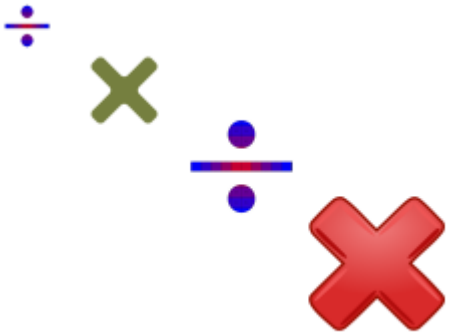


# Progression in Calculation

Multiplication and Division

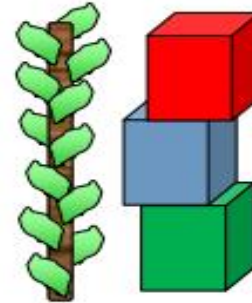


# Progression in Calculation

Multiplication and Division

Year R

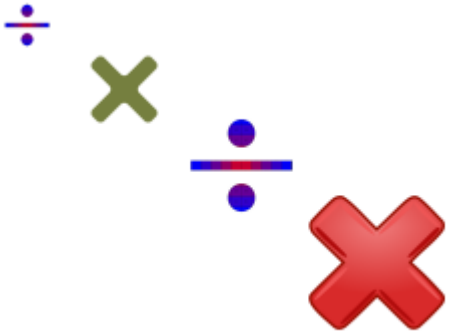
Each day Jack's beanstalk doubled in height. It was twice as tall.  
Today it is 3 bricks tall. How tall will it be tomorrow?



Cut the food in half to  
share with a friend.



3 friends wanted to share the last 6 apples. To  
make it fair they need the same amount each.



# Progression in Calculation

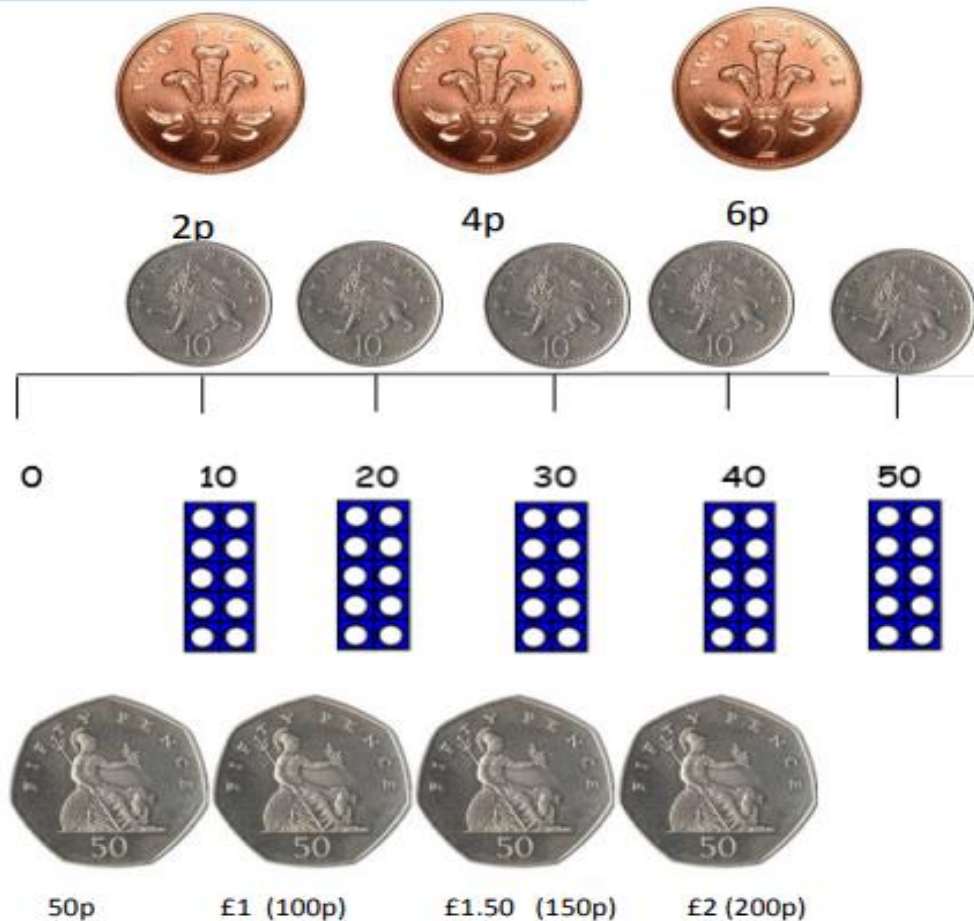
Multiplication and Division

Year 1 and 2

## Counting and Place Value

Year 1

Count in multiples of two, five and ten.



