Addition and subtraction – formal methods

Adding and subtracting whole numbers

Addition: Add each column, starting with the ones.
Regroup as needed if a column exceeds 9.

62,376 + 29,813 =

	6	2	3	7	6
+	2	9	8	1	3
	9	2	1	8	9
		1	1		

Subtraction: Subtract each column, starting with the ones.
Exchange as needed.

73,514 - 24,123 =

	⁶7̸	3	⁴5̸¹	1	4
-	2	4	1	2	3
	4	9	3	9	1

Adding and subtracting decimals

Check that the **decimal points** are lined up.
Use place holders to fill empty place value columns.

Addition: Add each column, starting with the lowest place value.
Regroup as needed if a column exceeds 9.

48.5 + 6.742 =

	4	8	.	5	0	0
+	0	6	.	7	4	2
	5	5	.	2	4	2
		1		1		

Subtraction: Subtract each column, starting with the lowest place value.
Exchange as needed.

24.64 – 9.124 =

	¹2̸	¹4	.	6	³4̸¹	0
-	0	9	.	1	2	4
	1	5	.	5	1	6

Adding and subtracting whole numbers and decimals

The **decimal point** goes **at the end** of the **whole number**.
Check that the **decimal points** are lined up.
Use place holders to fill empty place value columns.

Addition: Add each column, starting with the lowest place value.
Regroup as needed if a column exceeds 9.

63 + 8.235 =

	6	3	.	0	0	0
+	0	8	.	2	3	5
	7	1	.	2	3	5
		1				

Subtraction: Subtract each column, starting with the lowest place value.
Exchange as needed.

72 – 4.814 =

	⁶7̸	¹1̸	.	⁹0̸	⁹0̸	¹0
-	0	4	.	8	1	4
	6	7	.	1	8	6

Addition and subtraction – informal

Adding and subtracting using place value

Adding multiples of 10

Use place value headings to add mentally.

70 + 3,000 =

70 + 3,000 =

Th	H	T	O
3	0	7	0

50,000 + 300 + 80 + 4 =

50,000 + 300 + 80 + 4 =

TTh	Th	H	T	O
5	0	3	8	4

5,000 + 12 =

5,000 + 12 =

Th	H	T	O
5	0	1	2

7,403 + 50 =

7,403 + 50 =

Th	H	T	O
7	4	5	3

Missing numbers in partitioned questions

Label place value headings to find missing value.

405,008 = 400,000 + 5,000 + 8 =

HTh	TTh	Th	H	T	O
4	0	5	0	0	8

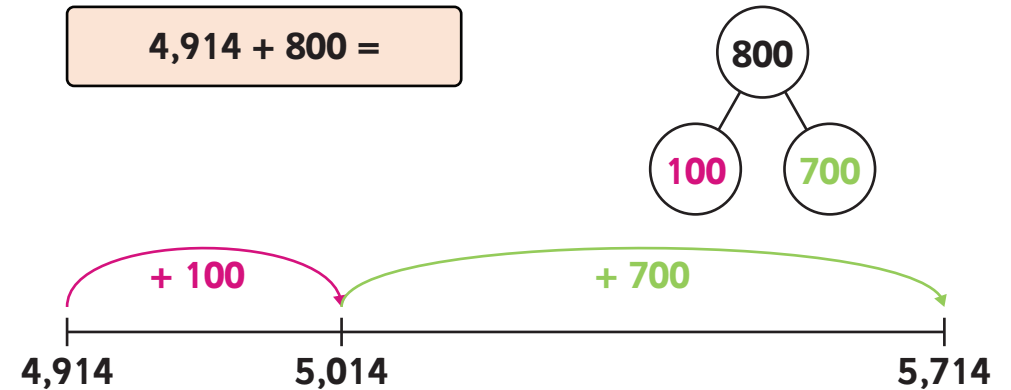## Adding and subtracting multiples of 10

Adding multiples of 10

Add to the nearest multiple of 10, 100 or 1,000.

Partition the added number.

