

Unit (1) Number and Place value

Numbers to 10,000,000:

Reading, Writing and Representing Numbers

There are many useful tools to help structures, and they can be represented in different ways.

Numerals

Numbers can be represented with digits.

4,120,513

Words

They can also be written as words as shown below.

four million, one hundred and twenty thousand, five hundred and thirteen

Commas are used to help separate the sections of the number, making it easier to read.

Different ways of saying numbers to 10,000,000

Some numbers can be said in different ways.

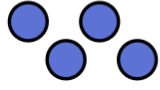


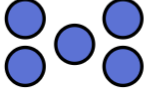


For example:

500,000 = five hundred thousand = half a million

250,000 = two hundred and fifty thousand = quarter of a million

Visual Representations of Numbers-Place Value Charts

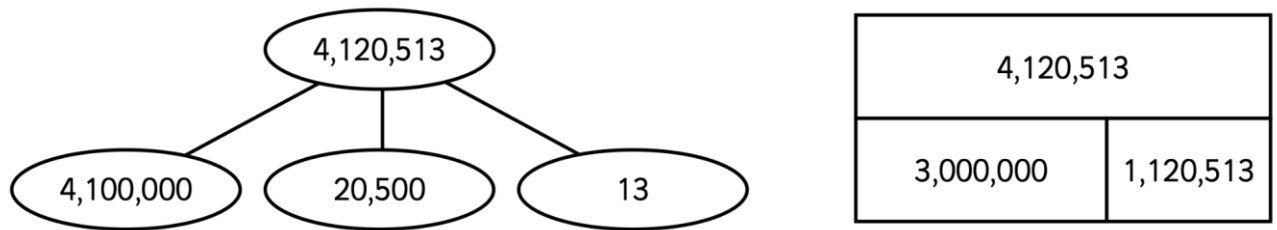
These charts start with the largest value digit on the left and end with the smallest value digit on the right. You can represent the number with counters or digits.

millions	hundred thousands	ten thousands	thousands	hundreds	tens	ones
						
4	1	2	0	5	1	3

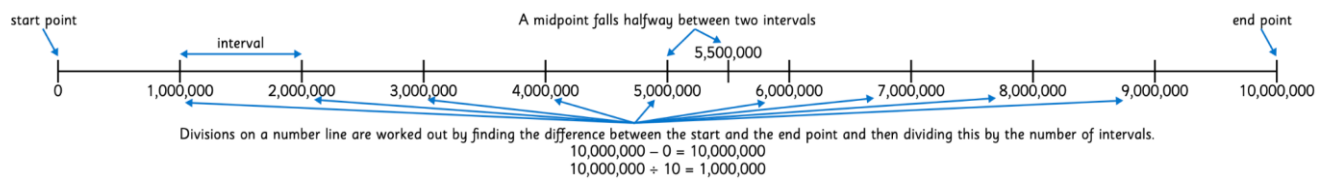
Zeros must always be used as a placeholder when a column does not have a value.

Part-whole and bar models

These models can separate numbers into parts so you can see the relationship between those parts and the whole number.



Number lines to 10,000,000



Powers of 10

A Gattegno Chart is a useful tool for seeing the relationship between multiplying and dividing numbers by 10, 100, and 1000.

1,000,000	2,000,000	3,000,000	4,000,000	5,000,000	6,000,000	7,000,000	8,000,000	9,000,000
100,000	200,000	300,000	400,000	500,000	600,000	700,000	800,000	900,000
10,000	20,000	30,000	40,000	50,000	60,000	70,000	80,000	90,000
1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000
100	200	300	400	500	600	700	800	900
10	20	30	40	50	60	70	80	90
1	2	3	4	5	6	7	8	9

50,000 is 10 times the size of 5,000
 500,000 is 100 times the size of 5,000
 5,000,000 is 1,000 times the size of 5,000

500 is one-tenth of the size of 5,000
 50 is one-hundredth of the size of 5,000
 5 is one-thousandth of the size of 5,000

Moving up the chart

- Moving up the chart by 1 row means the number is 10 times the size
- Moving up the chart by 2 rows means the number is 100 times the size. ($10 \times 10 = 100$)
- Moving up the chart by 3 rows means the number is 1000 times the size. ($10 \times 10 \times 10 = 1000$)

Moving down the chart

- Moving down the chart by 1 row means the number is one-tenth the size
- Moving down the chart by 2 rows means the number is one-hundredth the size.
- Moving down the chart by 3 rows means the number is one-thousandth of the size.

Compare and order any integers

You can compare integers by looking at the place value of each digit in a number, starting with the first digit. Integers can be equal to ($=$), greater than ($>$) or less than ($<$) another integer.

$$300,760 = 300,000 + 760$$

$$1,208,465 > 1,098,765$$

$$109,984 < 190,984$$

When you order numbers, you place them in an *ascending* sequence where the value of the numbers gets *larger*, or a *descending* sequence where the value of the numbers gets *smaller*.

Ascending: 309,087 509,879 9,054,873

Descending: 9,054,873 509,879 309,087

Rounding any integer

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-thousandths digit.
- To round a number to the **nearest 1,000,000**, you should look at the hundred-thousandth digit.

Number	Nearest 10	Nearest 100	Nearest 1,000
527,356	527,360	527,400	527,000

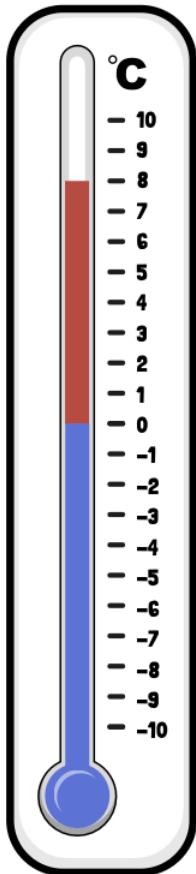
Number	Nearest 10,000	Nearest 100,000	Nearest 1,000,000
527,356	530,000	500,000	1,000,000

Negative numbers

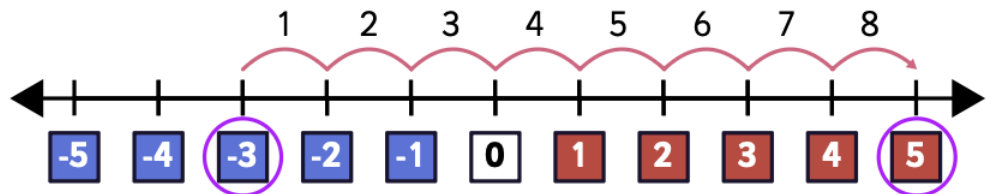
Number lines do not stop at zero. Numbers above zero are called positive numbers, and numbers below zero are called negative numbers.

Negative numbers are used in real life to show temperature, amounts of money in a bank account, and the depth of valleys below sea level.

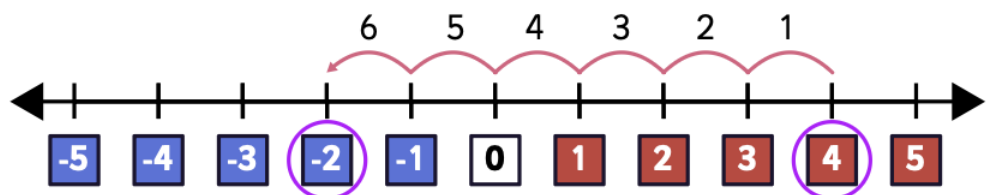
Number lines are helpful when adding and subtracting negative numbers.



$$-3 + 8 = 5$$



$$4 - 6 = -2$$



The temperature is 8°C.
If it drops by 10°C, the new temperature will be -2°C.

Unit (2 & 3) Four Operations

Addition

	4	5	8	6	4
+	2	3	4	9	7
	6	9	3	6	1
		1	1	1	

Starting with the ones, add each column in turn. Regroup tens, hundreds, thousands, ten thousands as required.

#Note: Integers are positive numbers, negative numbers, and zero. Integers do not have any added parts, such as decimals or fractions.

Subtraction

		6	12	1	
	3	5	7	4	2
-		3	4	7	6
	3	2	2	6	6

Starting with the ones, subtract each column in turn. Exchange tens, hundreds, thousands, and/or ten thousands as required.

Common factors

Factors of 48

1	2	3	4	6	8	12	16	24	48
---	---	---	---	---	---	----	----	----	----

Factors of 30

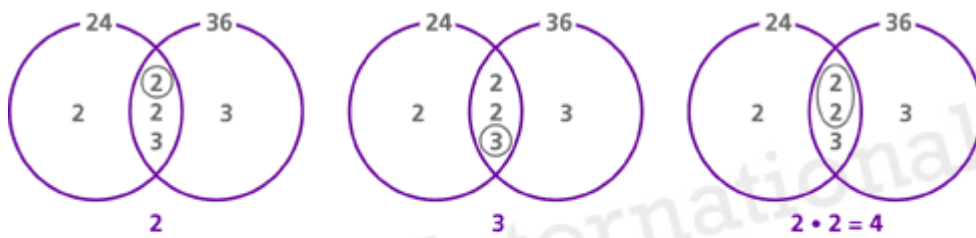
1	2	3	5	6	10	15	30
---	---	---	---	---	----	----	----

Common factors of 48 and 30 are: 1, 2, 3, 6

Highest Common Factor (HCF) is: 6

Common factor using a Venn Diagram

Common Factors of 24 and 36



Common multiples

Multiples of 3

3	...	18	21	24	...	39	42
---	-----	----	----	----	-----	----	----

Multiples of 7

7	14	21	28	35	42
---	----	----	----	----	----

Common multiples of 3 and 7 are: 21 and 42

Lowest Common Multiple (LCM) is: 21

LCM of 6, 8 and 10



Multiples of 6:

6	12	18	24	30	36	42	48	54	60
66	72	78	84	90	96	102	108	114	120
126	132								

Multiples of 8:

8	16	24	32	40	48	56	64	72	80
88	96	104	112	120	128	136			

Multiples of 10:

10	20	30	40	50	60	70	80	90	100
110	120	130	140						

LCM (6, 8, 10) = 120

Rules of divisibility

DIVISIBILITY RULES

Divisible by...