Year 3

Count in zero from multiples of 4, 8, 50, 100 and find 100 more or less than a given num-

What will change/stay the same if I add/subtract another 100?

Year 2

Count in steps of 2, 3, 5 from 0 and in tens from any number forwards and backwards

Year 2

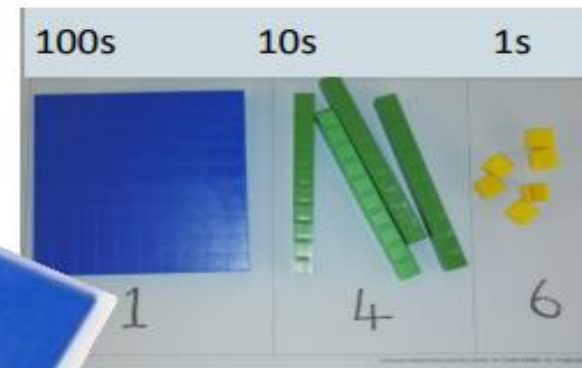
Recall and use multiplication tables and division facts for the 2, 5 and 10 multiplication tables.

$$3 \times 5 = 15$$

How many 3s in 15?

How many groups of 3 in 15?

$$3 \times \square = 15$$





## Using objects and pictorial representations alongside concrete resources



If I have 6 socks. How many pairs will that make?

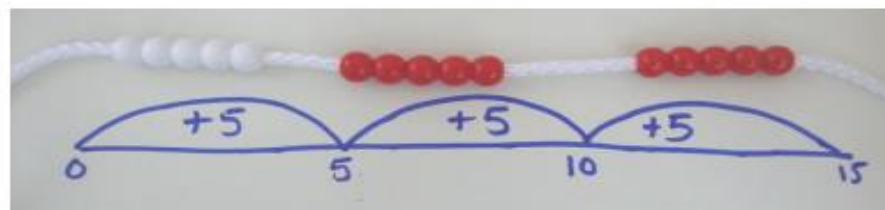
3 pairs



5 frogs on each lily pad

$$5 \times 3 = 15$$

Repeated Addition



Year 1

Solve one step problems involving multiplication and division by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.

Year 2

Solve problems using multiplication and division, using materials, arrays, repeated addition, mental methods and multiplication and division facts, including problems in contexts.

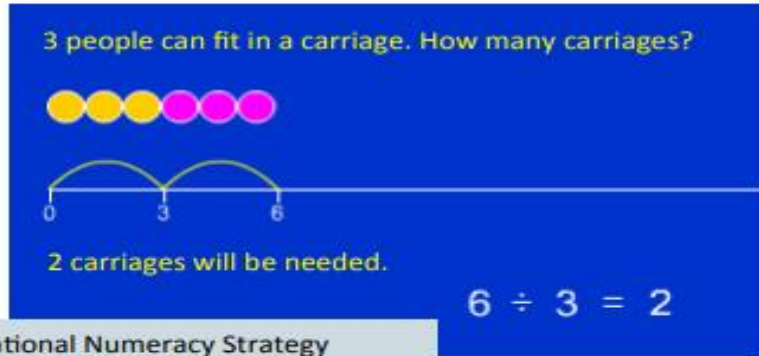
$$15 \text{ frogs} \div 3 \text{ lilly pads} = \boxed{\phantom{00}} \text{ Frogs on each}$$

$$\boxed{\phantom{00}} \text{ frogs} \times 3 \text{ lilly pads} = 15$$

There are 15 frogs. There are the same amount on each Lilly pad. If there are 3 Lilly pads, how many are sat on each one?

