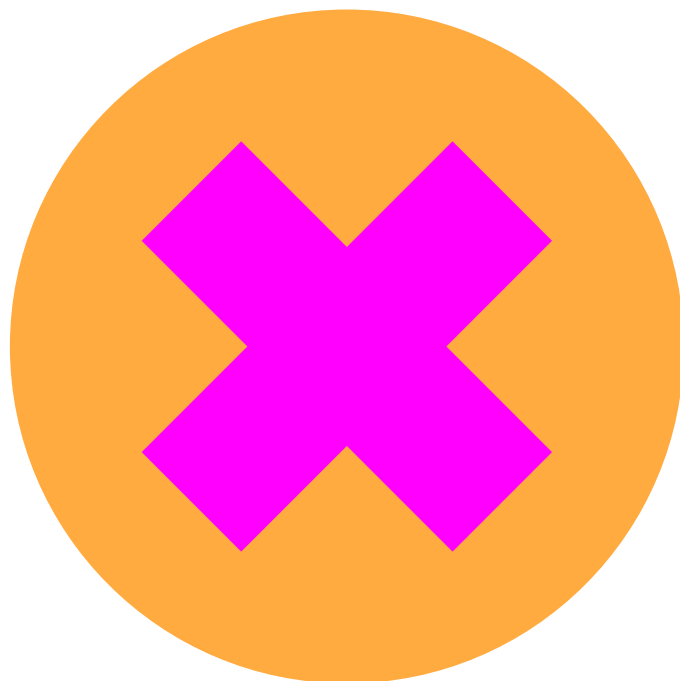


MULTI-DIGIT MULTIPLICATION STRATEGIES

Split Strategy
The Standard Algorithm
The Area Model
The Lattice Method



MULTI-DIGIT MULTIPLICATION

SPLIT

How does it work?

Split the largest number into hundred, tens and ones, multiply each by the second number separately, then add the answers together.

For example:

$$264 \times 7 = 1848$$

A tree diagram with three lines extending downwards from the number 264 to the numbers 200, 60, and 4, illustrating the splitting of the number into hundreds, tens, and ones.

$$200 \times 7 = 1400$$

$$60 \times 7 = 420$$

$$4 \times 7 = 28$$

$$1400 + 420 + 28 = 1848$$

2 X 1 DIGIT MULTIPLICATION

ALGORITHM

How does it work?

Multiply the bottom number by the top number one digit at a time, working your way from right to left. If the product is a 2-digit number, the first digit will need to be carried over and added to the product of the next answer.

For example: $72 \times 6 = 432$

Step 1: Complete $6 \times 2 = 12$

Step 2: Record the 2 and carry the 1

$$\begin{array}{r} 1 \\ 72 \\ \times 6 \\ \hline 2 \end{array}$$

Step 3: Complete $6 \times 7 = 42$

Step 4: Add the 1 carried over = 43

Step 5: Record the answer 43

$$\begin{array}{r} (+1) \\ 72 \\ \times 6 \\ \hline 432 \end{array}$$

2 X 2 DIGIT MULTIPLICATION

ALGORITHM

How does it work?

Start with the numbers in the unit column, multiplying the bottom number by the top number one digit at a time, working your way from right to left. When multiplying the numbers in the tens column, record the answer on a new line with a place holder '0' written in the unit column, to ensure your answer will be recorded with the correct place value. When both multiplication problems are complete, add both products to calculate the final answer.

For example:

$$428 \times 67 = 28676$$

Step 1:

Multiply 7 by 428, one digit at a time, carrying the first digit of any 2-digit product and adding it to the product of the next answer.

$$\begin{array}{r} 1 \quad 5 \\ 428 \\ \times 67 \\ \hline 2996 \\ \hline \\ \hline \end{array}$$

Step 2:

Add a place holder 0 in the next row, to ensure the next answer is recorded in the correct place value space. Cross out any numbers carried previously.

$$\begin{array}{r} \cancel{1} \quad \cancel{5} \\ 428 \\ \times 67 \\ \hline 2996 \\ \hline 0 \quad \leftarrow \\ \hline \end{array}$$

Step 3:

Repeat step 1, multiplying 6 by 428.

When complete, add both products to calculate the final answer.

$$\begin{array}{r} 1 \quad 4 \\ 428 \\ \times 67 \\ \hline 12996 \\ \hline 25680 \\ \hline 28676 \\ \hline \end{array}$$

3 X 3 DIGIT MULTIPLICATION

ALGORITHM

How does it work?