2	last digit of a number is 0, 2, 4, 6, and 8
3	the sum of the digits is a multiple of 3
4	last two digits of a number are a multiple of 4
5	last digit of a number is 5 or 0
6	divisible by 2 and 3
9	the sum of the digits is a multiple of 9
10	last digit of a number is 0

Multiply up to 4 digits by a 2-digit number

1	3	2	
	1	5	4
x		2	6
	2	9	4
3	0	8	0
4	0	0	4
1	1		

Start with the ones.

$$154 \times 6 = 924$$

$$154 \times 20 = 3080$$

$$3080 + 924 = 4004$$

Short division

		4	4	0	5
12	5	2	8	6	0

Start from the left.

$$5 \div 12 = 0 \text{ r}5$$

$$52 \div 12 = 4 \text{ r}4$$

$$48 \div 12 = 4$$

$$6 \div 12 = 0 \text{ r}6$$

Division using factors

$$280 \div 14 = 20$$

|
2x7

$$2 \overline{) 280} \quad 7 \overline{) 140}$$

Long division

			2	4	r	1	2
1	5	3	7	2			
	-	3	0	0			
			7	2			
	-		6	0			
			1	2			

- 1 × 15 = 15
- 2 × 15 = 30
- 3 × 15 = 45
- 4 × 15 = 60
- 5 × 15 = 75
- 10 × 15 = 150

Interpret remainders, in fractions, or by rounding as appropriate for the context.

432 ÷ 15 becomes

$$15 \overline{) 432} \text{ r}12$$

$$\begin{array}{r} 28 \\ 15 \overline{) 432} \\ \underline{300} \\ 132 \\ \underline{120} \\ 12 \end{array}$$

Answer: 28 remainder 12

432 ÷ 15 becomes

$$15 \overline{) 432}$$

$$\begin{array}{r} 28 \\ 15 \overline{) 432} \\ \underline{300} \quad 15 \times 20 \\ 132 \\ \underline{120} \quad 15 \times 8 \\ 12 \end{array}$$

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

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

432 ÷ 15 becomes

$$15 \overline{) 432.0}$$

$$\begin{array}{r} 28.8 \\ 15 \overline{) 432.0} \\ \underline{300} \\ 132 \\ \underline{120} \\ 120 \\ \underline{120} \\ 0 \end{array}$$

Answer: 28.8

Order of Operations and Brackets

When there are different operations within a calculation, the order in which they are completed affects the answer. In mixed operation calculations, the calculations are not carried out from left to right.

B	Brackets	$10 \times (4 + 2) = 10 \times 6 = 60$
O	Order	$5 + 2^2 = 5 + 4 = 9$
D	Division	$10 + 6 \div 2 = 10 + 3 = 13$
M	Multiplication	$10 - 4 \times 2 = 10 - 8 = 2$
A	Addition	$10 \times 4 + 7 = 40 + 7 = 47$
S	Subtraction	$10 \div 2 - 3 = 5 - 3 = 2$

If there is no operation sign written, it means multiplication; e.g., $4(2 + 1)$ means $4 \times (2 + 1)$.

Primes to 100

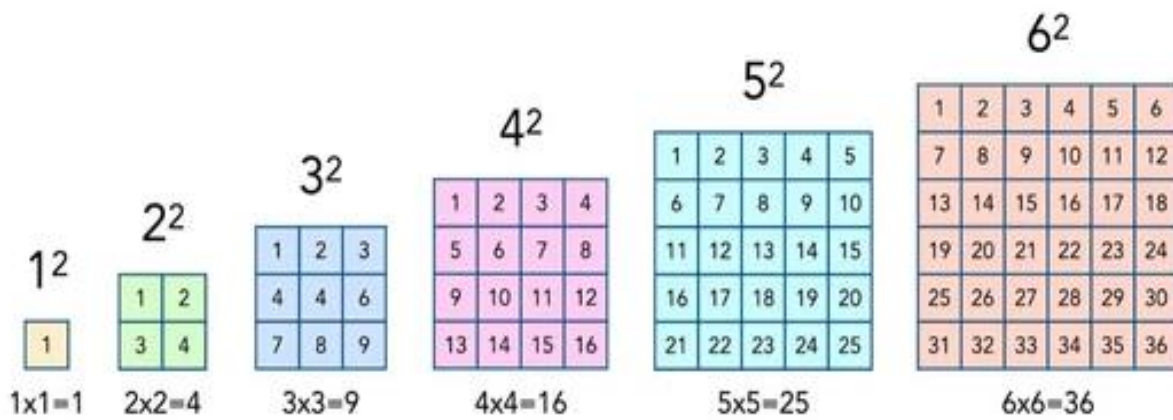
A prime number has exactly two factors: 1 and itself.

Prime Numbers									
1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Squares and cubes

Square numbers


This is when we multiply the number by itself, the first 5 square numbers are shown below.




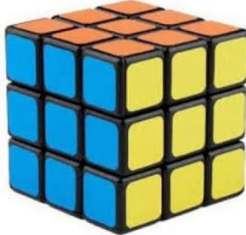
Cube numbers

This is when we multiply the number by itself three times; the first 3 square numbers are shown below.

When you multiply a number by itself, and then multiply it by itself again, you get a cube number.


$$1 \times 1 \times 1 = \underline{1}$$


$$2 \times 2 \times 2 = \underline{8}$$


$$3 \times 3 \times 3 = \underline{27}$$

MPA International School

Squares 1 to 20



Cubes 1 to 20



$1^2 = 1$

$2^2 = 4$

$3^2 = 9$

$4^2 = 16$

$5^2 = 25$

$6^2 = 36$

$7^2 = 49$

$8^2 = 64$

$9^2 = 81$

$10^2 = 100$

$11^2 = 121$

$12^2 = 144$

$13^2 = 169$

$14^2 = 196$

$15^2 = 225$

$16^2 = 256$

$17^2 = 289$

$18^2 = 324$

$19^2 = 361$

$20^2 = 400$

$1^3 = 1$

$2^3 = 8$

$3^3 = 27$

$4^3 = 64$

$5^3 = 125$

$6^3 = 216$

$7^3 = 343$

$8^3 = 512$

$9^3 = 729$

$10^3 = 1000$

$11^3 = 1331$

$12^3 = 1728$

$13^3 = 2197$

$14^3 = 2744$

$15^3 = 3375$

$16^3 = 4096$

$17^3 = 4913$

$18^3 = 5832$

$19^3 = 6859$

$20^3 = 8000$

Mental calculations

1. **Change the order of calculations**

$$50 \times 34 \times 2 = 50 \times 2 \times 34 = 100 \times 34 = 3400$$

2. **Rounding**

$$£8.99 + £3.49 = £12.48$$

$$\text{Round to } £9 + £3.50 = £12.50$$

We've added 1p to each amount, so then subtract 2p.

$$£12.50 - 2p = £12.48$$

3. **Estimate on a number line**



Subdivide line to estimate: **17**

Reasons from known facts

Facts we know from one calculation can help us to answer another similar calculation without starting again.

$$90 \div 10 = 9 \quad \text{so } 90 \div 20 = 4.5 \text{ and } 90 \div 5 = 18$$

$$16 \times 9 = 144 \quad \text{so } 1.6 \times 9 = 14.4$$

$$4352 \div 17 = 256$$

$$\text{so } 256 \times 18 = 4352 + 256 = 4608$$

$$3786 + 2850 = 6636$$

$$\text{so } 4786 + 2850 = 7636$$

$$\text{and } 2786 + 3850 = 6636$$

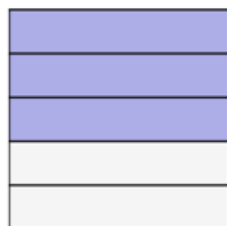
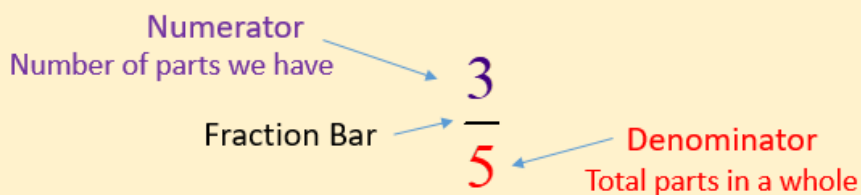
$$\text{and } 8636 - 3786 = 4850$$

Unit (4 & 3) Fractions

What is a fraction?

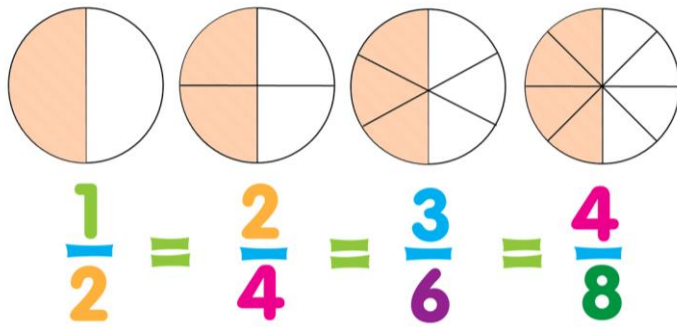
Fractions

A fraction is a number that describes a relationship between a part (represented by the numerator) and a whole (represented by the denominator).



Equivalent fractions

Equivalent fractions are fractions that name the **same amount**.



Multiply

$$\frac{2}{3} \stackrel{\times 2}{=} \frac{4}{6} \stackrel{\times 2}{=} \frac{8}{12}$$

The diagram shows the process of multiplying both the numerator and denominator of $\frac{2}{3}$ by 2 to get $\frac{4}{6}$, and then multiplying both by 2 again to get $\frac{8}{12}$. Pink arrows and 'x2' labels indicate the multiplication steps.

