Year 5 Mathematics Knowledge Organiser

Addition and Subtraction

Key Concepts

- Add whole numbers with more than 4-digits
- Subtract whole numbers with more than 4-digits
- Estimate
- Inverse operations

Key Vocabulary

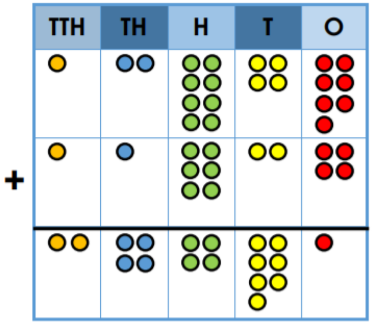
- add/addition
- subtract/subtraction
- calculate/calculation
- mental calculation
- written method
- operation
- total
- amount
- exchange
- regroup
- inverse
- estimate

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:



	1	2	8	4	7
+	1	1	6	2	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.

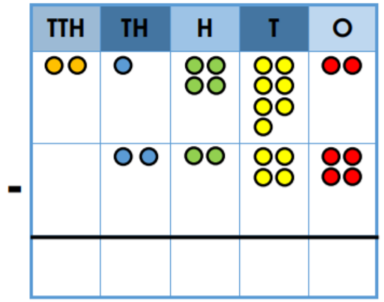
Inverse Operations

Inverse means opposite. The opposite of addition is subtraction and therefore the opposite of subtraction is addition. Using an inverse operation is a useful way of checking your answer.

I have calculated that 14,257 - 5,483 = 8,774. How can I check my answer? ?

To check the answer to your subtraction, you can use the inverse, which is addition. If we add 5,483 to your answer of 8,774 it should total 14,257 - your original number. If it does, you have calculated correctly.

Subtraction - Formal Written Methods



	2	1	4	7	2
-		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 subtracting.

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

	2	1	4	6 ~~7~~	12
-		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 thousands for 10 thousands. To show this, the 2 (in the ten thousands place) is changed to a 1. The 1 (thousand) becomes an 11. 11 - 2 = 9.

Finally, looking at the ten thousands column, 1 - 0 = 1. The final answer to the subtraction is 19,228.

	4	1 ~~2~~	11	4	6 ~~7~~	12
-		1	2	2	4	4
	4	0	9	2	2	8

Year 5 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 cor- rect.

I am calculating 23,478 + 12,983. I think the answer is 34,461.

I am also calculating 23,478 + 12,983. I think the answer is 36,461.

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

Instead, they could use **rounding** to check if their an- swer is correct.

We can round the numbers to the nearest hundred. S

o 23,478 + 12,983 becomes 23,500 + 13,000.

23,500 + 13,000 = 36,500.

Now we compare our estimate to the actual answers given. The answer 36,461 is very close to the estimate of 36,500 so that tells us it is more likely to be correct.

Multiplication and Division

Key Concepts

- identify multiples and factors, including finding all factor pairs of a number, and com- mon factors of two numbers
- establish whether a number up to 100 is prime and recall prime numbers up to 19
- multiply and divide whole numbers and those involving decimals by 10, 100 and 1000
- recognise and use square numbers and cube numbers, and the notation for squared (2) and cubed (3)

Key Vocabulary

- factor
- multiple
- common
- prime number
- square number
- squared
- cube number
- cubed

Multiplication and Division Vocabulary

multiply times groups of lots of product repeated addition

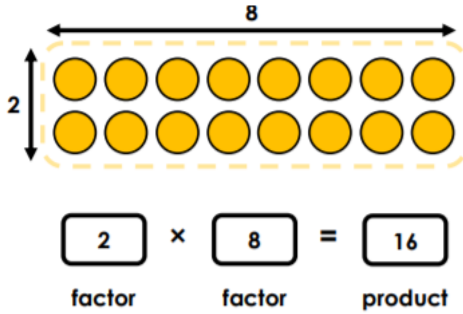
X

divide division share shared by equal

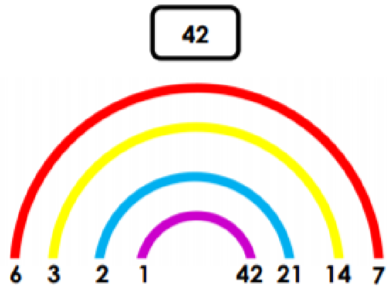
÷

Multiplying

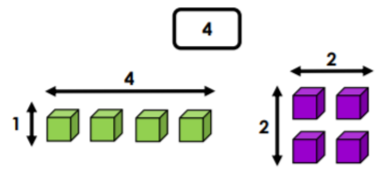
Factors are the numbers that multiply together to make a product.