Add the second part.
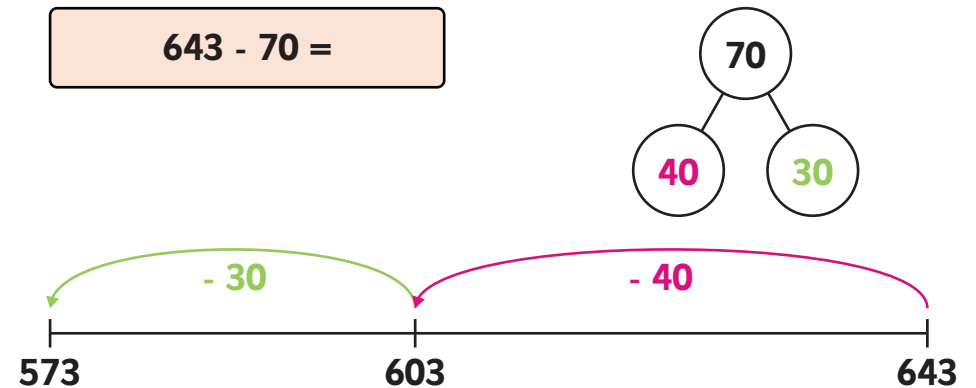
4,914 + 800 =

Subtracting multiples of 10

Subtract to the nearest multiple of 10, 100 or 1,000.

Partition the subtracted number.

Subtract the second part.

643 - 70 =

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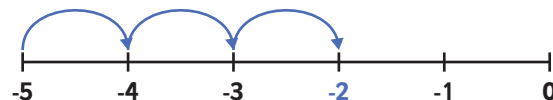
Addition and subtraction

Adding and subtracting with negative numbers

We can use a number line to add and subtract with negative numbers.

Adding to a negative number (below zero)
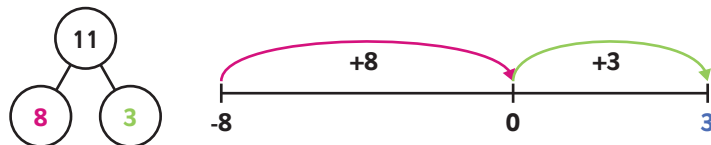
Use number line to add.

$$- 5 + 3 = - 2$$

-5 -4 -3 -2 -1 0

Adding to a negative number (crossing zero)

Add to zero.
Partition added number.
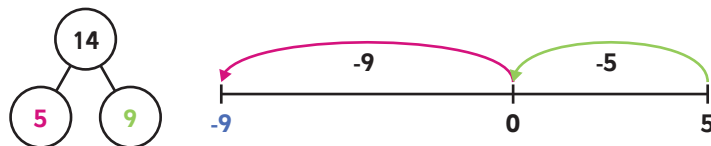Add the second part.

$$- 8 + 11 = 3$$

11
8   3

+8   +3

-8   0   3

Subtracting (crossing zero)

Subtract to zero.
Partition subtracted number.
Subtract the second part.

$$5 - 14 = - 9$$

14
5   9

-9   -5

-9   0   5

Subtracting from a negative number

Use a number line to subtract.

$$- 1 - 3 = - 4$$

-5 -4 -3 -2 -1 0
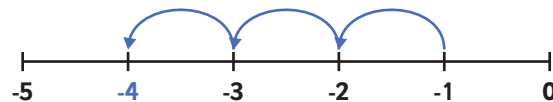
Adding with missing numbers

Addition: missing number **first** or **second**
Use the inverse (subtraction).
Then, use addition to check your answer.

| 409 | + 64 = 473 |

```
    4  6⁄7¹ 3          4  0  9
 -     6  4        +     6  4
    4  0  9              4  7  3
                              1
```

$$23 + \boxed{518} = 541$$

```
    5  3⁄4¹ 1          5  1  8
 -     2  3        +     2  3
    5  1  8              5  4  1
                              1
```

NOTE: If the missing number is the **sum**, then add as normal!

Subtracting with missing numbers

Subtraction: missing number **first**
Use the inverse (addition).
Then, use subtraction to check your answer.

| 293 | - 78 = 215 |

```
    2  1  5          2  8⁄9¹ 3
 +     7  8        -     7  8
    2  9  3              2  1  5
          1
```

Subtraction: missing number **second**
Subtract the difference from the first number.
Then, use subtraction to check your answer.

$$874 - \boxed{616} = 258$$

```
    8  6⁄7¹ 4          8  6⁄7¹ 4
 -     2  5  8     -     6  1  6
       6  1  6          2  5  8
```

NOTE: If the missing number is the **difference**, then subtract as normal!

Multiplication and division – formal methods

Multiplying by a 2-digit number

Line the digits up in the correct place value columns.

Multiply by the **ones**.
Then multiply by the **tens**.

Remember: As you are multiplying by **tens**, there is a place holder.

Add to find the total.