Simplifying fractions

Example #1

Simplify: $\frac{8}{32}$

Step 1

Factors of 8: 1, 2, 4, 8
Factors of 32: 1, 2, 4, 8, 16, 32

Step 3

$$\frac{8 \div 8}{32 \div 8} = \frac{1}{4}$$

Example #2

Simplify: $\frac{18}{27}$

Step 1

Factors of 18: 1, 2, 3, 6, 9, 18
Factors of 27: 1, 3, 9, 27

Step 3

$$\frac{18 \div 9}{27 \div 9} = \frac{2}{3}$$

Example #3

Simplify: $\frac{66}{93}$

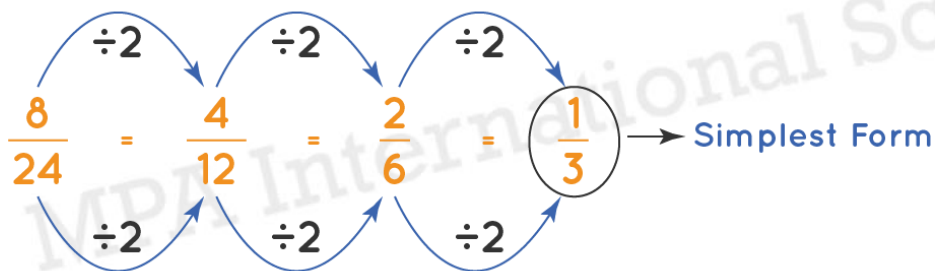
Step 1

Factors of 66: 1, 2, 3, 6, 11, 22, 33, 66
Factors of 93: 1, 3, 31, 93

Step 3

$$\frac{66 \div 3}{93 \div 3} = \frac{22}{31}$$

Simplest Form of Fraction $\frac{8}{24}$



strategies for comparing fractions

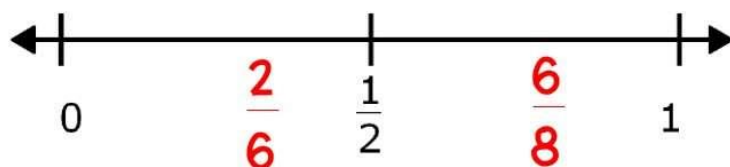
- ① Same denominator—compare the numerators

$$\frac{2}{8} < \frac{5}{8}$$

- ② Same numerator—compare the denominators

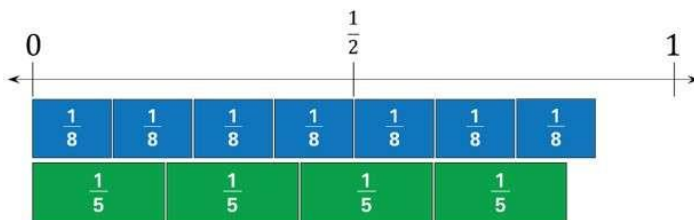
$$\frac{2}{4} > \frac{2}{8}$$

- ③ Relate to one-half



$$\frac{2}{6} < \frac{6}{8}$$

- ④ Compare like unit fractions from a whole



$$\frac{7}{8} > \frac{4}{5}$$

- ⑤ Find a common denominator

$$\frac{6}{8} \text{ and } \frac{5}{6} \quad \frac{6}{8} \times \frac{3}{3} = \frac{18}{24} \quad \frac{5}{6} \times \frac{4}{4} = \frac{20}{24}$$

$$\frac{6}{8} < \frac{5}{6}$$

- ⑤ Find a common numerator

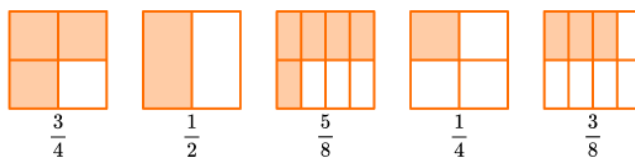
$$\frac{9}{12} \text{ and } \frac{3}{5} \quad \frac{3}{5} \times \frac{3}{3} = \frac{9}{15}$$

$$\frac{9}{12} > \frac{3}{5}$$

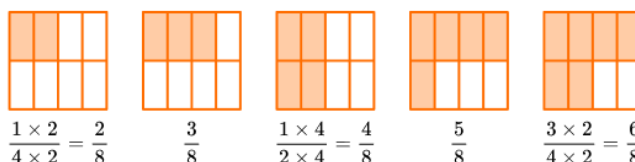
Ordering fractions

Ordering fractions is arranging a set of fractions from least to greatest (**ascending** order) or from greatest to least (**descending** order).

 **Example** Write the fractions in ascending order.

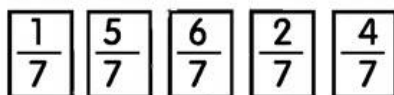


Find a common denominator and use the size of the numerators to order the fractions.



Rule #1 - If all of the **denominators** are the same, the fraction with the greatest numerator has the greatest value.

Example:



greatest to least

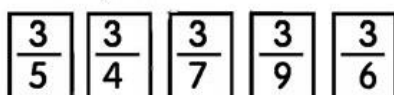


least to greatest



Rule #2 - If all of the **numerators** are the same, the fraction with the smallest denominator has the greatest value.

Example:



greatest to least

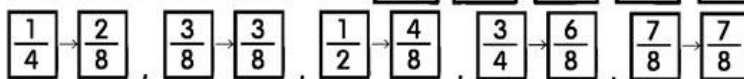
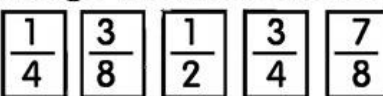


least to greatest



Rule #3 - If all the **numerators and denominators** are different, find the LCD and change the fractions to show the same denominators.

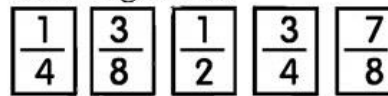
**The LCD of 4, 8, 2, 4, 8 is 8



greatest to least



least to greatest



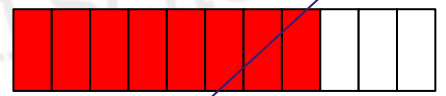
Add and subtract fractions

❖ **Same Denominator**

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



$$\frac{8}{11} - \frac{3}{11} = \frac{5}{11}$$



❖ **Different Denominators**

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

$$\frac{9}{10} - \frac{1}{4}$$

Multiples of 7: 7, 14, 21, 28, **35**

Multiples of 10: 10, **20**

Multiples of 5: 5, 10, 15, 20, 25, 30, **35**

Multiples of 4: 4, 8, 12, 16, **20**

$$\frac{2}{7} = \frac{10}{35}, \frac{3}{5} = \frac{21}{35}$$

$$\frac{9}{10} = \frac{18}{20}, \frac{1}{4} = \frac{5}{20}$$

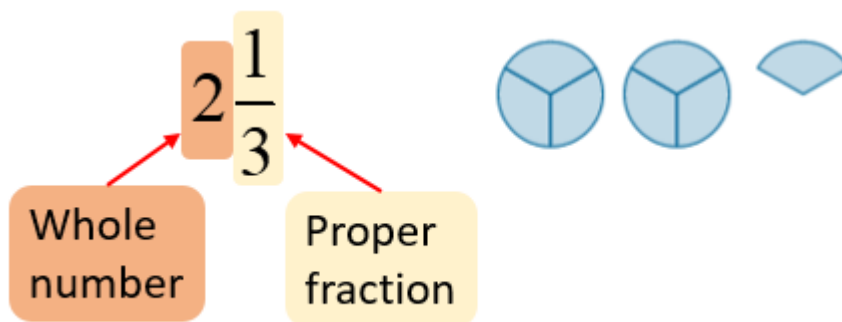
$$\frac{10}{35} + \frac{21}{35} = \frac{31}{35}$$

$$\frac{18}{20} - \frac{5}{20} = \frac{13}{20}$$

What are Mixed numbers?

Mixed Numbers

A mixed number is a number that consists of a whole number and a proper fraction.



How to convert improper fractions into mixed numbers?

Improper fraction $\left\{ \begin{array}{l} \mathbf{15} \text{ --- Numerator} \\ \mathbf{7} \text{ --- Denominator} \end{array} \right.$

Step 1: Divide the numerator with the denominator

$$15 \div 7 = 2 \text{ R } 1$$

Step 2: Assemble the mixed fraction

$$\frac{15}{7} = 2 \frac{1}{7}$$

$$\frac{15}{7} = 2 \frac{1}{7}$$

Mixed number

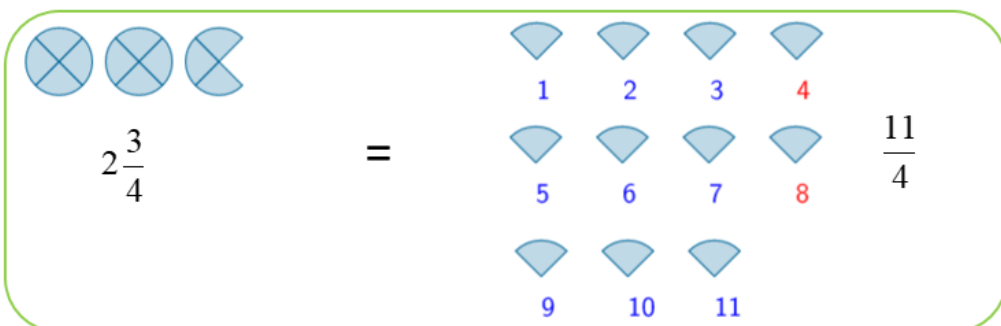
Mixed numbers into improper fractions

Mixed Number to Improper Fraction

$$2 \frac{3}{4} = \frac{(4 \times 2) + 3}{4} = \frac{8 + 3}{4} = \frac{11}{4}$$

Mixed Number

Improper Fraction



Add two mixed numbers

- ❖ Add or subtract the whole numbers and fractions separately

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

Add the wholes: $2 + 1 = 3$

Add the parts:

$$\frac{2}{5} + \frac{3}{10} = \frac{4}{10} + \frac{3}{10} = \frac{7}{10}$$

$$3 + \frac{7}{10} = 3\frac{7}{10}$$

$$2\frac{1}{2} - 1\frac{1}{4}$$

Subtract the wholes: $2 - 1 = 1$

Subtract the parts:

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

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

- ❖ Convert the mixed numbers to improper fractions

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

$$2\frac{2}{5} = \frac{12}{5} \qquad 1\frac{3}{10} = \frac{13}{10}$$

$$\frac{12}{5} + \frac{13}{10} = \frac{24}{10} + \frac{13}{10} = \frac{37}{10}$$

$$\frac{37}{10} = 3\frac{7}{10}$$

$$2\frac{1}{2} - 1\frac{1}{4}$$

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

$$\frac{5}{2} - \frac{5}{4} = \frac{10}{4} - \frac{5}{4} = \frac{5}{4}$$

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

Adding and subtracting / mixed numbers.