To find all factors of a given number, it is best to work systematically. Start at one and ask yourself what factor it is paired with to make the product you are requiring. Then, you can try the next logical number for example 2. There are some numbers that will and some numbers that will not be a factor of your product.



When a number is a square number, two of its factors are the same. In the example below, 2 would pair with another 2 to make the product 4. Therefore, the number has an odd number of factors.



The factors of **4** are **1**, **2** and **4**.

Year 5 Mathematics Knowledge Organiser

Multiplication and Division

Common Factors

When we have found all of the factors of at least two different products, we can see if they share some of the same factors. These are called common factors. Here are the factors of two different products. The ticks indicate the ones that 8 and 28 have in common

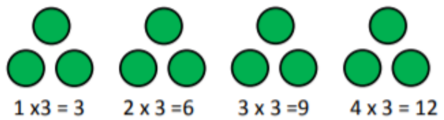
Factors of 8
1 ✓
2 ✓
4 ✓
8

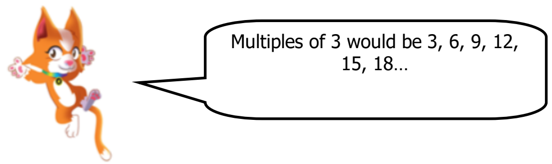
Factors of 28
1 ✓
2 ✓
4 ✓
7
14
28

The common factors of **8** and **28** are **1, 2** and **4**.

Multiples

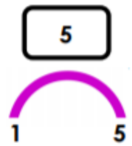
Multiples are the result of multiplying two numbers together. They can be seen as extended times tables.





Prime Numbers

A prime number is a number that only has 2 factors – 1 and itself. 5 is a prime number as it can only be divided by 1 and itself. 5 is not in any other times tables.

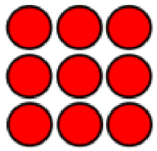


6 is not a prime number as it can be divided by 1 and itself but also by 2 and 3.

Square numbers

A square number is a number that has been multiplied by itself. The symbol to show this is ². When square numbers are represented in an array, it forms a square shape.

$3^2 = 3 \times 3 = 9$



$2^2 = 2 \times 2 = 4$ $3^2 = 3 \times 3 = 9$

$4^2 = 4 \times 4 = 16$ $5^2 = 5 \times 5 = 25$

It's important to remember that ² doesn't mean 'multiply by 2'

Cube numbers

A cube number is a number that has been multiplied by itself then multiplied by itself again. The symbol to show this is ³.

$2^3 = 2 \times 2 \times 2 = 8$ $3^3 = 3 \times 3 \times 3 = 27$

$4^3 = 4 \times 4 \times 4 = 64$ $5^3 = 5 \times 5 \times 5 = 125$

It's important to remember that ³ doesn't mean 'multiply by 3'.

Multiply and dividing by 10, 100 and 1,000

When a number is multiplied by 10, 100 or 1,000, the digits move to the left in the place value column.

The digits move 1 place left when we multiply by 10, 2 places to multiply by 100 and 3 places to multiply by 1,000. The empty place value spaces are filled with a 0 as a place holder.

TH	H	T	O	
	4	2	3	
	100 100 100 100	10 10	1 1 1	
100 100 100 100	10 10	1 1 1	0	x10

423 x 10 = 4,230

When a number is divided by 10, 100 or 1,000, the digits move to the right in the place value column: 1 place when dividing by 10, 2 places to divide by 100 and 3 places to divide by 1,000.

Look what happens when we divide 7,900 by 10, 100 and 1,000:

TH	H	T	O	.	t	
7	9	0	0			
	7	9	0			÷10
		7	9			÷100
			7	.	9	÷1,000

Year 5 Mathematics Knowledge Organiser

Place Value

Key Concepts

- Roman Numerals to 1000
- Numbers to a million
- Rounding to the nearest 10, 100, 1000 and 10,000
- Recognising the place value of numbers up to 100,000
- Partitioning
- 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
- ones, tens, hundreds, thousands, ten thousands, hundred thousands

Place Value of Digits

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

HTH	TTH	TH	H	T	O
7	1	4	8	2	5

In the number above, the 7 digit is in the hundred thousands place so it really means 700,000.

The 1 digit is in the ten thousands place so it really means 10,000.

The 4 digit is in the thousands place so it really means 4,000.

The 8 digit is in the hundreds place so it really means 800.

The 2 digit is in the tens place so it really means 20. The 5 digit is in the ones place so it means 5.