348 x 23 =

		3	4	8	
	x		2	3	
	1	0	4	4	348 x 3 =
	6	9	6	0	348 x 20 =
	8	0	0	4	
			1	1	

Multiplying decimals by integers

Multiply by the **ones**.
If the multiplier has 2-digits, multiply by the **tens**.
Remember: if you are multiplying by **tens**, there will be a place holder.

Add to find the total.
Remember to include the **decimal point** in your answer.
Be careful to line it up accurately.

35.7 x 6 =

	3	5 .	7
x			6
2	1	4 .	2

4.15 x 18 =

	4 .	1	5	
x		1	8	
3	3 .	2	0	4.15 x 8 =
4	1 .	5	0	4.15 x 10 =
7	4 .	7	0	

Multiplication and division – working with 0 and 1

Multiplying by 0

When multiplying a number by **0**, the answer is always **0**.

724 x 0 = 0

Multiplying and dividing by 1

When multiplying or dividing a number by **1**, the answer is always **itself**.

4,167 x 1 = 4,167

819 ÷ 1 = 819

Multiplication and division – informal methods

Multiplying and dividing by 10, 100 and 1,000

To multiply by 10, I move all the digits **one** place to the **left**.
To multiply by 100, I move all the digits **two** places to the **left**.
To multiply by 1,000, I move all the digits **three** places to the **left**.

Use placeholders to fill empty columns as needed.

5.23 x 100 = 523

M	HTh	TTh	Th	H	T	O	Tth	Hth	Thth
					5 .	2	3		
				5	2	3 .			

To divide by 10, I move all the digits **one** place to the **right**.
To divide by 100, I move all the digits **two** places to the **right**.
To divide by 1,000, I move all the digits **three** places to the **right**.

Use placeholders to fill empty columns as needed.

28 ÷ 1,000 = 0.028

M	HTh	TTh	Th	H	T	O	Tth	Hth	Thth
				2	8 .				
				0 .	0	2	8		

Multiplying multiples of 10

Find factor pairs for both numbers.

Use known times tables facts.
Multiply by multiples of 10.

40 x 800 =
4   10   8   100

4 x 10 x 8 x 100 =

(4 x 8) x (10 x 100) =

32 x 1,000 = 32,000

Dividing multiples of 10

Find a factor pair of the first number (dividend).

Use known times table facts to divide.
Multiply by multiples of 10.

720 ÷ 8 =
72   10

72 x 10 ÷ 8 =

(72 ÷ 8) x 10 =

9 x 10 = 90

Dividing using factors

Find a factor pair of the divisor.
Divide by each part.

360 ÷ 40 =
10   4

(360 ÷ 10) ÷ 4 =

36 ÷ 4 = 9

255 ÷ 15 =
5   3

(255 ÷ 5) ÷ 3 =

51 ÷ 3 = 17

Division methods

Short division

Lay out the division.
Starting from the left, divide each digit by the divisor.
Carry over any remainders to the next column.

3,145 ÷ 5 =

```
      0  6  2  9
  5 | 3  ³1  ¹4  ⁴5
```

Divide decimals by integers

Lay out the division.
Starting from the left, divide each digit by the divisor.
Carry over any remainders to the next column.

8.68 ÷ 4 =

```
      2 . 1  7
  4 | 8 . 6  ²8
```

Remember to include the **decimal point** in your answer.
Be careful to line it up accurately.

Long division

Lay out the division.
Write down your 14 times table.
Work out how many times your divisor goes into your thousands, hundreds, tens and ones.
Remember to pull down your tens and ones.

4,788 ÷ 14 =

1 x 14 = 14
2 x 14 = 28
3 x 14 = 42
4 x 14 = 56
5 x 14 = 70

```
           0  3  4  2
    14 |   4  7  8  8
           4  2
              5  8
              5  6
                 2  8
                 2  8
                    0
```

Multiplying three numbers

Multiply two of the numbers.
Then multiply the result by the last number.

Remember, multiplication is commutative –
you can multiply in any order.

4 x 6 x 5 =

(4 x 5) x 6 =

20 x 6 = 120

Fractions

Add and subtract fractions (same denominator)

When fractions have the same denominator, **add the numerators.**
The denominator stays the same.

$$\frac{2}{7} + \frac{4}{7} = \frac{6}{7}$$

Add and subtract fractions (different denominators)

When fractions have different denominators, convert to the same denominator.