1. Convert mixed numbers to fractions

$$3\frac{1}{4} - 1\frac{3}{5} = \frac{13}{4} - \frac{8}{5} =$$

2. Find the LCM and subtract

$$\frac{65}{20} - \frac{32}{20} = \frac{33}{20} =$$

3. Convert back to a mixed number

$$1\frac{13}{20}$$

Multiply fractions by integers

1. Multiply the numerator of the fractions by the whole number
2. To simplify, divide the numerator and denominator by the same amount

$$2 \times \frac{3}{10} = \frac{6}{10} = \frac{3}{5}$$

EXAMPLE

Step One: Rewrite the whole number as fraction over 1.

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

Step Two: Multiply the numerators then the denominators.

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

Step Three: Simplify (if possible) and solve.



Cancellation method

$$\frac{2}{3} \text{ of } 24 = \frac{2}{3} \times \frac{24}{1} = \frac{48}{3} = 16$$

Cancellation Method

1. Look for a pair of numerator and denominator to cancel or reduce.
2. Multiply.

$$\frac{2}{3} \times \frac{\overset{8}{\cancel{24}}}{1} = \frac{16}{1} = 16$$

Multiply fractions by fractions

$$\text{Multiply: } \frac{1}{3} \times \frac{3}{5}$$

Step-1:

$$\frac{1 \times 3}{3 \times 5} = \frac{3}{15}$$

Step-2:

$$\frac{\cancel{3}^1}{\cancel{15}_5} = \frac{1}{5}$$

$$\therefore \frac{1}{3} \times \frac{3}{5} = \frac{1}{5}$$

fraction multiplying with cancelling

$$\frac{\overset{4}{\cancel{8}}}{\underset{1}{\cancel{9}}} \times \frac{\overset{1}{\cancel{9}}}{\underset{5}{\cancel{10}}}$$

$$\frac{\overset{2}{\cancel{6}}}{\underset{1}{\cancel{7}}} \times \frac{\overset{2}{\cancel{14}}}{\underset{5}{\cancel{15}}}$$

$$\frac{\overset{1}{\cancel{5}}}{\underset{1}{\cancel{6}}} \times \frac{\overset{4}{\cancel{24}}}{\underset{5}{\cancel{25}}}$$

by Fractions

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

by Whole Numbers

$$\frac{3}{8} \times 2$$
$$\frac{3}{8} \times \frac{2}{1} \rightarrow \frac{3 \times 2}{8 \times 1} \rightarrow \frac{6}{8}$$

Rewrite the whole number as a fraction with a denominator of 1.

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

by Mixed Numbers

$$3\frac{2}{3} \times 4\frac{1}{5}$$
$$\frac{21}{5} \times \frac{11}{3} \rightarrow \frac{21 \times 11}{5 \times 3} \rightarrow \frac{231}{15}$$

Rewrite the mixed numbers as improper fractions.

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

Divide a fraction by an integer

Remember:

- K** Keep the first number the same.
- F** Flip the second number. (upside down)
- C** Convert division sign into multiplication sign.

Divide Whole Number by Fraction

$$5 \div \frac{2}{3}$$
$$= \frac{5}{1} \div \frac{2}{3}$$

Rewrite the whole number as a fraction with a denominator of 1.

$$= \frac{5}{1} \times \frac{3}{2}$$

Change \div to \times
Flip the second fraction.
Cancel any common factors.
Multiply.

$$= \frac{15}{2} = 7\frac{1}{2}$$

Change to mixed number, if necessary

Divide a fraction by a fraction

Divide Fraction by Fraction

$$\frac{1}{6} \div \frac{2}{3}$$

$$= \frac{1}{\cancel{6}^2} \times \frac{\cancel{3}^1}{2}$$

Change \div to \times
Flip the second fraction.
Cancel any common factors.
Multiply.

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

Simplify, if necessary

Dividing fractions

Multiply by the reciprocal of the divisor.	Find the product and simplify
$\frac{3}{4} \div \frac{1}{8}$	$\frac{3}{4} \times \frac{8}{1} = \frac{24}{4}$
$\frac{3}{4} \times \frac{8}{1}$	$= 6$

by Fractions

$$\frac{2}{3} \div \frac{4}{5}$$

$$\frac{2}{3} \div \frac{4}{5} \rightarrow \frac{2}{3} \times \frac{5}{4}$$

↑ Change ↑
Keep Flip

$$\frac{2}{3} \times \frac{5}{4} = \frac{2 \times 5}{3 \times 4} = \frac{10}{12} = \frac{5}{6}$$

by Whole Numbers

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

$$\frac{3}{7} \div \frac{2}{1} \rightarrow \frac{3}{7} \times \frac{1}{2}$$

↑ Change ↑
Keep Flip

$$\frac{3}{7} \times \frac{1}{2} = \frac{3 \times 1}{7 \times 2} = \frac{3}{14}$$

by Mixed Numbers

$$6\frac{1}{2} \div 2\frac{1}{4}$$

$$\frac{13}{2} \div \frac{9}{4} \rightarrow \frac{13}{2} \times \frac{4}{9}$$

↑ Change ↑
Keep Flip

$$\frac{13}{2} \times \frac{4}{9} = \frac{13 \times 4}{2 \times 9} = \frac{52}{18} = \frac{26}{9} = 2\frac{8}{9}$$

How to Divide Mixed Numbers using Keep-Change-Flip!

Fraction of an amount

$$\frac{3}{4} \text{ of } 36$$

Divide by the denominator then multiply by the numerator

$$36 \div 4 = 9 \times 3 = 27$$

$$\left(\frac{3}{4} \text{ of } 36 = 27 \right)$$

2. Multiply by the numerator

$\frac{5}{2}$ of 10 = 25

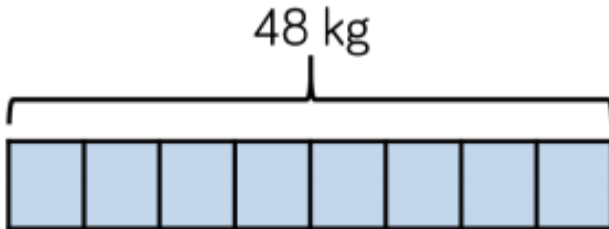
1. Divide by the denominator

$$10 \div 2 = 5$$

$$5 \times 5 = 25$$

Fraction of an amount

Find $\frac{5}{8}$ of 48kg

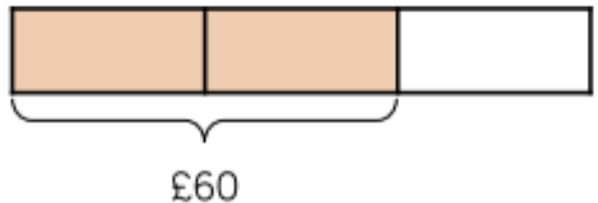


$$1/8 \text{ of } 48\text{kg} = 48 \div 8 = 6\text{kg}$$

$$5/8 = 6 \times 5 = 30\text{kg}$$

Find the whole

Jack has spent $\frac{2}{3}$ of his money. He spent £60, how much money did he start with?



$$2/3 = \text{£}60 \text{ so } 1/3 = \text{£}30$$

$$\text{£}60 + \text{£}30 = \text{£}90 / \text{£}30 \times 3 = \text{£}90$$

Unit (6) Measure - imperial and metric measures

Measurement in the metric system

Mass: Measure how **heavy** something is.

Eg, My school bag weighs 3 kg.

Mass is measured in **grams (g)**, **kilograms (kg)**

Length: Measure the **distance** between 2 points

Eg, My pencil is 1 metre long.

Length is measured in **millimetres (mm)**, **centimetres (cm)**, **metres (m)**, and **kilometres (km)**.

Capacity: Measure the amount something can **contain**.

Eg, I drink 200 ml of milk every day.

Capacity is measured in **millilitres (ml)** and **litres (l)**.

METRIC UNITS

LENGTH

1 CENTIMETER = 10 MILLIMETERS

1 METER = 100 CENTIMETERS

1 METER = 1,000 MILLIMETERS

1 KILOMETER = 1,000 METERS

WEIGHT

1 GRAM = 1,000 MILLIGRAMS

1 KILOGRAM = 1,000 GRAMS

CAPACITY

1 LITER = 1,000 MILLILITERS

1 KILOLITER = 1,000 LITERS

Convert metric measures

Length

$$1000 \text{ m} = 1\text{km}$$

$$100 \text{ cm} = 1\text{m}$$

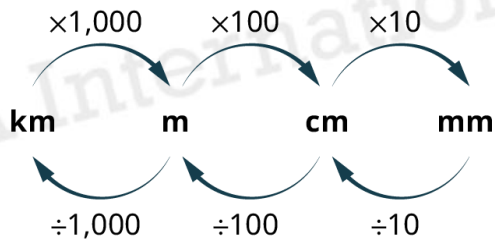
$$10\text{mm} = 1\text{cm}$$

$$\frac{1}{2}\text{m} = 0.5\text{m} = 50\text{cm}$$

$$\frac{1}{4}\text{m} = 0.25\text{m} = 25\text{cm}$$

$$\frac{3}{4}\text{m} = 0.75\text{m} = 75\text{cm}$$

$$\frac{1}{10}\text{m} = 0.01\text{m} = 10\text{cm}$$



Mass

$$1 \text{ tonne} = 1000 \text{ kg}$$

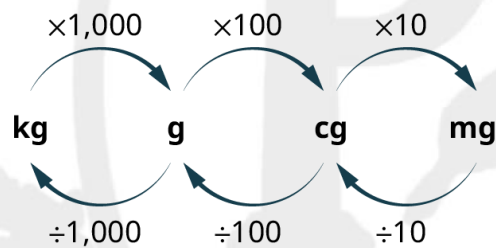
$$1000\text{g} = 1 \text{ kg}$$

$$\frac{1}{10} \text{ kg} = 0.1 \text{ kg} = 100\text{g}$$

$$\frac{1}{4} \text{ kg} = 0.25 \text{ kg} = 250\text{g}$$

$$\frac{1}{2} \text{ kg} = 0.5 \text{ kg} = 500\text{g}$$

$$\frac{3}{4} \text{ kg} = 0.75 \text{ kg} = 750\text{g}$$



Capacity

$$1000 \text{ ml} = 1\text{l}$$

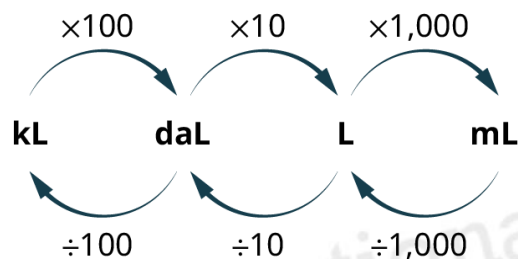
$$\frac{1}{10}\text{l} = 0.1\text{l} = 100\text{ml}$$

