Year 6 Mathematics Knowledge Organiser

Addition and Subtraction

Key Concepts

- Add whole numbers
- Subtract whole numbers
- Estimate
- Inverse operations

Key Vocabulary

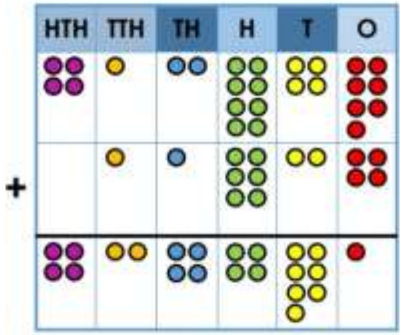
- add/addition
- subtract/subtraction
- calculate/calculation
- mental calculation
- written method
- Inverse
- estimate
- operation
- total
- amount
- exchange
- regroup

Addition and Subtraction Vocabulary

add total combined more increase plus altogether sum

minus take away reduce less than difference decrease fewer than

Addition - Formal Written Methods Using counters to show column addition:

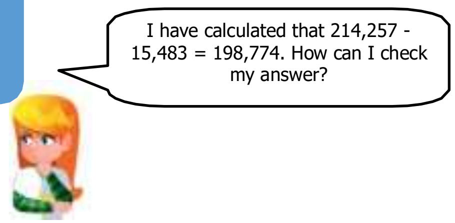


	4	1	2	8	4	7
+		1	1	6	2	4
	4	2	4	4	7	1
			1		1	

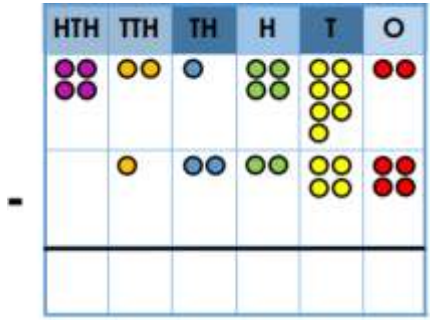
With column addition and subtraction, you must always start the calculation with the column on the right. 7 + 4 is 11. We can not put 11 in the ones column so a ten is placed under the tens column and the one is placed in the ones column. Then, we add the extra ten when we add that column.

Inverse Operations

Inverse means opposite. The opposite of addition is subtraction and therefore the opposite of subtrac- tion is addition. Using an inverse operation is a use- ful way of checking your answer.



Subtraction - Formal Written Methods



	4	2	1	4	7	2
-		1	2	2	4	4

In the ones column, we don't have enough to subtract 4 from 2. We need to exchange a ten for ten ones. To show this, the 7 is changed to a 6 because we now have 6 tens. The 2 becomes a 12. 72 is the same as 60 + 12. We still have the same amount, but it has been regrouped. Now, we can start sub- tracting.

12 - 4 = 8 so 8 is written in the ones column. In the tens col- umn, 6 - 4 = 2 so 2 is written in the tens column.

	4	2	1	4	$\overset{6}{\cancel{7}}$	$^{1}2$
-		1	2	2	4	4
					2	8

The hundreds column is a straight forward calculation: 4 - 2 = 2.

Looking at the thousands column, we do not have enough to subtract 2 from 1. We need to exchange one of the ten thou- sands for 10 thousands. To show this, the 2 (in the ten thou- sands place) is changed to a 1. The 1 (thousand) becomes an 11. 11 - 2 = 9.

Next, look at the ten thousands column. Now, we have 1 - 1 = 0

Finally, looking at the hundred thousands column, 4 - 0 = 4

The final answer to the subtraction is 409,228.

To check the answer to your subtraction, you can use the inverse, which is addition. If we add 15,483 to your answer of 198,774 it should total 214,257 - your original number. If it does, you have calculated correctly.

	4	$\overset{1}{\cancel{2}}$	$^{1}1$	4	$\overset{6}{\cancel{7}}$	$^{1}2$
-		1	2	2	4	4
	4	0	9	2	2	8

Year 6 Mathematics Knowledge Organiser

Addition and Subtraction

Estimate Answers

Estimating means to get a rough idea of an answer . We can use estimation to help us check if an answer to a calculation is correct.

I am calculating 223,478 + 112,983. I think the answer is 314,352.

I am also calculating 223,478 + 112,983. I think the answer is 336,461.

Dexter and Ash could check their answers by doing the calculation again. However, if they have made a mistake, they may just make the same mistake again.

Instead, they could use **rounding** to check if their answer is correct.

We can round the numbers to the nearest thousand. So 223,478 + 112,983 becomes 223,000 + 113,000.