Start with the numbers in the unit column, multiplying the bottom number by the top number one digit at a time, working your way from right to left. When multiplying the numbers in the tens column, record the answer on a new line with a place holder '0' written in the unit column. When multiplying numbers in the hundreds column, record the answer on a new line with 2 zeros. When all multiplication problems are complete, add all products to calculate the final answer.

For example: $841 \times 563 = 473483$

Step 1:

Multiply 3 by 841, one digit at a time, carrying the first digit of any 2-digit product and adding it to the product of the next answer.

$$\begin{array}{r}
 841 \\
 \times 563 \\
 \hline
 2523 \leftarrow \\
 \dots\dots\dots \\
 \dots\dots\dots \\
 \dots\dots\dots
 \end{array}$$

Step 2:

Add a place holder 0 in the next row, cross out any numbers carried previously, then repeat step 1 by multiplying 6 by 841

$$\begin{array}{r}
 841 \\
 \times 563 \\
 \hline
 2523 \\
 50460 \leftarrow \\
 \dots\dots\dots \\
 \dots\dots\dots
 \end{array}$$

Step 3:

Add 2 zeros in the next row, cross out any numbers carried previously, then repeat step 1 by multiplying 5 by 841. When complete, add all products to calculate the final answer.

$$\begin{array}{r}
 841 \\
 \times 563 \\
 \hline
 2523 \\
 50460 \\
 420500 \leftarrow \\
 \hline
 473483
 \end{array}$$

MULTI-DIGIT MULTIPLICATION

AREA

How does it work?

Use the table to split the problem into hundreds, tens and ones, multiply each by the second number separately, then add the answers together.

Example 1: $453 \times 8 = 3624$

x	400	50	3
8	3200	400	24

$$3200 + 400 + 24 = 3624$$

Example 2: $531 \times 82 = 43542$

x	500	30	1
80	40000	2400	80
2	1000	60	2

$$40000 + 2400 + 80 + 1000 + 60 + 2 = 43542$$

MULTI-DIGIT MULTIPLICATION

THE LATTICE METHOD

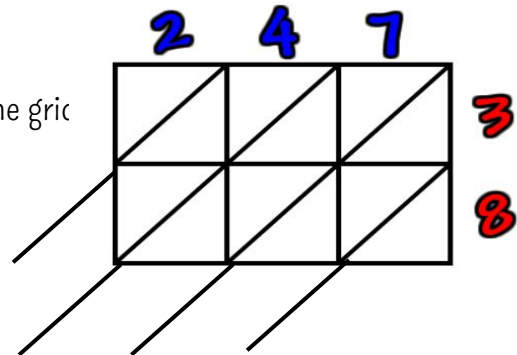
How does it work?

Draw a grid with diagonal lines that extend past the grid. Next, arrange the factors along the top and right side of the grid. Then multiply the numbers that meet in each space on the grid. The tens and ones are split on either side of the diagonal line. Continue multiplying for each space on the grid. Add using diagonal rows, and write the sum of each diagonal row along the left side and bottom of the grid. If the sum is a 2-digit number carry the tens digit to the next diagonal row.

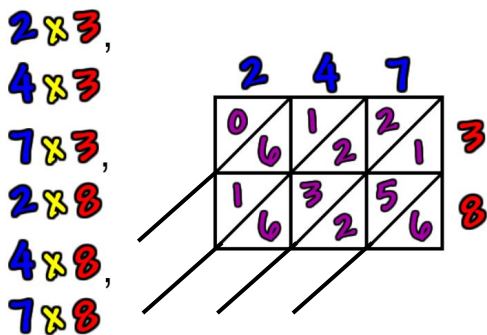
Example:

$$247 \times 38$$

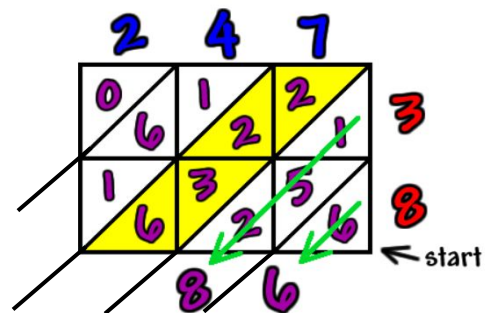
Step 1: Set up the grid



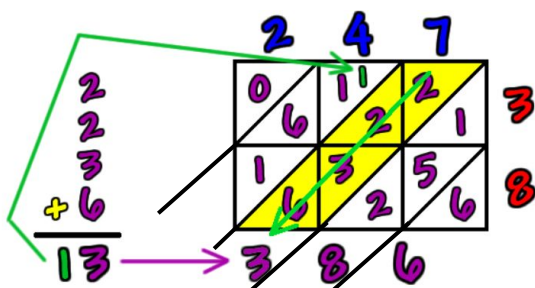
Step 2: Multiply the numbers that meet in each space on the grid. The tens and ones are split on either side of the diagonal line.