$$\frac{1}{4}\text{l} = 0.25\text{l} = 250\text{ml}$$

$$\frac{1}{2}\text{l} = 0.5\text{l} = 500\text{ml}$$

$$\frac{3}{4}\text{l} = 0.75\text{l} = 750\text{ml}$$

$$\frac{1}{100}\text{l} = 0.01\text{l} = 10\text{ml}$$



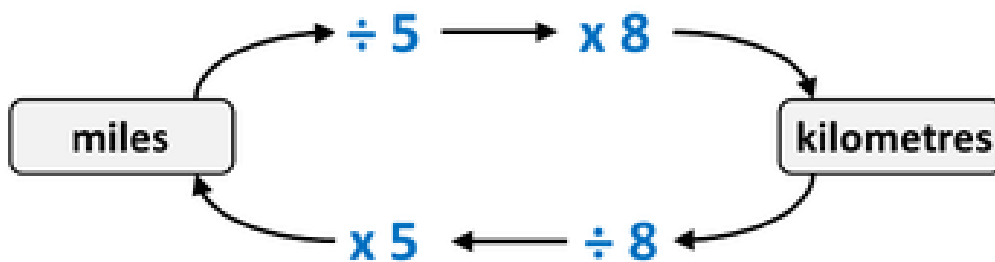
1 mile = 1.609 kilometres

This is made simpler using the following method of conversion

5 miles \approx 8 kilometres

(the \approx symbol means approximately)

How to convert between miles and kilometres



Examples

15 miles \approx 24 kilometres

$\div 5 \times 8$

48 kilometres \approx 30 miles

$\div 8 \times 5$

Trickier Examples!

With these you may need to use a formal method for division and/or multiplication

12 miles

$12 \div 5 = 2.4$

$2.4 \times 8 = 19.2$ km




15 km

$15 \div 8 = 1.875$

$1.875 \times 5 = 9.375$ miles

Convert metric and imperial measures

Metric	Imperial
Millimetres Centimetres Metres Kilometres Milligrams Grams Kilograms tonnes Millilitres Litres	Inch Yard Foot / feet Acre Ounce pounds Stone Pint gallon

	Metric	Imperial
Length 	Millimeter (mm) Centimeter (cm) Meter (m) Kilometer (km)	Inch (in) Foot (ft) Yard (yd) Mile (mi)
Weight 	Milligram (mg) Gram (g) Kilogram (kg) Metric Ton (t)	Ounce (oz) Pound (lb) Stone (st)
Volume 	Milliliter (ml) Liter (L)	Pint (pt) Quart (qt) Gallon (gal)

Length	Mass	Capacity
1 inch = 2.5cm	16 ounces = 1 pound	8 pints = 1 gallon
1 foot = 30cm	1 ounce = 25g	1 gallon = 4.5 litres
1 mile = 1.6km	1 pound = 450g	1 pint = 570ml
5 miles = 8km	2.2 pounds = 1kg	

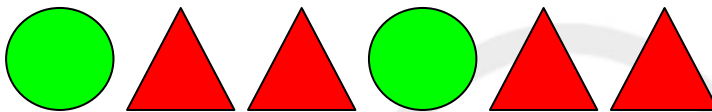
Unit (7) Ratio and proportion

Key Vocabulary

<ul style="list-style-type: none"> ❖ Ratio ❖ Proportion ❖ “For every there are.....” ❖ Part ❖ Whole 	<ul style="list-style-type: none"> ❖ Scale factor ❖ Enlargement ❖ Similar shapes ❖ Length ❖ Width ❖ perimeter
--	---

Ratio Language

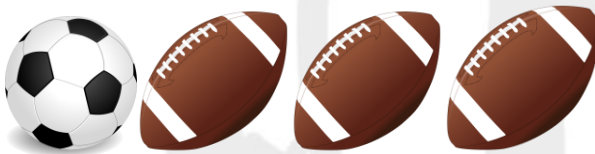
- For every 1 circle, there are 2 triangles.



- For every 2 bananas, there are 3 apples.



- For every 1 football, there are 3 rugby balls.



Ratios and Fractions

	<p>For every 1 rugby ball, there are 2 footballs.</p> <p>Ratio of rugby balls to footballs 1 : 2</p> <p>$\frac{1}{3}$ of the balls are rugballs.</p>
	<p>For every 1 triangle, there are 3 squares.</p> <p>Ratio of triangles to squares 1 : 3</p> <p>$\frac{1}{4}$ of the shapes are triangles.</p>

The Ratio Symbol



The ratio of footballs to rugby balls; 1 : 4
The ratio of rugby balls to footballs; 4 : 1



The ratio of circles to triangles; 2 : 3
The ratio of triangles to circles; 3 : 2



The ratio of apples to bananas; 1 : 2
The ratio of bananas to oranges; 2 : 3
The ratio of apples to bananas to oranges; 1 : 2 : 3
The ratio of oranges to bananas to apples; 3 : 2 : 1

Ratio and Proportion Problem-Solving

To use the ingredients for 1 people, you **divide** all the quantities by 10.

Ingredients for Fruit Smoothie (serves 10 people)

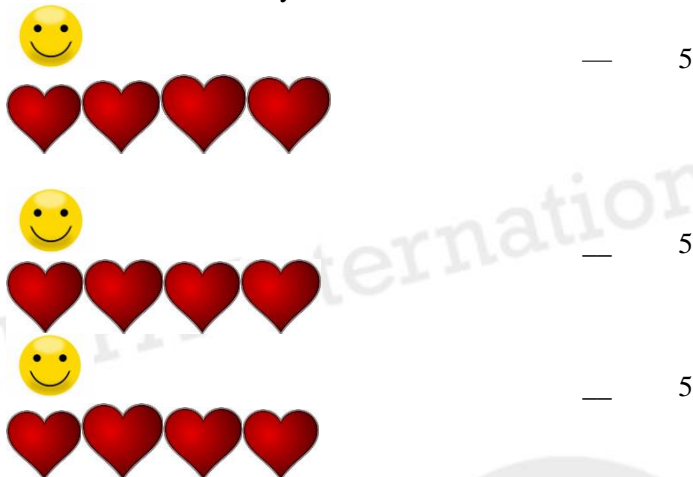
800g of bananas
500g of strawberries
200g of raspberries
700ml of milk
300ml of natural yogurt

To use the ingredients for 5 people, you halve all the quantities (**divided by 2**).

To use the ingredients for 20 people, you double all the quantities (**multiplied by 2**).

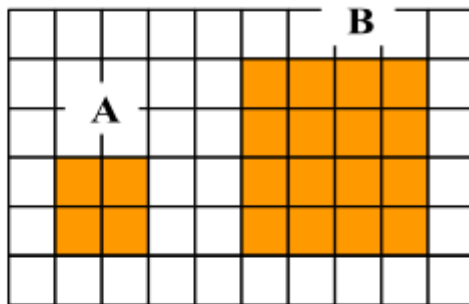
In a bag of 15 sweets, there is 1 smiley face sweet for every 4 love heart sweets.

Therefore, there will be 3 smiley face sweets and 12 love heart sweets in the bag.

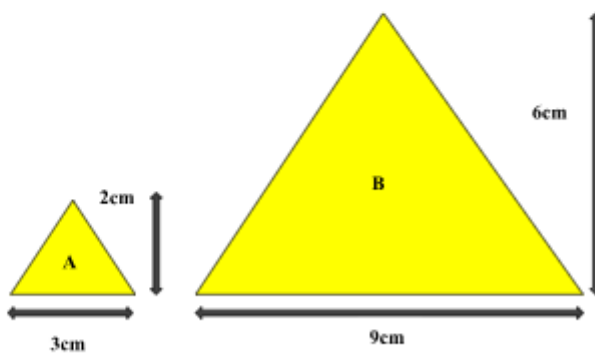


Scale Factor

- Shape A has been enlarged by a scale factor of 2 to make Shape B.
- Shape B is now two times as big as Shape A.



- Shape B has been enlarged from Shape A by a scale factor 3.
- Shape B is now three times as big as Shape A.