## Division as grouping and sharing

3 people will fit in a carriage.  
How many carriages will I need to carry 6 people?



ITPs National Numeracy Strategy

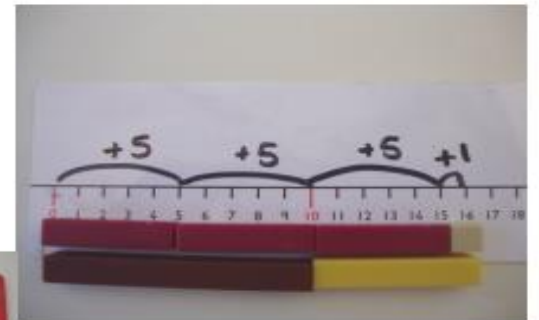
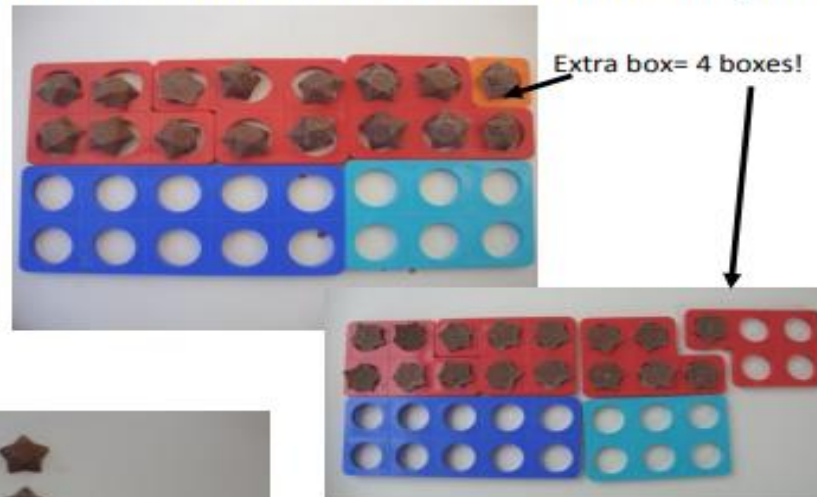
### Year 1

Solve one step problems involving multiplication and division by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.

5 chocolates will fit in a box. How many boxes will I need for 15 chocolates?



What if I had 16 chocolates...how many boxes would I need then?



There are 6 fish. How many bowls will I need if I want 2 fish in each?

There are 3 bowls, each with 2 fish!

I will group in 2s or share my fish across the 3 bowls.

Which is more efficient?



### Year 2

Solve problems using multiplication and division, using materials, arrays, repeated addition, mental methods and multiplication and division facts, including problems in contexts.



## Multiplication- Repeated addition, arrays and multiples



$$4 \times 1$$

$$4 \times 2$$

$$4 \times 3$$

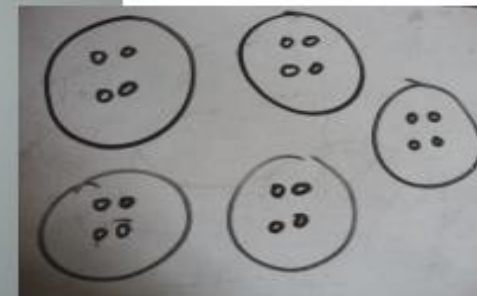
$$4 \times 4$$

$$4 \times 5$$



Year 1

Solve one step problems involving multiplication and division by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.



4 Cheerios in one bowl, how many in 5 bowls?

$$4 + 4 + 4 + 4 + 4 = 20$$

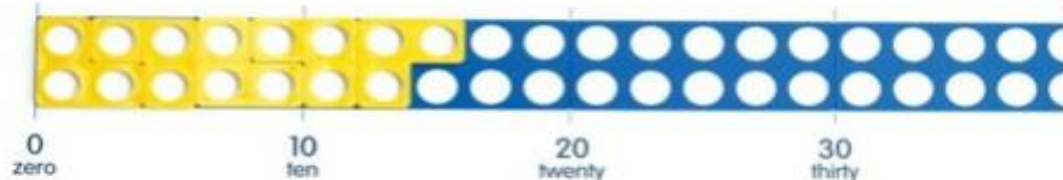
$$4 \times 5 = 20$$

If 5 friends wanted to share 20 Cheerios, how many would they each have?  $20 \text{ Cheerios} \div 5 \text{ people} = 4 \text{ Cheerios each}$