Partitioning

Numbers can be partitioned (broken apart) in more than one way. The number 714,825 could be partitioned in many ways such as:

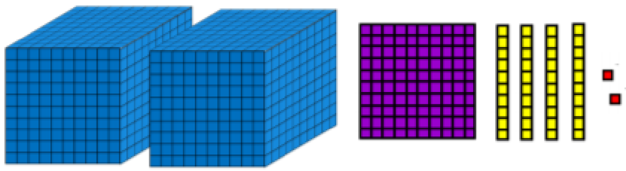
700,000 + 10,000 + 4,000 + 800 + 20 + 5 or

714,000 + 825 or 700,000 + 14,000 + 700 + 125 or

600,000 + 140,000 + 600 + 220 + 5

Representing Numbers to 10,000

A four-digit number is made up of thousand, hundreds, tens and ones. Different concrete manipulatives and pictorial diagrams can be used to represent these numbers. The number 2,132 can be represented like this:



This shows 2 thousands, 1 hundred, 4 tens and 2 ones.

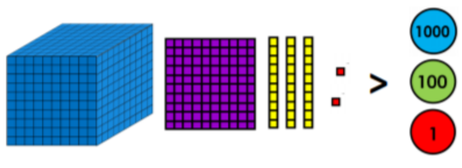
The same number can also be represented with place value counters:

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

Roman Numerals

I = 1	XXX = 30	C = 100
II = 2	XL = 40	D = 500
III = 3	L = 50	M = 1000
IV = 4	LX = 60	
V = 5	LXX = 70	MMXVIII = 2018
X = 10	LXXX = 80	
XX = 20	XC = 90	

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.

I've noticed a pattern. You always need to look at the digit that is one place value lower than that which you are rounding to.

27,356 to the **nearest 10** is 27,360

27,356 to the **nearest 100** is 27,400

27,356 to the **nearest 1000** is 27,000

27,356 to the **nearest 10,000** is 30,000

Year 5 Mathematics Knowledge Organiser

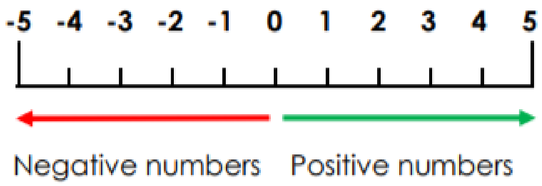
Place Value

Negative Numbers

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

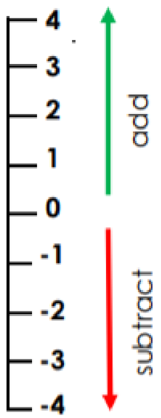
Positive numbers are any numbers more than zero e.g. 1, 2, 3, 4, 5.

Neg-



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

Ordering Numbers

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

123,518 | 123,736 | 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 .

122,845 | 123,518 | 123,736

Smallest →

Fractions

Key Concepts

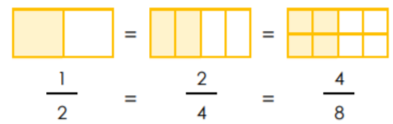
- compare and order fractions whose denominators are all multiples of the same number
- identify, name and write equivalent fractions of a given fraction, represented visually, including tenths and hundredths
- recognise mixed numbers and improper fractions and convert from one form to the other and write mathematical statements > 1 as a mixed number
- add and subtract fractions with the same denominator and denominators that are multiples of the same number
- multiply proper fractions and mixed numbers by whole numbers

Key Vocabulary

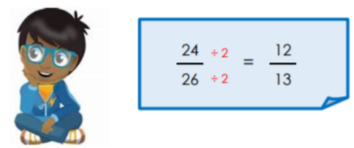
- numerator
- denominator
- equivalent
- mixed number
- improper fraction

Equivalent Fractions

Equivalent fractions have different numerators and denominators but share the same value.



If you multiply or divide the numerator and denominator of a fraction by the same number, the new fraction will be equivalent.



Improper Fractions and Mixed Numbers

An improper fraction has a numerator which is greater than the denominator. For example:

$\frac{3}{2}$ $\frac{7}{5}$ $\frac{13}{9}$ $\frac{28}{10}$

A mixed number is made up of an integer and a proper fraction. For example:

$1\frac{1}{2}$ $7\frac{3}{10}$ $15\frac{2}{3}$

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Fractions

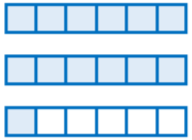
To convert between improper fractions and mixed numbers, we need to look at how many parts make up the whole.