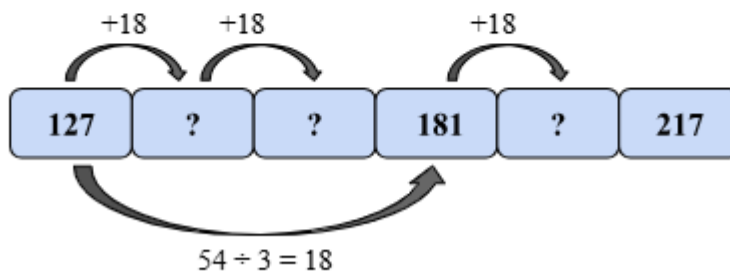
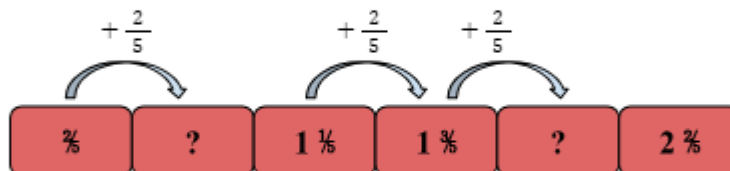
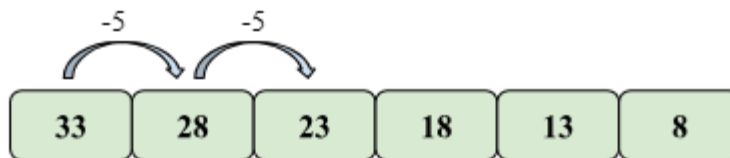
Unit (8) Algebra

Key Vocabulary

- | | |
|---------------------|---------------------|
| ❖ Term-to-term rule | ❖ One-step equation |
| ❖ Unknown | ❖ Two-step equation |
| ❖ Expression | ❖ Substitution |
| ❖ Equation | ❖ Pairs of unknowns |
| ❖ Formula | ❖ Enumerate |

Linear Number Sequence

- A linear number sequence is a sequence where each value **increases** or **decreases** by the **same amount** each time.
- Each number in a linear sequence is called a **term**.
- The constant change between each number is called the **term-to-term rule**.
- To identify the term-to-term rule, find the **difference** between two adjacent terms.
- When you know the term-to-term rule, you can use it to find the next number in the sequence.
- It can also be used to find missing numbers within a sequence.



Forming Expressions

An **expression** is a group of numbers, letters and operation symbols.

- Add 14 to a $a + 14$
- Subtract 20 from b $b - 20$
- Multiply c by 4 $4c$
- 12 more than d $d + 12$
- Multiply e by 3 subtract 5 $3e - 5$
- Add 12 to f and then multiply by 2 $2(f - 12)$

$$\begin{aligned} a + 14 &= 20 \\ b - 20 &= 15 \\ 4c &= 28 \end{aligned}$$

$$\begin{aligned} d + 12 &= 30 \\ 3e - 5 &= 10 \\ 2(f - 12) &= 44 \end{aligned}$$

An equation is a number statement with

an equal sign (=). Expressions on either side of the equal sign are of equal value.

Formulas / Formulae

(The word formula has two possible plural forms, formulae and formulas.)

A formula is a special type of equation that shows the relationship between different substituted variables. Formulas are often used in geometry to find area and volume.

	Area of triangle = (base × height) ÷ 2	
Area of rectangle = length × width		(12.5 × hours worked) + 25 = cost of job

Equations with Pairs of Unknowns

In an equation with two unknown numbers, there may be several possible values for the unknowns that will balance the equation.

$ab = 18$	
a	b
1	18
2	9
3	6
6	3
9	2
18	1

$2a + b = 10$	
a	b
2	6
3	4
4	2
5	0

Enumerating Possibilities

Enumerating means making a complete list of answers to a problem.

- Use a system for finding the possibilities.
- Organise your findings in an ordered list or table.
- Have a way of deciding when all possibilities have been found.

There are four ice cream flavours.

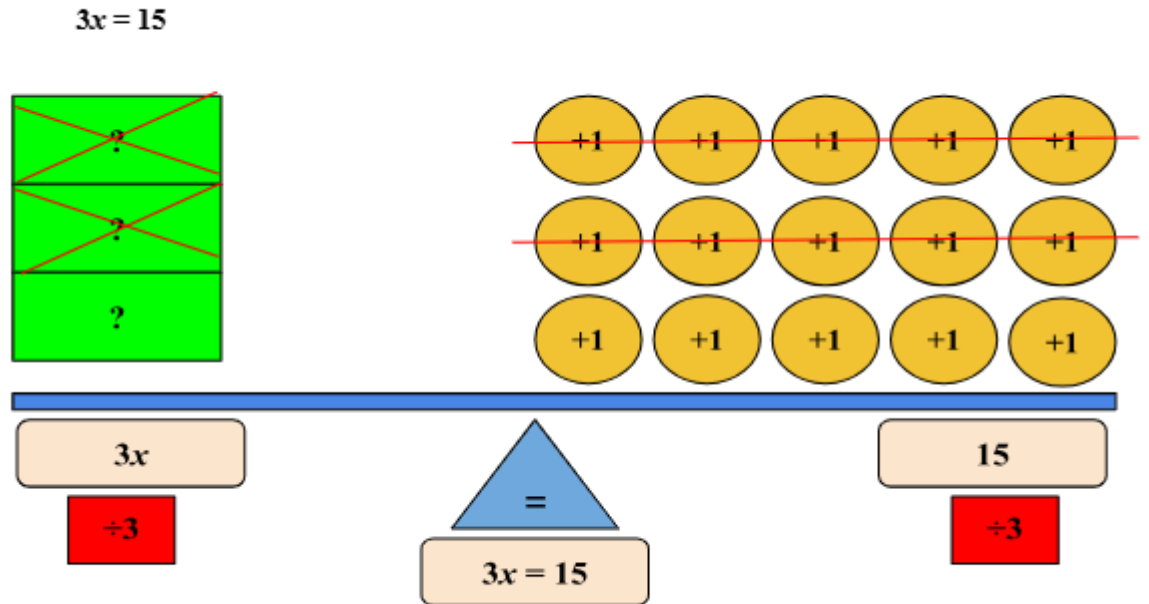


Two scoops of two different flavours give six possible combinations.

❖ Strawberry and green tea	❖ Green tea and chocolate
❖ Strawberry and chocolate	❖ Green tea and mint
❖ Strawberry and mint	❖ Chocolate and mint

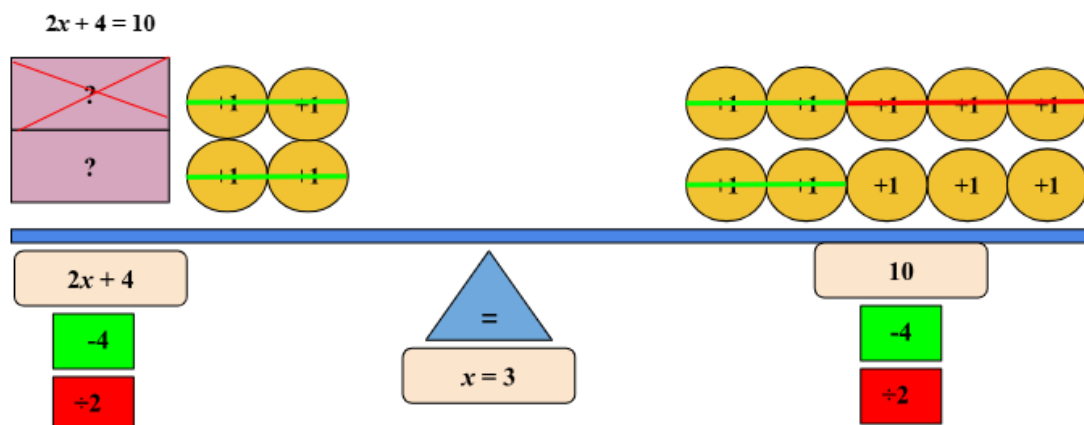
Solving One-Step Equations

- In algebra, missing numbers in equations are represented by letters.
- Any letter can be used, but often the letter x is used.
- An algebraic x is written to look different from a normal letter x to avoid confusion.