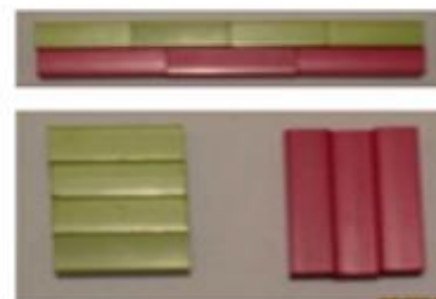
$$3 + 3 + 3 + 3 + 3$$

$$5 \times 3 = 15$$



Year 2

Solve problems using multiplication and division, using materials, arrays, repeated addition, mental methods and multiplication and division facts, including problems in contexts.

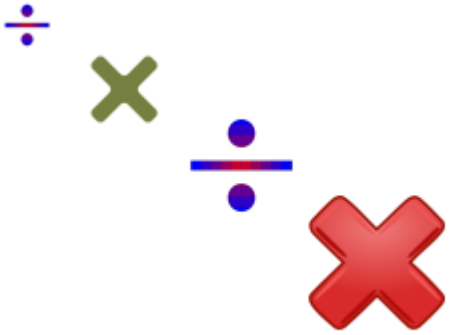


$$4 \times 3 = 3 \times 4$$



How many pies?





# Progression in Calculation

Multiplication and Division

Year 3 and 4

## Counting and place value



### Year 3

- Count in zero in multiples of 4, 8, 50, 100...

50p, £1, £1.50, £2

Or 50p, 100p, 150p, 200p

Count in different contexts using the language associated with the context.

Show number lines in many orientations and count in multiples.

50ml, 100ml, 150ml.

### Ordering and comparing numbers

What numbers could lie between these two values?

Which number is halfway between... and ...?



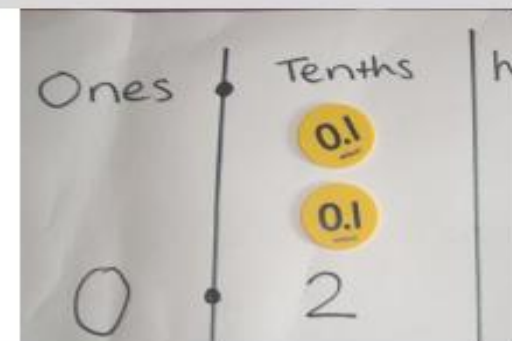
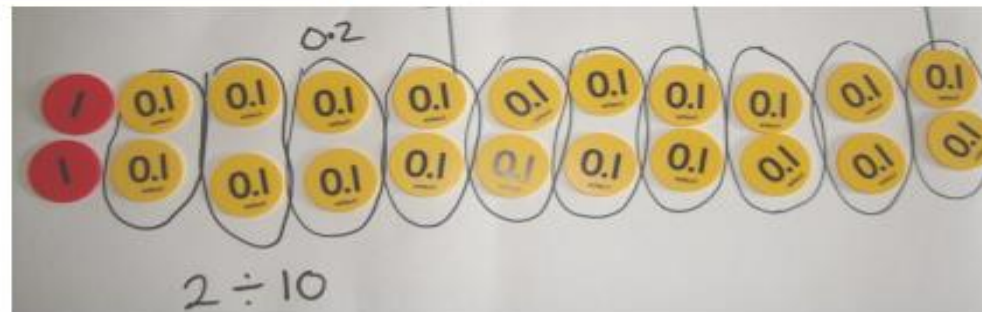
### Year 3 (Fractions)

Count up and down in tenths; recognise that tenths arise from dividing an object into 10 equal parts and in dividing one digit numbers or quantities by 10.

•

### Year 4 (Fractions)

- Count up or down in hundredths; recognise hundredths arise when dividing an object by one hundred and dividing tenths by ten.



