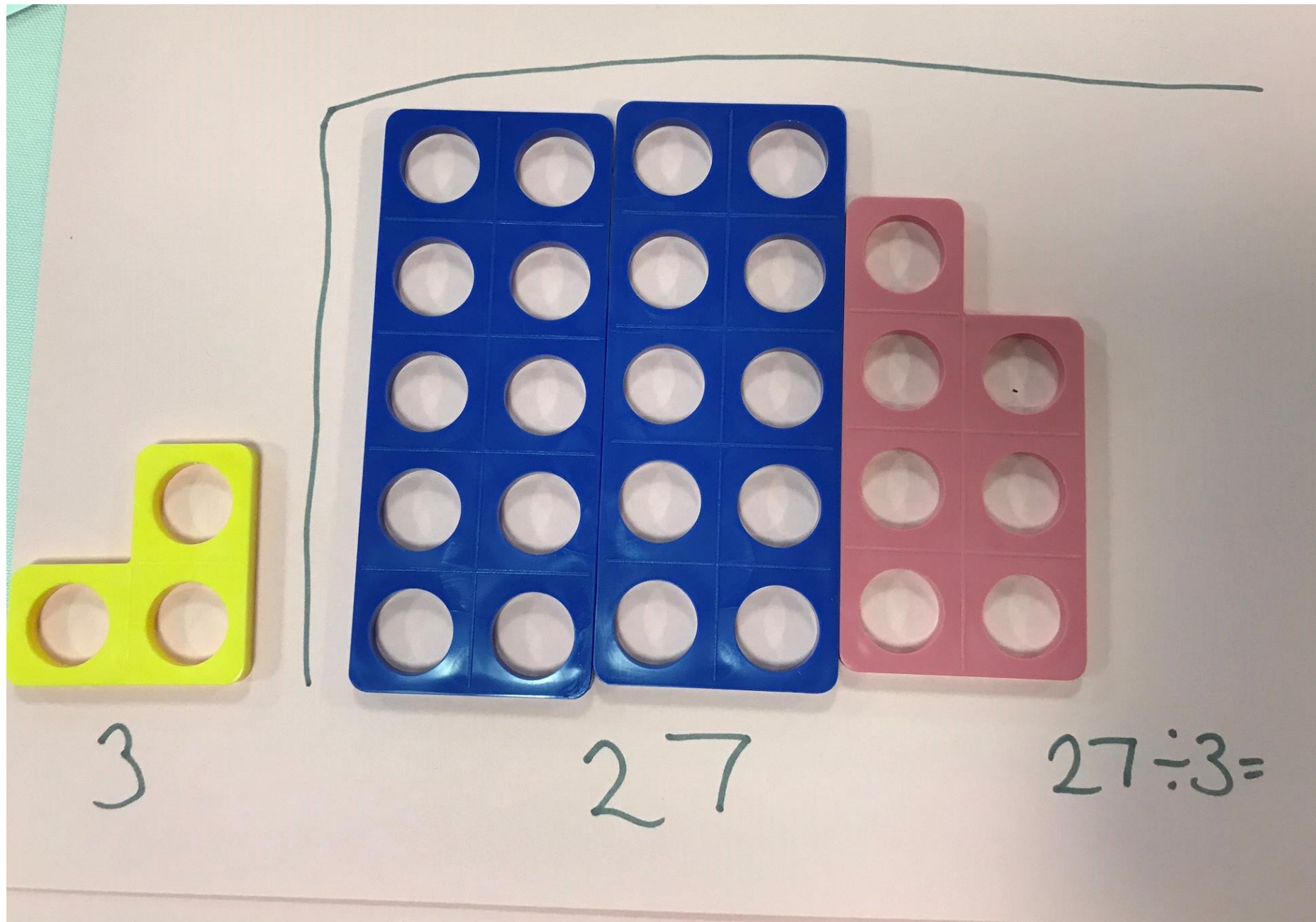
$$397 \div 17 =$$



Reverse proportional Grid

$$397 \div 17 = 23 \text{ r}6 \quad 23\frac{6}{17}$$

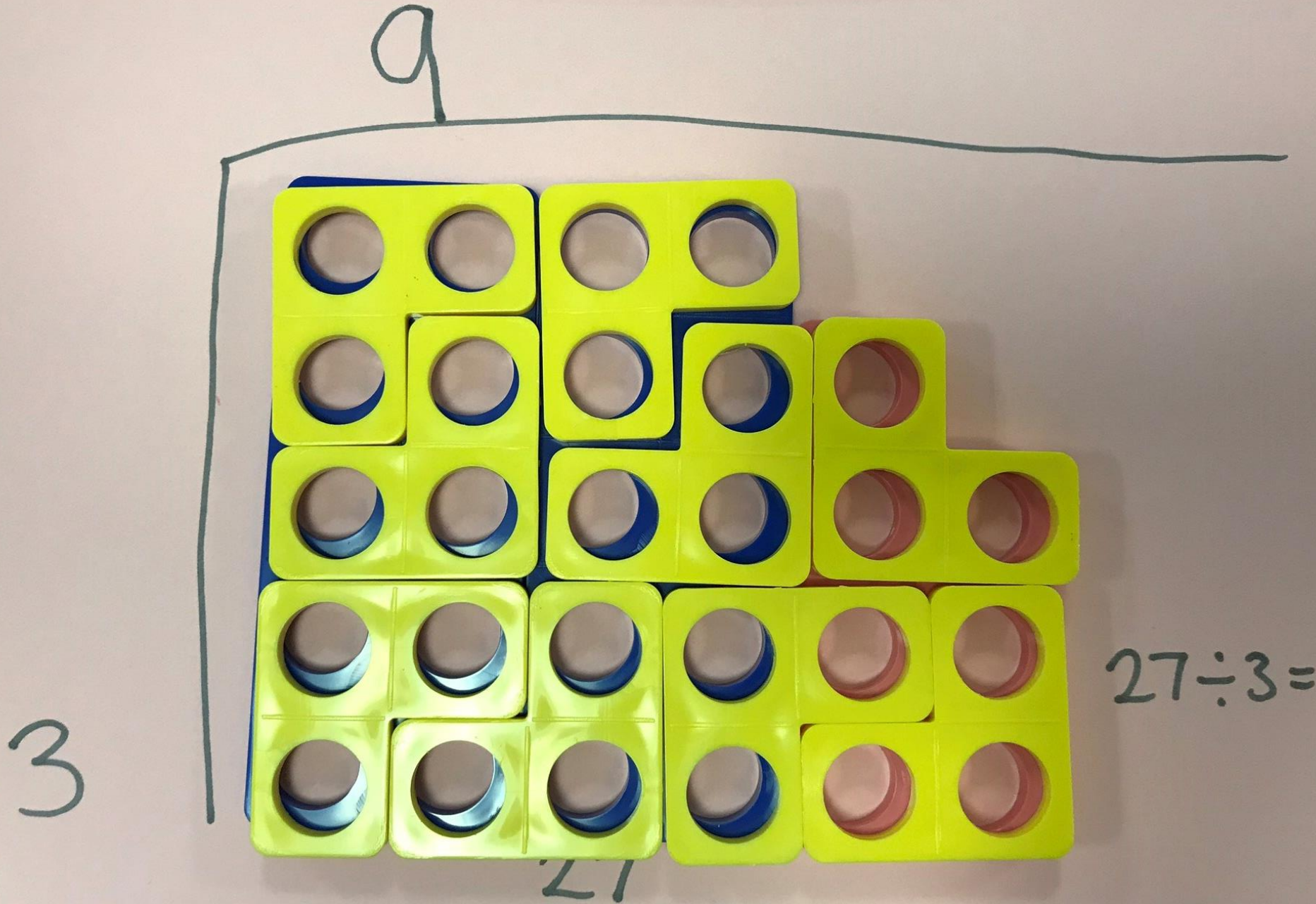




3

27

$27 \div 3 =$



Qn. 17

2018 R2

$$8 \text{ litres} = 8000 \text{ ml}$$

$$\text{Cup} = 225 \text{ ml}$$

$$\text{Cup} \times 2 = 450 \text{ ml}$$

$$\text{Cup} \times 4 = 900 \text{ ml}$$

$$\text{Cup} \times 8 = 1800 \text{ ml}$$

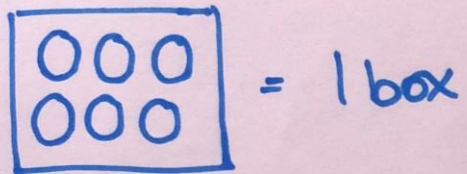


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Qn. 7

2018 R2



$$980 \div 6$$

$$100 \text{ boxes} = 600 \text{ eggs}$$

$$50 \text{ boxes} = 300 \text{ eggs}$$

$$150 \times 6 = 900 \quad 900$$

$$5 \times 6 = 30 \quad 930$$

$$8 \times 6 = 48$$

$$163 \times 6 = 978$$

163 full boxes

I know:

$$10 \times 97 = 970$$

$$100 \times 97 = 9700$$

$$50 \times 97 = 4850$$

$$20 \times 97 = 1940$$

$$90 \times 97 = 8730$$

\div	90	1	
97	8730	97	

91

$$? \times 97 = 8827$$



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$$97 \overline{) 8827}$$
$$\underline{8730}$$
$$0097$$

$97 \times 100 = 9700$

$97 \times 90 = 8730$

$\times 90$

$\times 1$

Formal algorithm

- short division (with remainders)

$$\begin{array}{r} 86 \text{ r.} 2 \\ \hline 5 \overline{) 432} \end{array}$$

$$\begin{array}{r} 86 \frac{2}{5} \\ \hline 5 \overline{) 432} \end{array}$$

↑
Expressing remainder as a fraction

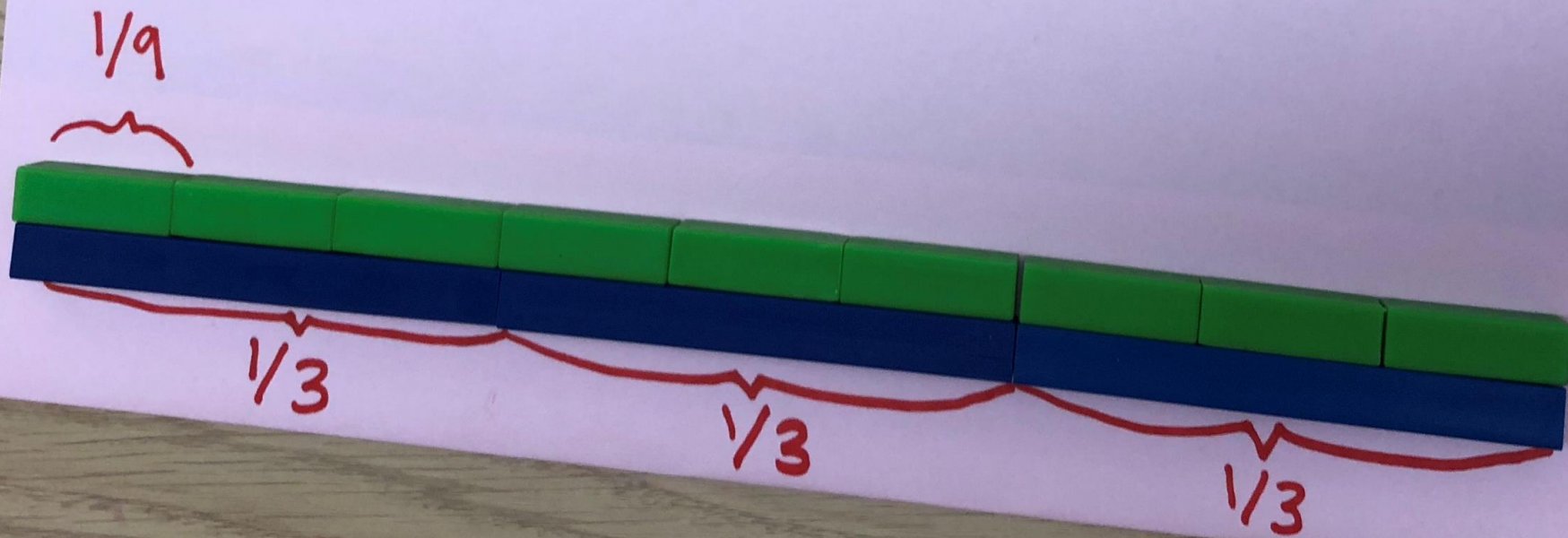
Expressing remainder as a decimal

$$\begin{array}{r} 86.4 \\ \hline 5 \overline{) 432.0} \end{array}$$

$$\begin{array}{r} 053 \quad \text{r } 3 \\ \hline 4 \overline{) 215} \\ \underline{8} \\ 15 \\ \underline{12} \\ 3 \end{array}$$

• 75

$$\frac{1}{3} \div 3$$



The End



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