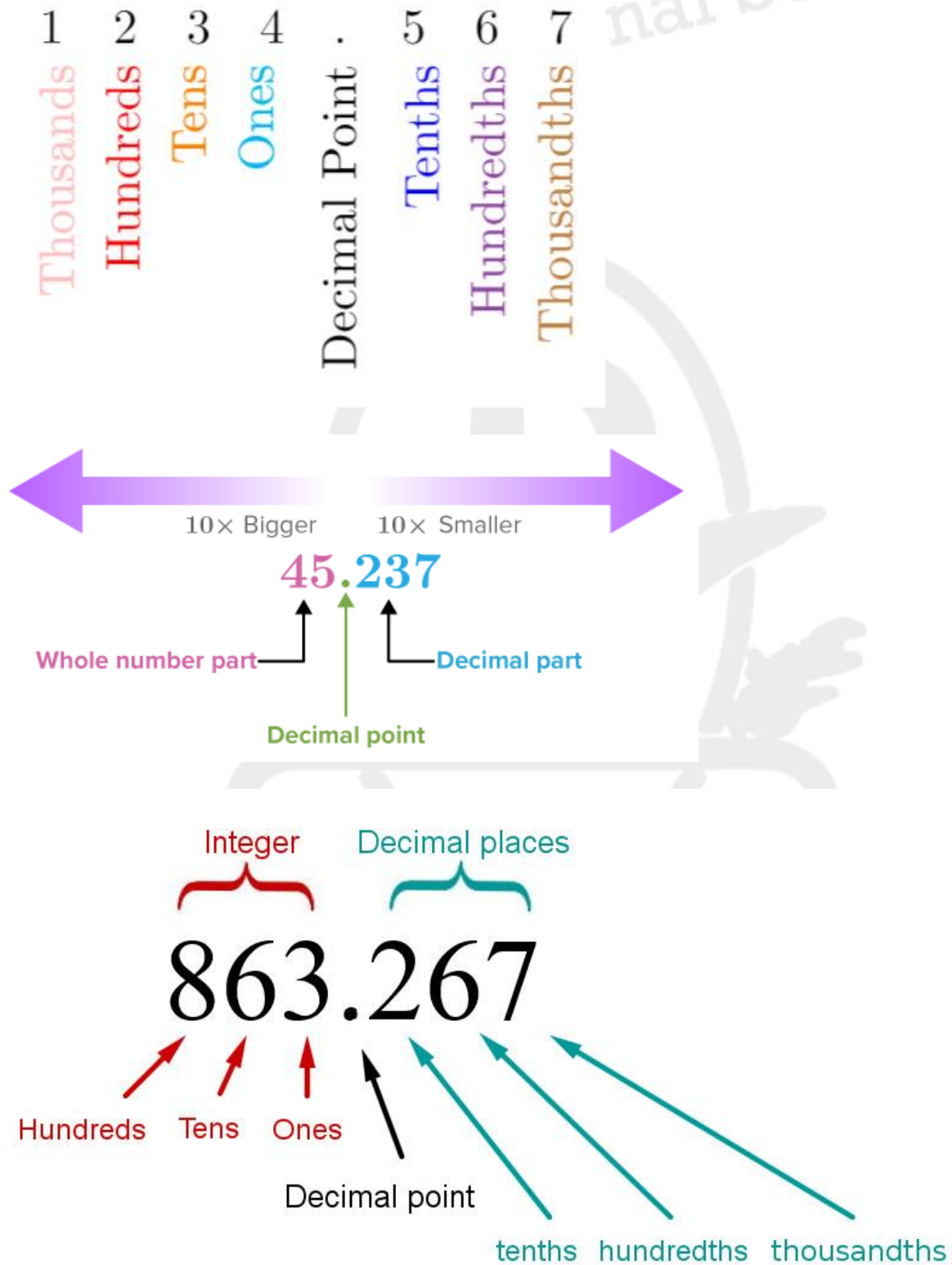


Solving Two-Step Equations

- The multiplication sign is not used in algebra to avoid confusing it with the algebraic x used to show a missing number.
- Inverse operations are used to isolate the letter on one side of the equation.



Decimal place value extends our understanding of place value to decimal numbers. Decimal place are the digits to the right of the decimal point. Place value helps us understand the value of each digit in a number.



Rounding Decimals

Find your **place** and look **next door**.
5 or greater, add one more.

All digits in front, stay the same.
All digits behind, zero's the name.

Round 1.362 to the nearest hundredths.

1.362 → 1.360

6 is at the hundredths place.
We look next door and find the number 2.
2 is less than 5 and so 6 remains the same.

Round 25.378 to the nearest tenths.

25.378 → 25.400

3 is at the tenths place.
We look next door and find the number 7.
7 is more than 5 and so we increase 3 to 4.

Rounding Decimals

To the Nearest Hundredths


MATH
MONKS

Round 67.4692 to its nearest **hundredths**.

67.4692 → 67.47

- 1 6 at the hundredths place is to be rounded.
- 2 The next digit to the right is 9.
- 3 9 > 5, so 1 is to added to 6. 9 & 2 are removed.

HOW TO Add & Subtract Decimals

STEP 1	STEP 2	STEP 3	STEP 4	STEP 5
Line up the numbers and <u>decimal points</u> .	Add a zero (placeholder) to the right of any numbers as needed.	Beginning with the lowest place value, add or subtract from <u>right to left</u> .	Bring <u>down</u> the decimal point.	Check to see if your answer <u>makes sense</u> .
$\begin{array}{r} 7.12 \\ + 4.259 \\ \hline \end{array}$	$\begin{array}{r} 7.120 \\ + 4.259 \\ \hline \end{array}$	$\begin{array}{r} 7.120 \\ + 4.259 \\ \hline 11.379 \end{array}$	$\begin{array}{r} 7.120 \\ + 4.259 \\ \hline 11.379 \end{array}$	$7 + 4 = 11$ 

Adding & Subtracting Decimals

Steps:

1. Stack your decimals.
2. Put placeholders (zeroes) in empty spaces, if needed.
3. Drop your decimal point.
4. Add or Subtract

$$\begin{array}{r} 34.567 \\ + 65.371 \\ \hline 99.938 \end{array}$$

Multiply by 10, 100, and 1000

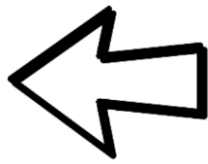
Multiplying by 10

When multiplying by 10, the number gets 10 times bigger. Move each digit 1 place to the left.



Multiplying by 100

When multiplying by 100, the number gets 100 times bigger. Move each digit 2 places to the left.



Multiplying by 1000

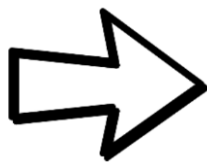
When multiplying by 1000, the number gets 1000 times bigger.
Move each digit 3 places to the left.



Divide by 10, 100, and 1000

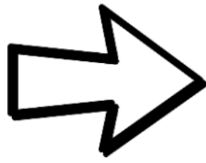
Dividing by 10

When dividing by 10, the number is getting 10 times smaller. Move each digit 1 place to the right.



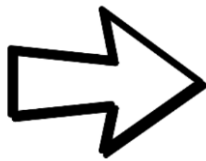
Dividing by 100


When dividing by 100, the number is getting 100 times smaller. Move each digit 2 places to the right.









Dividing by 1000

When dividing by 1000, the number is getting 1000 times smaller. Move each digit 3 places to the right.




 Maths Angel

Movement of the Decimal Point

Division	Multiplication
$12.34 \div 10 = 1.234$ 	$12.34 \times 10 = 123.4$ 
$12.34 \div 100 = 0.1234$ 	$12.34 \times 100 = 1234$ 
$12.34 \div 1000 = 0.01234$ 	$12.34 \times 1000 = 12340$ 

**Moving the decimal point right makes the number larger;
left makes it smaller.**



Multiply decimals by integers

$$\begin{array}{r}
 15 \longrightarrow 0 \text{ Decimal Place} \\
 \times 6.5 \longrightarrow 1 \text{ Decimal Place} \\
 \hline
 75 \\
 + 90 \times \\
 \hline
 97.5
 \end{array}$$

$\begin{array}{r} 0 \text{ Decimal Place} \\ + 1 \text{ Decimal Place} \\ \hline 1 \text{ Decimal Place} \end{array}$

$$\begin{array}{r}
 1.25 \longrightarrow 2 \text{ decimal places} \\
 \times 15 \longrightarrow 0 \text{ decimal places} \\
 \hline
 625 \\
 + 1250 \\
 \hline
 18.75
 \end{array}$$

$\begin{array}{r} 2 \text{ decimal places} \\ + 0 \text{ decimal places} \\ \hline 2 \text{ decimal places} \end{array}$

Multiplying decimals

$$\begin{array}{r}
 2.34 \\
 \times 4.6 \\
 \hline
 1404 \\
 + 936 \bullet \\
 \hline
 10.764
 \end{array}$$

$$2.34 \times 4.6 = 10.764$$

No. of digits after Decimal in 2nd Number
 No. of digits after Decimal in 1st Number
 No. of digits after Decimal in 1st Number

Decimal Divided by a Whole Number

Ex) $24.36 \div 3$

3 → divisor

24.36 → dividend

8.12

$$\begin{array}{r}
 \overline{08.12} \\
 3 \overline{)24.36} \\
 \underline{-24.} \\
 0.3 \\
 \underline{-0.3} \\
 0.06 \\
 \underline{-0.06} \\
 0
 \end{array}$$

$$\begin{array}{r}
 \overline{36.79} \\
 2 \overline{)73.59} \\
 \underline{-6} \\
 13 \\
 \underline{-12} \\
 15 \\
 \underline{-14} \\
 19 \\
 \underline{-18} \\
 1
 \end{array}$$

$$\begin{array}{r}
 \overline{36.795} \\
 2 \overline{)73.590} \\
 \underline{-6} \\
 13 \\
 \underline{-12} \\
 15 \\
 \underline{-14} \\
 19 \\
 \underline{-18} \\
 10 \\
 \underline{-10} \\
 \text{😊}
 \end{array}$$

Need to keep going!

Fractions to decimals & Fractions as division

$$\frac{7}{20} \stackrel{\times 5}{=} \frac{35}{100} \text{ or } 0.35$$

$$\frac{7}{50} \stackrel{\times 2}{=} \frac{14}{100} \text{ or } 0.14$$

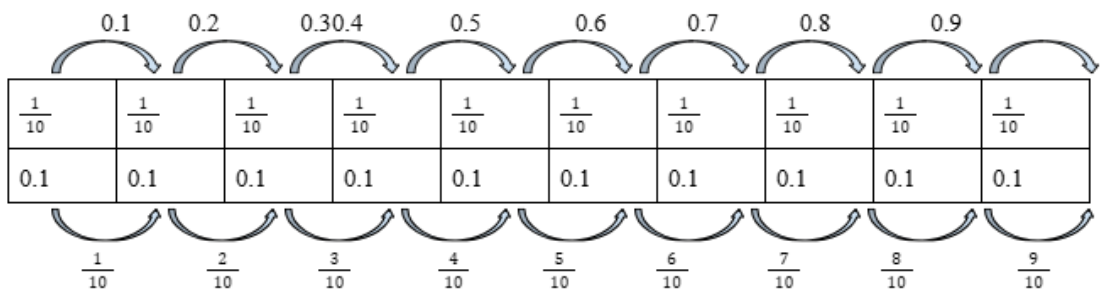
$$\frac{7}{25} \stackrel{\times 4}{=} \frac{28}{100} \text{ or } 0.28$$

$$\frac{8}{200} \stackrel{\div 2}{=} \frac{4}{100} \text{ or } 0.04$$

- When the denominator is not a factor or multiple of 100

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

	0	.	8	7	5
8	7	.	0	6	0



MPA

Percent %

- a type of **part-to-total** ratio, where the total is **100**.
- symbol: %
- “per 100”
- “out of 100”

20 %

20 **per** 100

20 **out of** 100

Fractions to Percentages

$$\frac{15}{50} = \frac{30}{100} = 0.3 = 30\%$$

$$\frac{60}{200} = \frac{30}{100} = 0.3 = 30\%$$

Converting **fractions to percentages** is representing the fraction as a percentage without changing its value.

E.g.