Complete:

## Developing Reasoning and Application to other domains

$$6 \times 2 =$$

$$6 \times 10 =$$

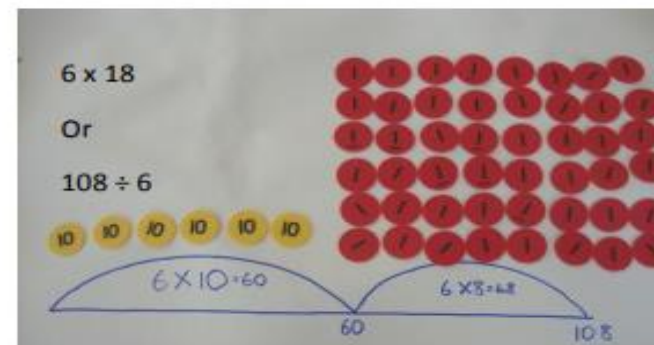
$$6 \times 20 =$$

$$6 \times 22 =$$

Year 3

- Write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including for two-digit times one-digit numbers, using mental methods and progressing to formal written methods

What is the same/different? Model these to show the connections



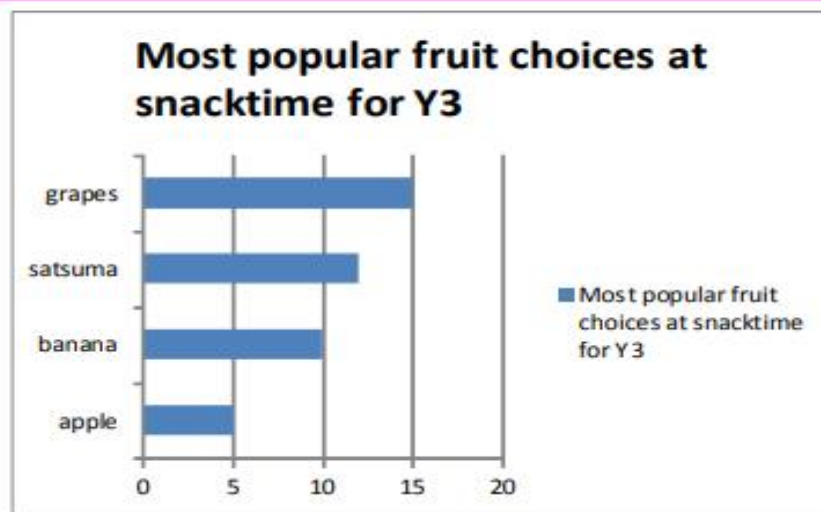
Children need a good grasp of using multiplication and division facts to allow them to use informal jottings to solve simple calculations mentally using recall of known facts.

Year 3 (Statistics)

Solve one and two step problems using information presented in scaled bar charts and pictograms

**Non- Statutory**

Pupils use simple scales e.g. 2, 5, 10 units per cm.














How many more people preferred banana to apple?

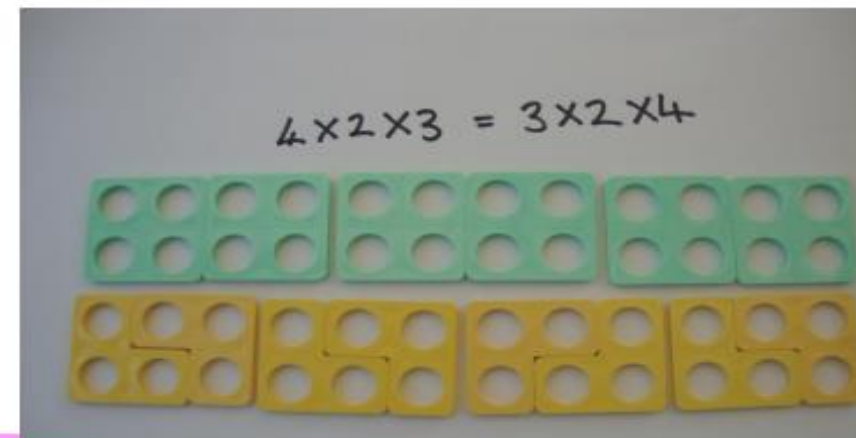
How many people had a snack altogether?