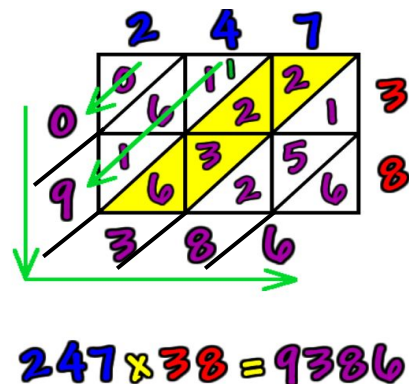
Step 3: Add using diagonal rows, and write the sum of each diagonal row along the left side and bottom of the grid.



Step 4: If the sum is a 2-digit number carry the tens digit to the next diagonal row.

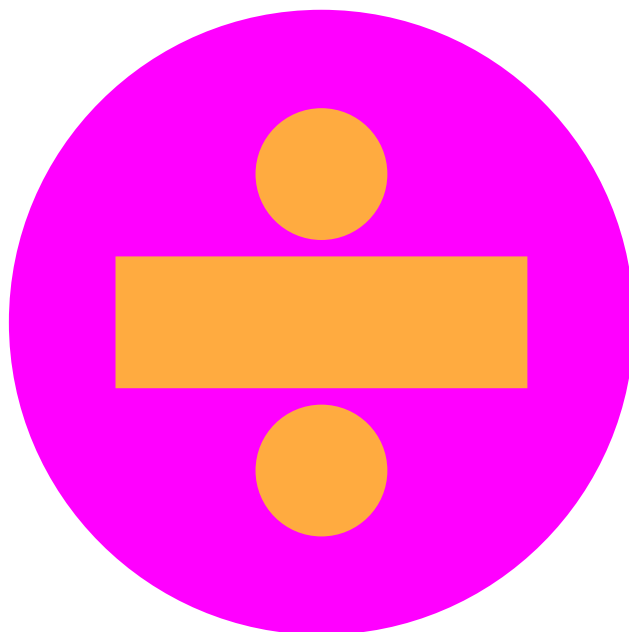


Step 5: Record the solution



DIVISION STRATEGIES

Short Division
Line and Dot Strategy
Division Lattice Method
Division Box Method



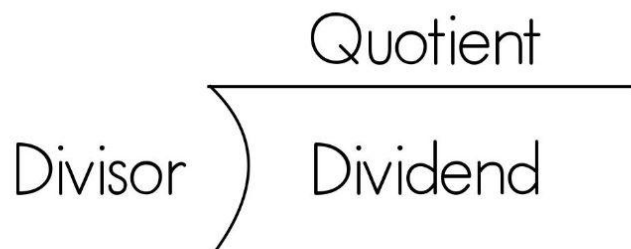
DIVISION

WITHOUT REMAINDERS

How does it work?

Divide the 'dividend' by the 'divisor' one number at a time from left to right, to find the 'quotient'.

If a number can not be divided completely into equal groups, record the number of times it can be divided, then carry the remainder to the next number of the dividend.



For example:

$$230 \div 2 = 115$$

Step 1:

Solve: $2 \div 2 = 1$
Record 1 on the line

$$\begin{array}{r} \boxed{1} \\ \hline 2 \overline{) \boxed{2}30} \\ \uparrow \end{array}$$

Step 2:

Solve: $3 \div 2 = 1 \text{ r } 1$
Record 1 on the line

$$\begin{array}{r} 1\boxed{1} \\ \hline 2 \overline{) 2\boxed{3}0} \\ \uparrow \end{array}$$

Step 3:

Carry the remainder 1,
then solve: $10 \div 2 = 5$
Record 5 on the line

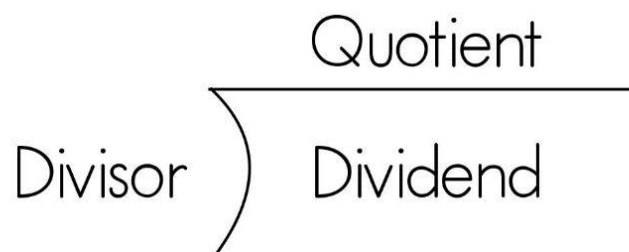
$$\begin{array}{r} 11\boxed{5} \\ \hline 2 \overline{) 23\boxed{0}} \\ \uparrow \end{array}$$

DIVISION

WITH REMAINDERS

How does it work?