223,000 + 113,000 = 336,000 Now we compare our estimate to the actual answers given. The answer 336,461 is very close to the estimate of 336,000 so that tells us it is more likely to be correct.

Multiplication and Division

Key Concepts

- Multiply up to a 4-digit by 2-digit number
- Short division
- Long division

Key Vocabulary

- Multiply
- times
- groups of
- lots of product
- divide
- share
- equal

Multiplication and Division Vocabulary

multiply times groups of lots of product repeated addition ×

divide division share shared by equal ÷

Multiplying

		4	2	1	6
x				3	4

When setting out long multiplication, it is important to position the digits carefully in the correct columns

First, we multiply each digit of the 4-digit number by the ones number - the 4.

4 x 6 = 24. The 4 is written in the ones column. The 2 is really a tens so it needs to go in the tens column. We write it smaller so it can be added to the next answer.

		4	2	1	6
x				3	4
	1	6	8	$_{2}$6	4

Next, we calculate 4 x 1. The answer of 4 is added to the 2 that we have carried over and a 6 is written in the tens column.

We then calculate 4 x 2 = 8 and write the answer in the hundreds column.

		4	2	1	6
x				3	4
	1	6	8	$_{2}$6	4
					0

Now we need to multiply all the digits of the 4-digit number by the tens number - the 3. To show that the 3 is really a 30, we put a zero in the ones column first.

The multiplication is then continued in the same way as before. We multiply the ones digit first, followed by the tens, hundreds and finally the thousands. If we get an answer of more than 9, it is carried over to the next column, as seen when 3 x 6 = 18 and the 1 is carried over to be added into the next column.

		4	2	1	6
x				3	4
	1	6	8	$_{2}$6	4
1	2	6	$_{1}$4	8	0

		4	2	1	6
x				3	4
	1	6	8	$_{2}$6	4
1	2	6	$_{1}$4	8	0
1	4	3	3	4	4
	1	1	1		

The final step is to add together the two answers - 16,864 + 126,480. We do this using the column addition method.

Year 6 Mathematics Knowledge Organiser

Multiplication and Division

Short Division

Bigger numbers can be tricky to divide as we don't learn our times tables for numbers that large. Instead, we can set out the division as shown

	6	8	7	1	2

We then divide the large number, one digit at a time, starting with the 8 (which represents 8000).

8 ÷ 6 = 1 with 2 left over. The 1 is written above the 8 on the line. The 2 is carried over to the next column. We now have 27 hundreds.

		1			
	6	8	${}^{2}7$	1	2

		1	4		
	6	8	${}^{2}7$	${}^{3}1$	2

27 ÷ 6 = 4 with 3 left over. The 4 is written above the 7 on the line. The 3 is carried over to the next column. We now have 31 tens.

31 ÷ 6 = 5 with 1 left over. The 5 is written above the 1 on the line. The 1 is carried over to the next column. We now have12 ones.

12 ÷ 6 = 2 exactly. 2 is written above the 2 on the line. Our final answer is 1,452

		1	4	5	2
	6	8	${}^{2}7$	${}^{3}1$	${}^{1}2$

Long division

Long division is useful if you need to divide by a 2-digit number. It is set out similar to short division.

8670 ÷ 15.

8 ÷ 15 does not give a whole number answer so we look at the next digit.

86 ÷ 15 = 5 with 11 left over. Put a 5 above the 6 on the line.

			5			
1	5	8	6	7	0	
	-	7	5			
		1	1			

15 x 5 = 75. Take that 75 away from the 86 to get your remainder of 11.

			5	7		
1	5	8	6	7	0	
	-	7	5	↓		
		1	1	7		
	-	1	0	5		
			1	2		

Next, carry the 7 down to make 117. 117 ÷ 15 = 7 with 12 left over. Put a 7 above the 7 on the line. 15 x 7 = 105. Take that away from 117 to get your remainder of 12.