Count in 5's to help you

How many more people prefer cats to dogs?

$$5 - 2 = 3$$

Favourite Pets	
Cat	    
Dog	 
Hamster	  
Each  stands for 2 votes	



$$4 \times 2 \times 3 = 3 \times 2 \times 4$$

True or false? Prove it!

Year 3 **Non- Statutory**

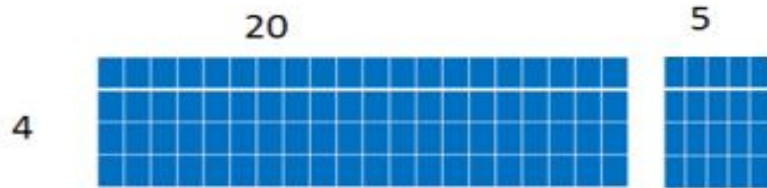
Pupils develop efficient methods, for example, using commutativity and associativity.



# Moving towards formal written methods of multiplication and division

## Multiplication

Ref: ITP: multiplication facts



$$\begin{array}{r} 25 \\ \times 4 \\ \hline 20 \text{ (5 x 4)} \\ 80 \text{ (20 x 4)} \\ \hline 100 \end{array}$$

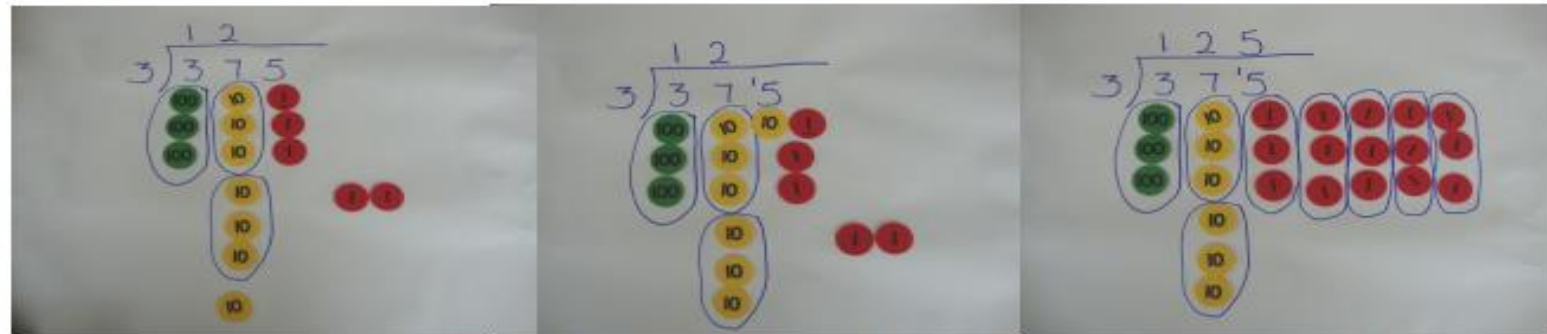
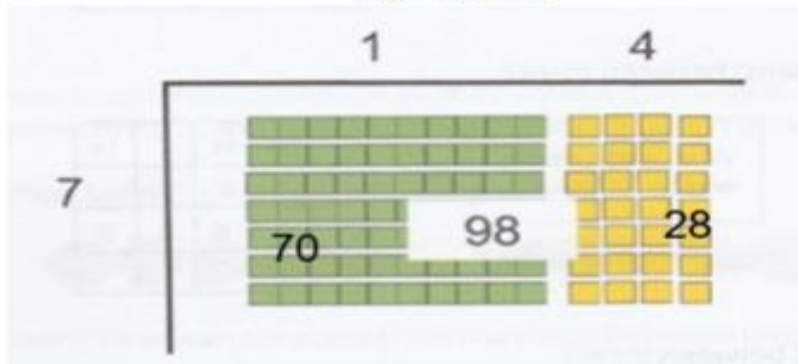
$$42 \times 4 = 168$$

$$40 \times 4 = 160$$

Linking arrays and grid method

## Division

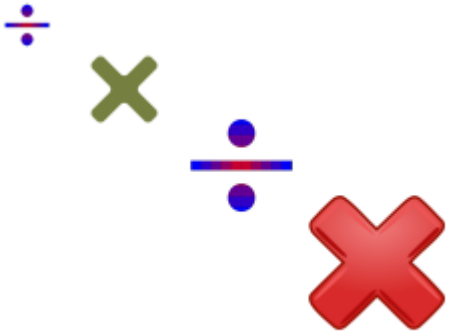
Ref: NCETM



Exchange or regroup the ten that cannot be grouped into 3s.