Divide the 'dividend' by the 'divisor' one number at a time from left to right, to find the 'quotient'. If a number can not be divided completely into equal groups, record the number of times it can be divided, then carry the remainder to the next number of the dividend. Any remainders left at the end of the problem can be written as r (remainder) or as a fraction/decimal.



For example:

$$895 \div 3 = 298 \text{ r}1$$

Step 1:

Solve: $8 \div 3 = 2 \text{ r} 2$
Record the 2 and carry the remainder 2

$$\begin{array}{r} \boxed{2} \\ 3 \overline{) 8} 29 5 \\ \uparrow \end{array}$$

Step 2:

Solve: $29 \div 3 = 9 \text{ r} 2$
Record the 9 and carry the remainder 2

$$\begin{array}{r} 2\boxed{9} \\ 3 \overline{) 8} 29 25 \\ \uparrow \end{array}$$

Step 3:

Solve: $25 \div 3 = 8 \text{ r} 1$
Record 8 r1 or $8\frac{1}{3}$

$$\begin{array}{r} 29\boxed{8} \text{r}1 \\ 3 \overline{) 8} 29 25 \\ \uparrow \end{array}$$

DIVISION

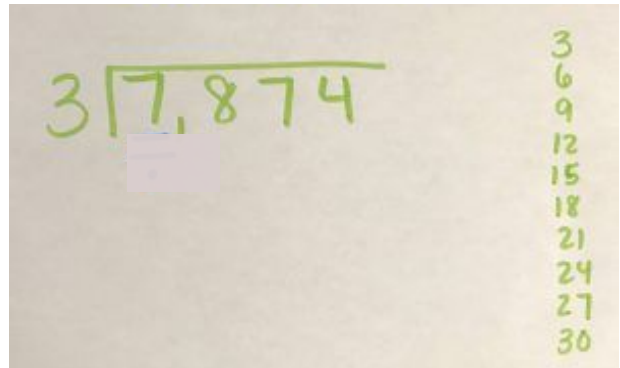
LINE AND DOT STRATEGY

How does it work?

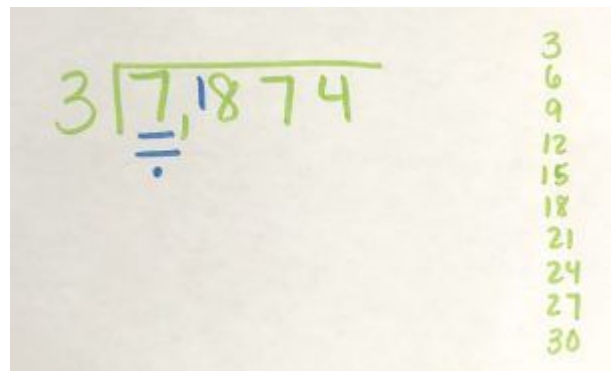
Set up the problem and skip count by the divisor on the side. Skip count by the divisor by until you reach the digit inside the division box. Each time you say a multiple, draw a line. If you can't say the next multiple without going over draw dot until you reach the inside number. Count the number of dots and carry over to the next digit to create a new number. Count the number of lines under each digit and write that in the quotient. Any dots at the end of the problem will be the remainder.

Example:

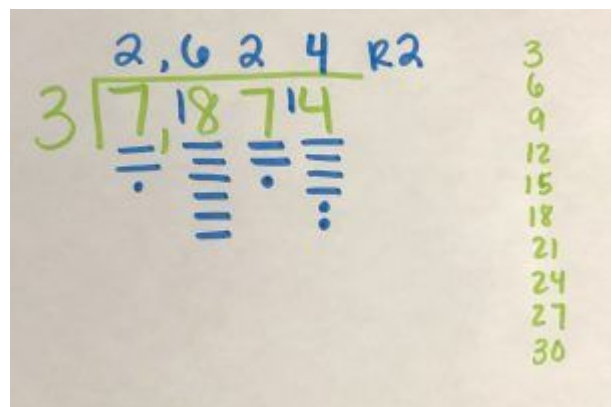
Step 1: Set up the problem and skip count by the divisor on the side.



Step 2: Skip count by the divisor by until you reach the digit inside the division box. Each time you say a multiple, draw a line. If you can't say the next multiple without going over draw dot until you reach the inside number.