Finally, carry the 0 down to make 120. 120 ÷ 15 = 8. Put an 8 above the 0 on the line. Now you have your final answer: 8670 ÷ 15 = 578

			5	7	8	
1	5	8	6	7	0	
	-	7	5	↓	↓	
		1	1	7		
	-	1	0	5	↓	
			1	2	0	

Place Value

Key Concepts

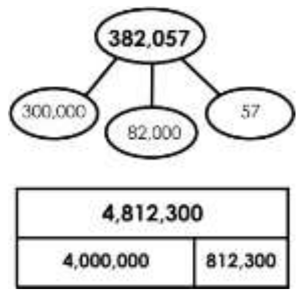
- Numbers to ten million
- Rounding any whole number to a required degree of accuracy
- Recognising the place value of numbers up to 10,000,000
- Compare and order numbers
- Negative numbers

Key Vocabulary

- increase/decrease
- less than/greater than
- equal to
- rounding
- nearest
- negative number
- compare
- order
- partitioning
- place value
- part, part whole
- ones, tens, hundreds, thousands, ten thousands, hundred thousands, millions, ten million

Representing Numbers:

Numbers can be represented in a variety of ways:



The above representations are often called part, part, whole diagrams. They can show different ways to partition a number.

Year 6 Mathematics Knowledge Organiser

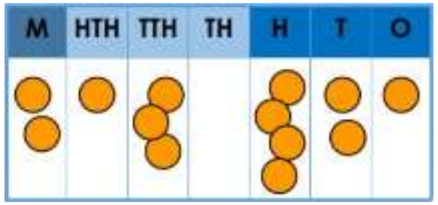
Place Value

Place Value of Digits

Place value helps us know the value of a digit, depending on its place in the number.

TM	M	HTH	TTH	TH	H	T	O
1	3	7	6	4	8	2	5

- In the number above, the 1 digit is in the ten millions place so it really means 10,000,000 (ten million).
- The 3 digit is in the millions place so it really means 3,000,000 (3 million).
- The 7 digit is in the hundred thousands place so it really means 700,000 (seven hundred thousand).
- The 6 digit is in the ten thousands place so it really means 60,000 (sixty thousand).
- The 4 digit is in the thousands place so it really means 4,000 (four thousand).
- The 8 digit is in the hundreds place so it really means 800 (eight hundred)
- The 2 digit is in the tens place so it really means 20 (twenty).
- The 5 digit is in the ones place so it means 5 (five).



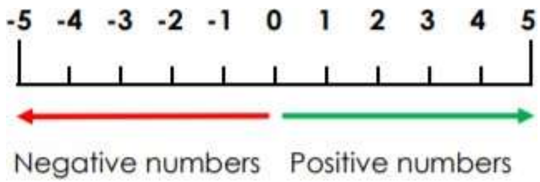
The counters on this place value chart show the number 2,130,421. This is written as two million, one hundred and thirty thousand, four hundred and twenty-one.

Negative Numbers

If you count backwards from zero, you reach negative numbers.

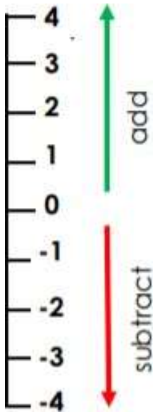
Positive numbers are any numbers more than zero e.g. 1, 2, 3, 4, 5.

Negative numbers are any numbers less than zero e.g. –1, -2, -3, -4, -5.



The number line shows that –5 is smaller than –1.

Negative numbers are often shown vertically such as on thermometers.



When we add a positive number to a negative number, we count upwards towards zero. -

2 + 5 = 3

When we subtract a positive number from a negative, we count down away from zero.

-1 — 3 = -4

Rounding

When rounding, you first need to identify which digit will tell you whether to round up or down.

- To round a number to the **nearest 10,** you should look at the ones digit.
- To round a number to the **nearest 100**, you should look at the tens digit.
- To round a number to the **nearest 1000**, you should look at the hundreds digit.
- To round a number to the **nearest 10,000**, you should look at the thousands digit.
- To round a number to the **nearest 100,000**, you should look at the ten thousands digit.
- To round a number to the **nearest 1,000,000**, you should look at the hundred thousands digit

527,356 to the **nearest 10** is 527,360

527,356 to the **nearest 100** is 527,400

527,356 to the **nearest 1000** is 527,000

527,356 to the **nearest 10,000** is 530,000

527,356 to the **nearest 100,000** is 500,000

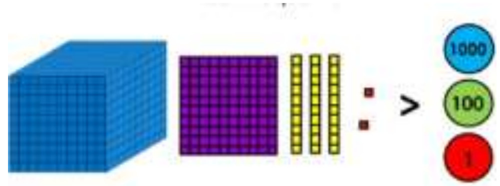
527,356 to the **nearest 1,000,000** is 1,000,000

Comparing Numbers

We can compare numbers using the < and > symbols.

< means less than > means greater than

= means equal to



122,845 < 123,518 2,579,736 > 2,579,436

Year 6 Mathematics Knowledge Organiser

Place Value

Ordering Numbers

When we put numbers in order, we need to compare the value of their digits.