For video model see: <https://www.ncetm.org.uk/resources/43589>

Year 4  
Multiply 2 digit and 3 digit numbers by a one digit number using formal written layout. (see appendices of National Curriculum)



# Progression in Calculation

Multiplication and Division

Year 5 and 6

## Developing written methods of multiplication and division

### Division using decimals

Children need a good grasp of exchanging or regrouping where  $0.1 \times 10 = 1$  and  $0.01 \times 10 = 0.1$

$$8 \overline{) 0.2}$$

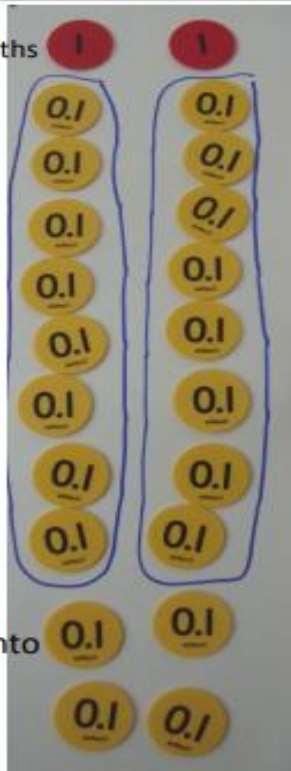
$$8 \overline{) \cancel{0.2} 0}$$

$$8 \overline{) \cancel{0.2} 5 0 0}$$

Year 6 (Fractions)

Use written division methods in cases where the answer has up to two decimal places.

regroup 2 into tenths



Group into 8

Group into 8s (as the divisor)



0.4 to regroup into hundredths

$2 \times 0.8 = 1.6$  with 0.4 to regroup into hundredths

True or false? Prove it.

How do you know?

Show using a model.

$$0.2 \times 5 = 0.5 \times 2$$

$$0.2 \times 4 + 0.2 = 0.2 \times 5$$



## Statutory Guidance– Formal Written Methods

### Short multiplication

24 × 6 becomes

$$\begin{array}{r} \phantom{0}24 \\ \times \phantom{0}6 \\ \hline 144 \\ \phantom{0}2 \phantom{0} \end{array}$$

Answer: 144

342 × 7 becomes

$$\begin{array}{r} \phantom{00}342 \\ \times \phantom{00}7 \\ \hline 2394 \\ \phantom{0}2 \phantom{0}1 \phantom{0} \end{array}$$

Answer: 2394

2741 × 6 becomes

$$\begin{array}{r} \phantom{000}2741 \\ \times \phantom{000}6 \\ \hline 16446 \\ \phantom{0}4 \phantom{0}2 \phantom{0} \end{array}$$

Answer: 16 446

### Long multiplication

24 × 16 becomes

$$\begin{array}{r} \phantom{00}24 \\ \times \phantom{00}16 \\ \hline 240 \\ 144 \\ \hline 384 \end{array}$$

Answer: 384

124 × 26 becomes

$$\begin{array}{r} \phantom{000}124 \\ \times \phantom{000}26 \\ \hline 2480 \\ \phantom{0}744 \\ \hline 3224 \\ \phantom{0}1 \phantom{0}1 \phantom{0} \end{array}$$

Answer: 3224

124 × 26 becomes

$$\begin{array}{r} \phantom{000}124 \\ \times \phantom{000}26 \\ \hline 744 \\ 2480 \\ \hline 3224 \\ \phantom{0}1 \phantom{0}1 \phantom{0} \end{array}$$

Answer: 3224

## Statutory Guidance– Formal Written Methods

### Short division

$98 \div 7$  becomes

$$\begin{array}{r} 14 \\ 7 \overline{) 98} \end{array}$$

Answer: 14

$432 \div 5$  becomes

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

Answer: 86 remainder 2

$496 \div 11$  becomes

$$\begin{array}{r} 45 \text{ r } 1 \\ 11 \overline{) 496} \end{array}$$

Answer:  $45\frac{1}{11}$

### Long division

$432 \div 15$  becomes

$$\begin{array}{r} 28 \text{ r } 12 \\ 15 \overline{) 432} \\ \underline{30} \phantom{0} \\ 132 \\ \underline{120} \\ 12 \end{array}$$