Step 3: Count the number of dots and carry over to the next digit to create a new number.



Step 4: Count the number of lines under each digit and write that in the quotient. Any dots at the end of the problem will be the remainder.

DIVISION

LATTICE METHOD

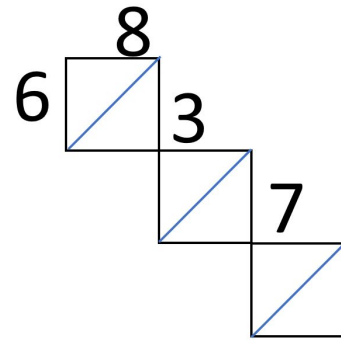
How does it work?

Draw a Step down grid with diagonal lines. Next, arrange the dividend along the top and the divisor to the left side of the grid. Divide the numbers that meet in the top space on the grid. The tens and ones are split on either side of the diagonal line. Circle the new number created and then divide that by the divisor on the left of the grid. Continue to divide the remaining grid numbers. Record the solution.

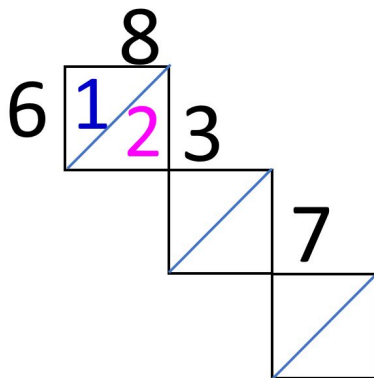
Example:

$$837 \div 6 =$$

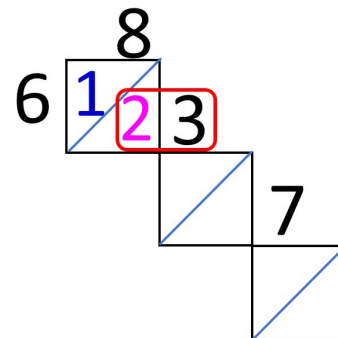
Step 1: Set up the grid.



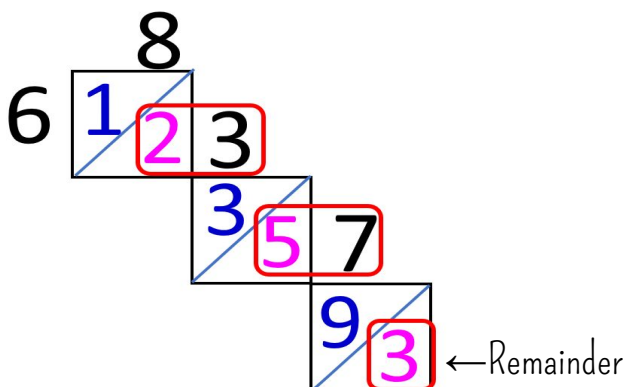
Step 2: Divide the numbers that meet in the top space on the grid. The tens and ones are split on either side of the diagonal line.



Step 3: Circle the new number created and then divide that by the divisor on the left of the grid.



Step 4: Repeat steps 2 and 3 until you reach the end of the grid.



Step 5: Record the solution

$$837 \div 6 = 139 \text{ r}3$$

DIVISION

BOX METHOD

How does it work?

Set up the boxes and write the multiplication facts that link with the divisor. Use the facts on the side to find the closest product to the number. Write the factor that is not the divisor in the quotient place and subtract the product. Carry the difference to the next box to create a new number. Repeat Step 2 for the remaining boxes. The difference in the final box is the remainder.

Example:

$$5 \overline{) 724}$$

Step 1: Set up the boxes and write the multiplication facts that link with the divisor.

Step 2: Use the facts on the side to find the closest product to the number. Write the factor that is not the divisor in the quotient place and subtract the product. Carry the difference to the next box to create a new number.

5	7	2	4
---	---	---	---

5 × 0 = 0
5 × 1 = 5
5 × 2 = 10
5 × 3 = 15
5 × 4 = 20
5 × 5 = 25
5 × 6 = 30
5 × 7 = 35
5 × 8 = 40
5 × 9 = 45
5 × 10 = 50

5	7	2	4
	<u>-5</u>		
	2		

Step 3: Repeat Step 2 for the remaining boxes. The difference in the final box is the remainder.

	1	4	4 r4
5	7	22	24
	<u>-5</u>	<u>-20</u>	<u>-20</u>
	2	2	4

$$5 \overline{) 724} \quad \begin{matrix} 1 & 4 & 4 & r4 \end{matrix}$$