2,123,518 **2,123,736** **2,122,845**

First, look at the millions digits in each number. Each number has the same digit in the millions place so you then keep comparing digits of the same place value until you find ones that are different. The thousands digits are different so that tells us that 2,122,845 is the smallest number because it has a 2 in the thousands place. Looking at the hundreds digits, we can see that 2,123,518 is the next smallest .

2,122,845 **2,123,518** **2,123,736**

Smallest →

Fractions

Key Concepts

- use common factors to simplify fractions and use common multiples to express fractions in the same denomination
- compare and order fractions, including fractions > 1
- multiply simple pairs of proper fractions, writing the answer in its simplest form
- divide proper fractions by whole numbers
- find the whole amount from the known value of a fraction

Key Vocabulary

- numerator
- denominator
- factors
- multiples
- equivalent
- simplify
- mixed numbers
- proper fractions
- improper fractions

Simplify Fractions

We can use our knowledge of equivalent fractions to simplify fractions. To find the simplest form of a fraction, we divide the numerator and denominator by their highest common factor.

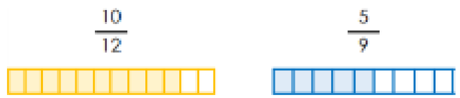
$\frac{12}{18}$ Factors of 12: 1, 2, 3, 4, <u>6</u>, 12

Factors of 18: 1, 2, 3, <u>6</u>, 9, 18

$$\frac{12 \div 6}{18 \div 6} = \frac{2}{3}$$

Compare and Order Fractions

To compare and order fractions, we need to find a common denominator or numera-



$$\frac{10}{12} = \frac{5}{6} \text{ so } \frac{5}{6} > \frac{5}{9}$$

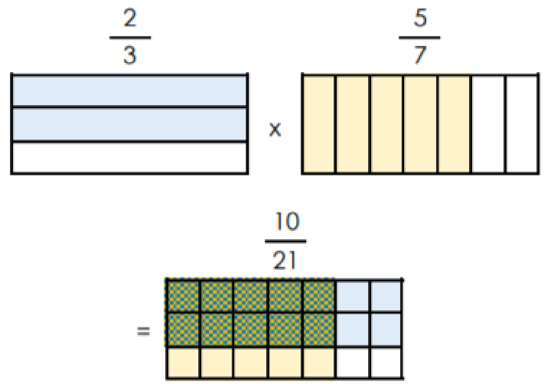
These fractions have been ordered from smallest to greatest. Their equivalent fractions using common numerators are shown beneath.

$\frac{8}{18}$ → $\frac{4}{9}$ $\frac{12}{15}$ → $\frac{4}{5}$ $\frac{18}{7}$ → $1\frac{4}{7}$

These fractions have been ordered from smallest to greatest. Their equivalent fractions using common numerators are shown beneath.

$$\frac{2}{3} \times \frac{5}{7} = \frac{10}{21}$$

We can use area models to represent multiplication calculations visually.



We can multiply fractions by fractions to find fractions of fractions.

$$\frac{4}{5} \text{ of } \frac{2}{3} = \frac{4}{5} \times \frac{2}{3} = \frac{8}{15}$$

Year 6 Mathematics Knowledge Organiser

Fractions

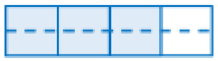
Divide Fractions by Integers

To divide fractions by integers, we divide the numerator by the whole number. If the numerator is a multiple of the integer, then this is nice and simple!

$$\frac{6}{11} \div 3 = \frac{2}{11}$$

If the numerator is not a multiple of the integer, then we could use diagrams to help us.

$$\frac{3}{4} \div 2 = \frac{3}{8}$$



We could also find an equivalent fraction with a numerator that is a multiple of the integer to help us divide the fraction equally.

$$\frac{8}{13} \div 6$$

$$\frac{8}{13} = \frac{24}{39}$$

$$\frac{24}{39} \div 6 = \frac{4}{39}$$

We can use our knowledge of multiplying fractions by unit fractions to help us divide fractions by integers.

$$\frac{8}{9} \div 4 = \frac{8}{9} \times \frac{1}{4} = \frac{8}{36} = \frac{2}{9}$$

This takes us back to finding fractions of fractions

$$\frac{7}{8} \div 5$$

Is the same as…

$$\frac{7}{8} \times \frac{1}{5}$$

Which is the same as...

$$\frac{1}{5} \text{ of } \frac{7}{8}$$

Four Rules with Fractions

Now that we can add, subtract, multiply and divide fractions, we can combine all four rules or operations

It is important to remember the rule of BIDMAS before completing calculations.