Answer: 28 remainder 12

$432 \div 15$  becomes

$$\begin{array}{r} 28 \\ 15 \overline{) 432} \\ \underline{30} \phantom{0} \\ 132 \\ \underline{120} \\ 12 \end{array}$$

$15 \times 20$

$15 \times 8$

$$\frac{12}{15} = \frac{4}{5}$$

Answer:  $28\frac{4}{5}$

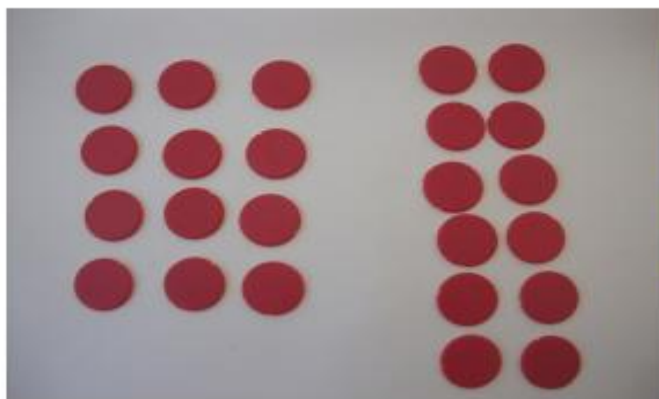
$432 \div 15$  becomes

$$\begin{array}{r} 28.8 \\ 15 \overline{) 432.0} \\ \underline{30} \phantom{0} \\ 132 \\ \underline{120} \\ 120 \\ \underline{120} \\ 0 \end{array}$$

Answer:  $28.8$

## Factors, Primes, Square and Cube Numbers and application to other domains

Use the counters to find factors of 12 by making arrays. What others can you find?  
How many arrays can you make with 13 counters?



Year 4  
Recognise and use factor pairs in mental calculation.

Year 5

Identify multiples and factors, including finding all factor pairs of a number and common factors of 2 numbers.

*Now compare finding the factors of 15.*

See Fractions, decimals, percentages and ratio and proportion booklet also.

$$2 \times 2 = 4$$



$$2 \times 2 \times 2 = 8$$



Year 5

Recognise and use square numbers and cube numbers, and use the notation for squared <sup>(2)</sup> and cubed <sup>(3)</sup>.

### Year 6 Ratio and Proportion

Solve problems using the relative sizes of two quantities where missing values can be found by using integer multiplication and division facts.

The volume of the box is  $150\text{cm}^3$ .

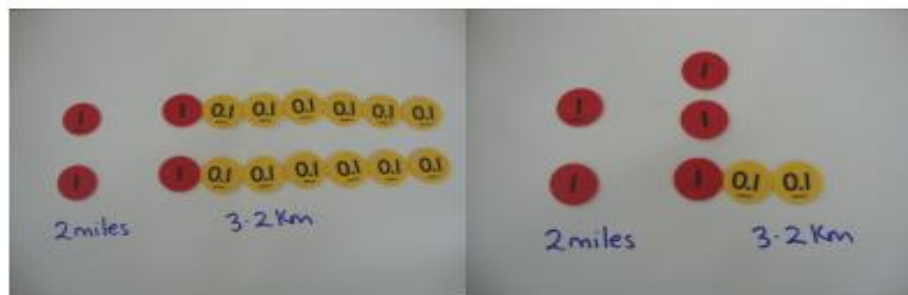
What could the dimensions be? Investigate.

$$\boxed{\phantom{00}} \times \boxed{\phantom{00}} \times \boxed{\phantom{00}} = 64$$

The number in the blue box is the same.  
What could it be?

1 mile = 1.6km

So 2 miles = 3.2km



Year 6 (Measures) See Year 5 objectives also

Convert between miles and km.

Solve problems involving the calculation and conversion of units of measure, using decimals notation up to 3 decimal places where appropriate.