The bar models show $\frac{13}{6}$.

There are 6 parts in the whole.

$13 \div 6 = 2$ remainder 1

$\frac{13}{6} = 2\frac{1}{6}$

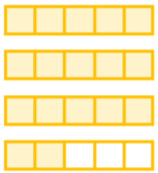


The bar models show $3\frac{2}{5}$.

There are 5 parts in the whole.

$3 \times 5 = 15$

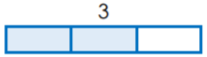
$\frac{15}{5} + \frac{2}{5} = \frac{17}{5}$



Compare and Order Fractions

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

$\frac{2}{3}$ $\frac{7}{9}$



$\frac{2}{3} = \frac{6}{9}$ so $\frac{2}{3} < \frac{7}{9}$

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

$1\frac{2}{5} \rightarrow 1\frac{4}{10}$

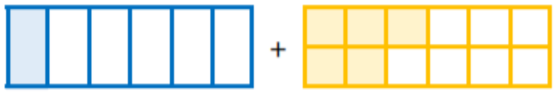
$\frac{3}{2} \rightarrow 1\frac{5}{10}$

$\frac{16}{10} \rightarrow 1\frac{6}{10}$

Add Fractions

When we add fractions with different denominators, we need to find a common denominator.

$\frac{1}{6}$ + $\frac{5}{12}$



$\frac{1}{6} = \frac{2}{12}$

$\frac{2}{12} + \frac{5}{12} = \frac{7}{12}$

Remember, when we have found the common denominator, we only need to add the numerators.

We can use this method to add three fractions b e y o n d 1

$\frac{3}{7} + \frac{12}{21} + \frac{10}{14} = \frac{3}{7} + \frac{4}{7} + \frac{5}{7} = \frac{12}{7} = 1\frac{5}{7}$

To add mixed numbers, we add the wholes then the parts.

$2\frac{10}{15} + 4\frac{2}{3}$

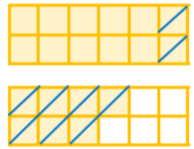
$2 + 4 = 6$

$\frac{10}{15} + \frac{2}{3} = \frac{2}{3} + \frac{2}{3} = \frac{4}{3}$

$6 + \frac{4}{3} = 6 + 1\frac{1}{3} = 7\frac{1}{3}$

Subtract Fractions

To **subtract fractions with different denominators,** we again find a common denominator. We can convert mixed numbers to improper fractions when we need to exchange.



$1\frac{7}{12} - \frac{3}{4} = 1\frac{7}{12} - \frac{9}{12}$

$1\frac{7}{12} - \frac{9}{12} = \frac{19}{12} - \frac{9}{12} = \frac{10}{12}$

Converting mixed numbers to proper fractions also helps us when we **subtract mixed numbers** where exchanging is needed.

$2\frac{1}{5} - 1\frac{7}{10} = 2\frac{2}{10} - 1\frac{7}{10} = \frac{22}{10} - \frac{17}{10} = \frac{5}{10}$

Multiply Fractions by Integers

To multiply a fraction by an integer, we multiply the numerator by the integer

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

To multiply a mixed number by an integer, we can multiply the whole and part separately or convert to an improper fraction.

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Hadley Wood Primary School

Fractions

$$2\frac{4}{9} \times 5$$

$2 \times 5 = 10$

$\frac{4}{9} \times 5 = \frac{20}{9} = 2\frac{2}{9}$

$10 + 2\frac{2}{9} = 12\frac{2}{9}$

$\frac{22}{9} \times 5 = \frac{110}{9} = 12\frac{2}{9}$

Fractions as Operators

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

$\frac{2}{11}$ of $4 = \frac{2}{11} \times 4 = \frac{8}{11}$

Perimeter and Area

Key Concepts

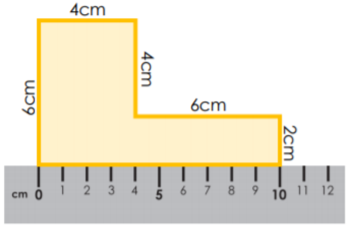
- measure and calculate the perimeter of composite rectilinear shapes in cm and m
- calculate and compare the area of rectangles including standard units, cm^2 and m^2 and estimate the area of irregular shapes

Key Vocabulary

- Measure
- Perimeter
- composite
- rectilinear
- centimetres
- metres
- area
- square centimetres
- square metres
- estimate
- irregular

Measure Perimeter

We do not need a grid to measure the perimeter of rectilinear shapes. We can use a ruler or metre stick to take our own accurate measurements.