When one denominator is a multiple of the other denominator:

$3 \underline{x\ 3} = 9$ $\quad \frac{1}{3} + \frac{4}{9}$

$1 \underline{x\ 3} = 3$ $\quad \frac{3}{9} + \frac{4}{9} = \frac{7}{9}$

When one denominator is not a multiple of the other denominator:

$$\frac{1}{4} + \frac{2}{5}$$
$$x5 \qquad x4$$
$$\frac{5}{20} + \frac{8}{20} = \frac{13}{20}$$

Add and subtract fractions (mixed numbers)

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

Convert to improper fractions. $\quad \frac{5}{2} + \frac{5}{4} =$
Convert to the same denominator.
Solve. $\quad \frac{10}{4} + \frac{5}{4} = \frac{15}{4} = 3\frac{3}{4}$
Convert back to a mixed number.

or

Add wholes. $\quad 2 + 1 = 3$
Convert to the same denominator. $\quad \frac{1}{2} + \frac{1}{4} \qquad 3\frac{3}{4}$
Add fractions.
Recombine whole and fraction. $\quad \frac{2}{4} + \frac{1}{4} = \frac{3}{4}$

Dividing fractions by integers

When the numerator is divisible by the divisor:
Divide the numerator by the divisor.
The denominator stays the same.

$$\frac{4}{7} \div 2 = \frac{2}{7}$$

When the numerator is <u>not</u> divisible by the divisor:
Multiply the denominator by the divisor.
The numerator stays the same.

$$\frac{4}{5} \div 3 = \frac{4}{15}$$

Multiplying fractions by fractions

Multiply the numerators.
Multiply the denominators.

$$\frac{1}{4} \times \frac{2}{3} = \frac{2}{12}$$

Mixed numbers
Convert to improper fractions. $\quad 2\frac{1}{3} \times \frac{2}{5}$
Multiply the numerators.
Multiply the denominators. $\quad \frac{7}{3} \times \frac{2}{5} = \frac{14}{15}$

Multiplying fractions by integers

An integer can be written as a fraction over 1.

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

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

Mixed numbers
Convert to improper fractions.
Write integer as a fraction over 1.

$$1\frac{2}{5} \times 4 =$$

$$\frac{7}{5} \times \frac{4}{1} = \frac{28}{5} = 5\frac{3}{5}$$

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Fractions, percentages and number

Fractions of amounts

Divide the amount by the denominator.
Multiply by the numerator.

$\frac{3}{5}$ of 465 = 279

	0	9	3	
5	4	⁴6	¹5	

	9	3
x		3
2	7	9

Calculate percentages

Find 1%, 10%, 20%, 25% or 50%.
Use multiples of these to find any percentage.

28% of 1,500 = 420

10% of 1,500 = 1,500 ÷ 10 = 150
1% of 1,500 = 1,500 ÷ 100 = 15

10% x 3 = 30%   150 x 3 = 450
1% x 2 = 2%   15 x 2 = 30
30% - 2% = 28%   450 – 30 = 420

Convert mixed number to improper fraction

Multiply whole by denominator.
Add the numerator.
The denominator stays the same.

$2\frac{+1}{2} = \frac{5}{2}$ 2 x 2 = 4
4 + 1 = 5

Convert improper fraction to mixed number

Divide numerator by denominator.

The result is the whole number.
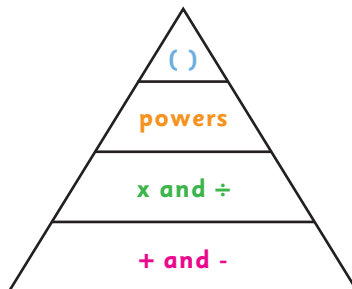The remainder is the numerator.
The denominator stays the same.

$\frac{15}{4} = 3\frac{3}{4}$

15 ÷ 4 = 3 r3

BIDMAS / BODMAS

B	Brackets
O	Order
D	Division
M	Multiplication
A	Addition
S	Subtraction

( )
powers
x and ÷
+ and -

(5 + 3) ÷ 2 =

Brackets first: 5 + 3 = 8
No order
Division: 8 ÷ 2 = 4

4 + 8 ÷ 2 =

No brackets
No order
Division: 8 ÷ 2 = 4
Addition: 4 + 4 = 8

Square and cube numbers

A **square number** is the result of multiplying a number by itself.

$6^2 = 6 \times 6 = 36$

A **cube number** is the result of multiplying a number by itself, then by itself again.

$3^3 = 3 \times 3 \times 3 = 27$