Brackets
Indices
Division
Multiplication
Addition
Subtraction

$$\frac{2}{7} + \frac{6}{7} \div 2$$

$$\frac{6}{7} \div 2 = \frac{3}{7}$$

$$\frac{2}{7} + \frac{3}{7} = \frac{5}{7}$$

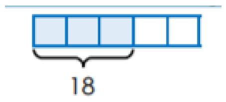
Find the Whole

We can find the whole amount using the known value of a fraction.

To do this, we divide the known value by the numerator and multiply this by the denominator

Dexter ate 3/5 of a box of strawberries.

She ate 18 of them altogether.



18 ÷ 3 = 6 so 1/5 = 6

6 x 5 = 30 so the whole is 30

There were 30 strawberries in Jane's box.

Position and Direction

Key Concepts

- describe positions on the full coordinate grid (all four quadrants)
- draw and translate simple shapes on the coordinate plane, and reflect them in the axes

Key Vocabulary

- position
- direction
- coordinates
- quadrants
- shapes
- translate
- units
- plane
- Reflect
- axis
- axes

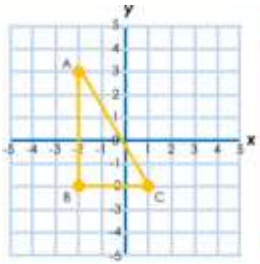
Year 6 Mathematics Knowledge Organiser

Position and Direction

Four Quadrants

We can use all four quadrants on a coordinate grid to read, write and plot points.

Remember the number on the x axis comes before the number on the y axis.

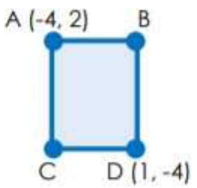


A (-2, 3)

B (-2, -2)

C (1, -2)

We can use our knowledge of the four quadrants and the properties of shapes to work out missing coordinates, even without the grid lines!



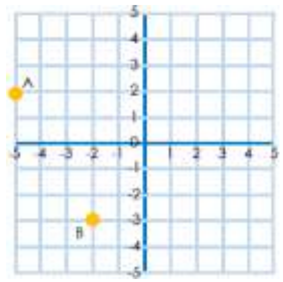
B (1, 2)

C (-4, -4)

Translations

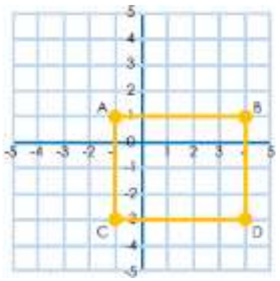
When we translate a point on a grid, we move it into a different position without changing it in any other way.

We describe translations using directional language and the number of 'units'.



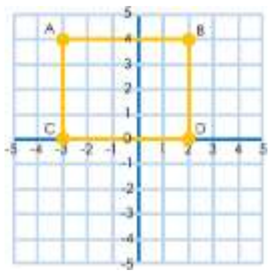
A was translated 3 units to the right and 5 units down to reach the position of B

We can use translation to change the position of shapes on a grid by translating one coordinate at a time.



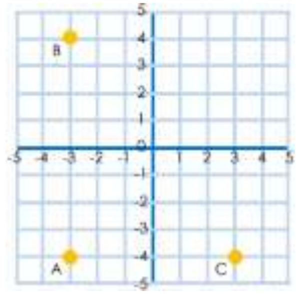
If we translate the shape 2 units to the left and 3 units up, the new coordinates will be:

A (-3, 4)
B (2, 4)
C (-3, 0)
D (2, 0)



Reflections

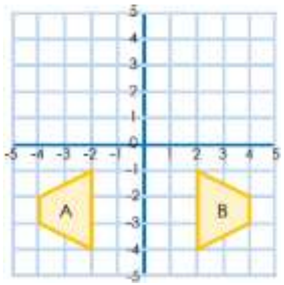
We can reflect points in the four quadrants by using the x or y axis as a mirror line



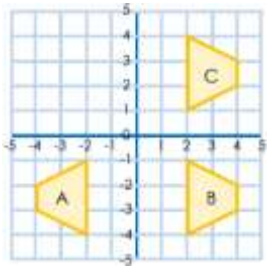
A has been reflected in the x axis to

A has been reflected in the y axis to create point C.

As with translation, we can change the position of shapes on a grid by reflecting one coordinate at a time.



A has been reflected in the y axis to create shape B.



If we reflect shape B in the x axis, the coordinates for shape C will be:

(2, 1) (2, 4) (4, 2) (4, 3)