Remember to line up the ruler carefully to take accurate measurements!

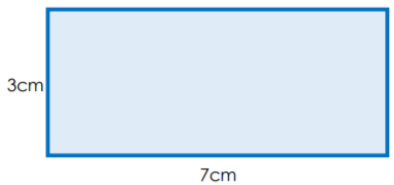
Now that we have the measurements of each side, we just need to add them together to find the perimeter!

$4 + 4 + 6 + 2 + 10 + 6 = 32$

The perimeter of the rectilinear shape is 32cm.

Area of Rectangles

To find the area of rectangles, we must multiply the length by the width.



length x width = area

7cm x 3cm = 21cm²

The units cm² (squared centimetres) or m² (square metres) are used for area.

We can use this knowledge to work out what the length and width could be using a given area.

Area = 12m²

Length and width could be:

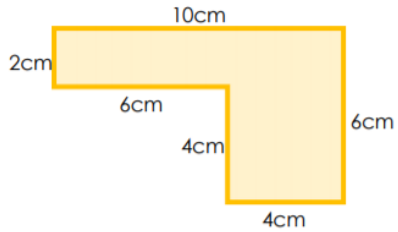
1m and 12m

2m and 6m

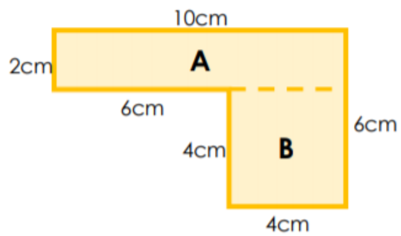
3m and 4m

Area of Compound Shapes

We can now apply our knowledge of finding the area of rectangles to calculate the area of compound shapes.



First we split the shape into rectangles.



Then we calculate the area of each rectangle and add these together to find the total area of the compound shape.

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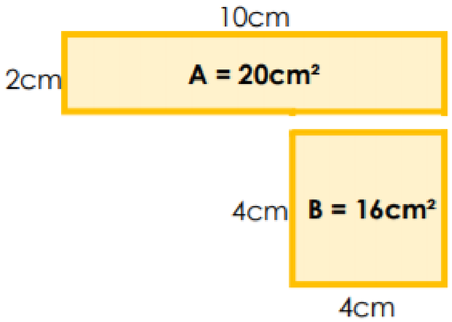
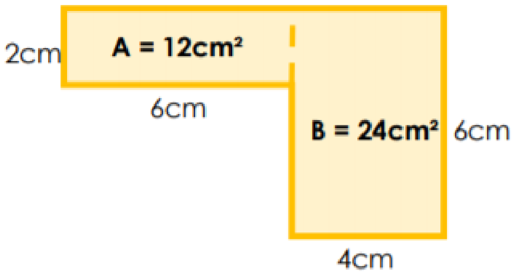
Perimeter and Area

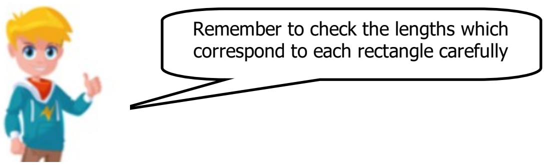


Total area = 20cm² + 16cm² = 36cm²

The area remains the same even if you split the shape in different ways.

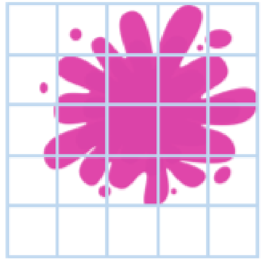


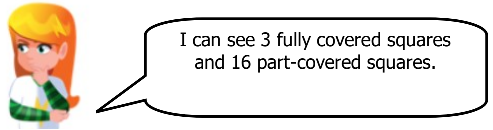
Total area = 12cm² + 24cm² = 36cm²



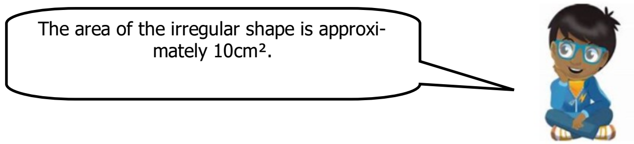
Area of Irregular Shapes

We can estimate the **area of irregular shapes** on a grid using our Year 4 knowledge of counting squares. We need to look at the number of whole squares which are covered, and the number of part-covered squares.





We can use our knowledge of fractions to add the different part-covered squares to create a rough total estimate.



Top tip!

Cross off squares as you count them to avoid miscalculating the area.