Convert $\frac{3}{4}$ to a percentage $\frac{3}{4} = \frac{3 \times 25}{4 \times 25} = \frac{75}{100} = 75\%$ So $\frac{3}{4} = 75\%$

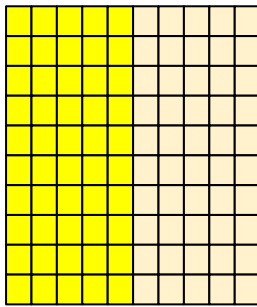
Convert $\frac{5}{8}$ to a percentage $\frac{5}{8} = 5 \div 8 \Rightarrow 8 \overline{) 5.0000}$ So $\frac{5}{8} = 0.625$

$0.625 \times 100 = 62.5\%$ So $\frac{5}{8} = 62.5\%$

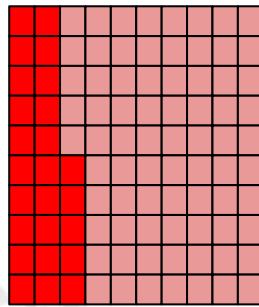


MPA International School

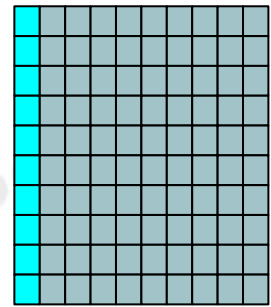
Equivalent Fractions, Decimals, and Percentages



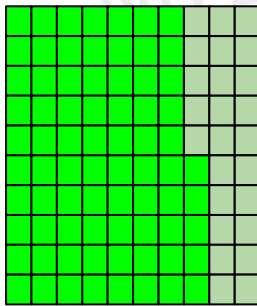
$$\frac{50}{100} = \frac{1}{2} = 0.5 = 50\%$$



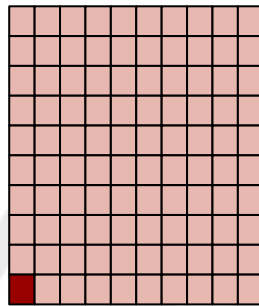
$$\frac{25}{100} = \frac{1}{4} = 0.25 = 25\%$$



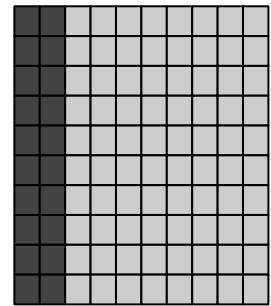
$$\frac{10}{100} = \frac{1}{10} = 0.1 = 10\%$$



$$\frac{75}{100} = \frac{3}{4} = 0.75 = 75\%$$



$$\frac{1}{100} = 0.01 = 1\%$$



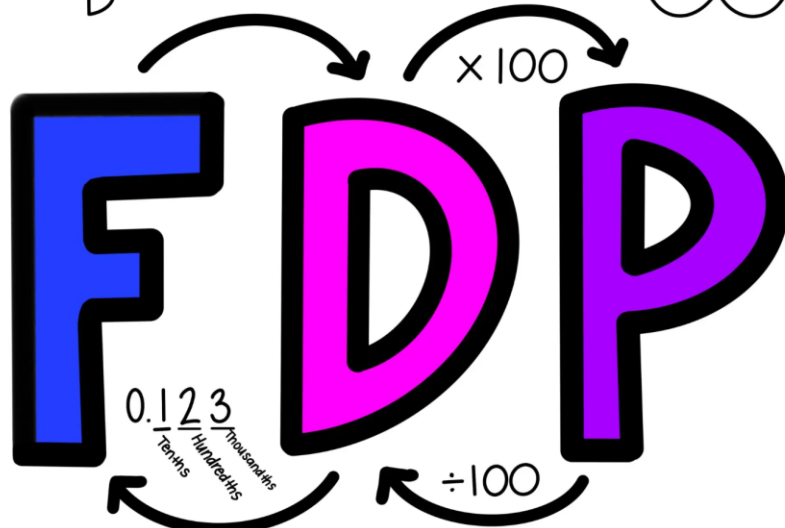
$$\frac{20}{100} = \frac{2}{10} = 0.2 = 20\%$$

FRACTION, DECIMAL, & PERCENT

Divide the numerator
by the denominator

$$\frac{N}{D} \rightarrow D \overline{)N}$$

Move the decimal
2 places to the right

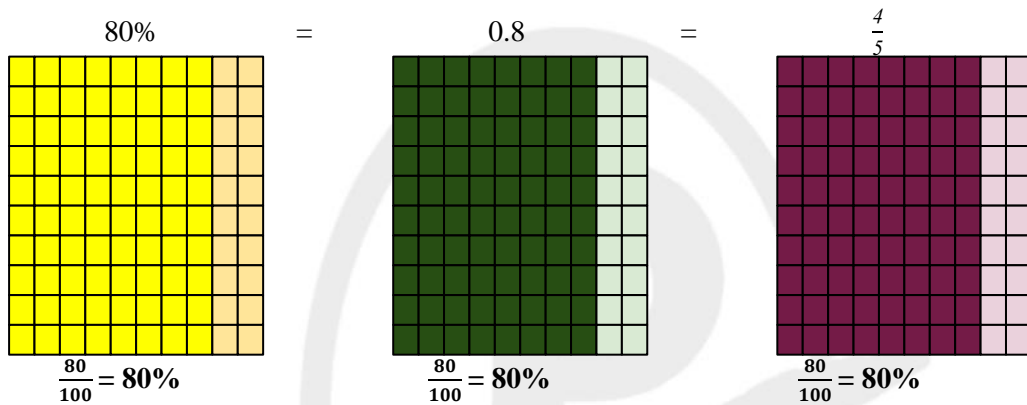
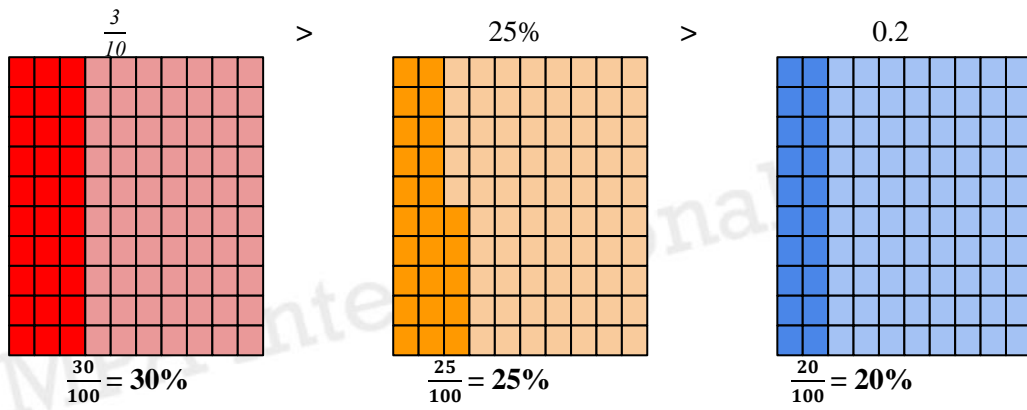


Say it aloud,
write as fraction,
Simplify it!

Move the decimal
2 places to the left

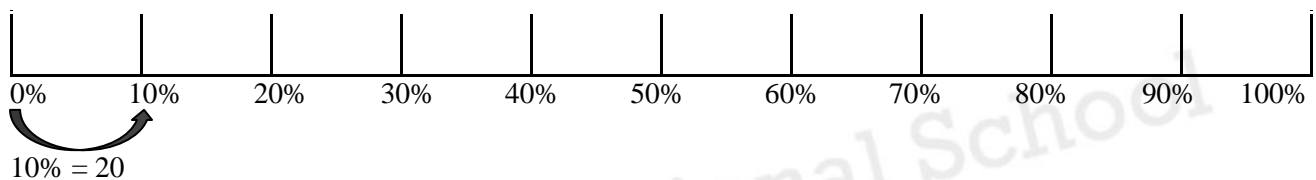
TammyBurt

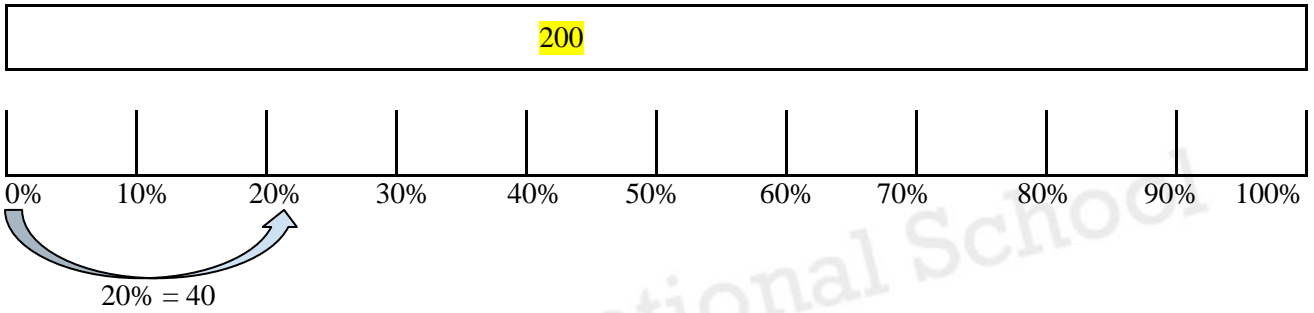
Ordering Fractions, Decimals, and Percentages



Finding a Percentage of an Amount

50% = $\frac{1}{2}$ so we can divide by 2	10% = $\frac{1}{10}$ so we can divide by 10	25% = $\frac{1}{4}$ so we can divide by 4	1% = $\frac{1}{100}$ so we can divide by 100
---	---	---	--





Ordering Fractions Decimals and Percentages (B) Example www.cazoommaths.com

Order the fractions, decimals and percentages smallest to largest.

$\frac{22}{25}$	81%	0.08	$\frac{4}{5}$
-----------------	-----	------	---------------

Method 1: First convert all the numbers into decimals


0.88	0.81	0.08	0.8
------	------	------	-----

The order would be 0.08, $\frac{4}{5}$, 81%, $\frac{22}{25}$

Method 2: First convert all the numbers into percentages

88%	81%	8%	80%
-----	-----	----	-----

The order would be 0.08, $\frac{4}{5}$, 81%, $\frac{22}{25}$

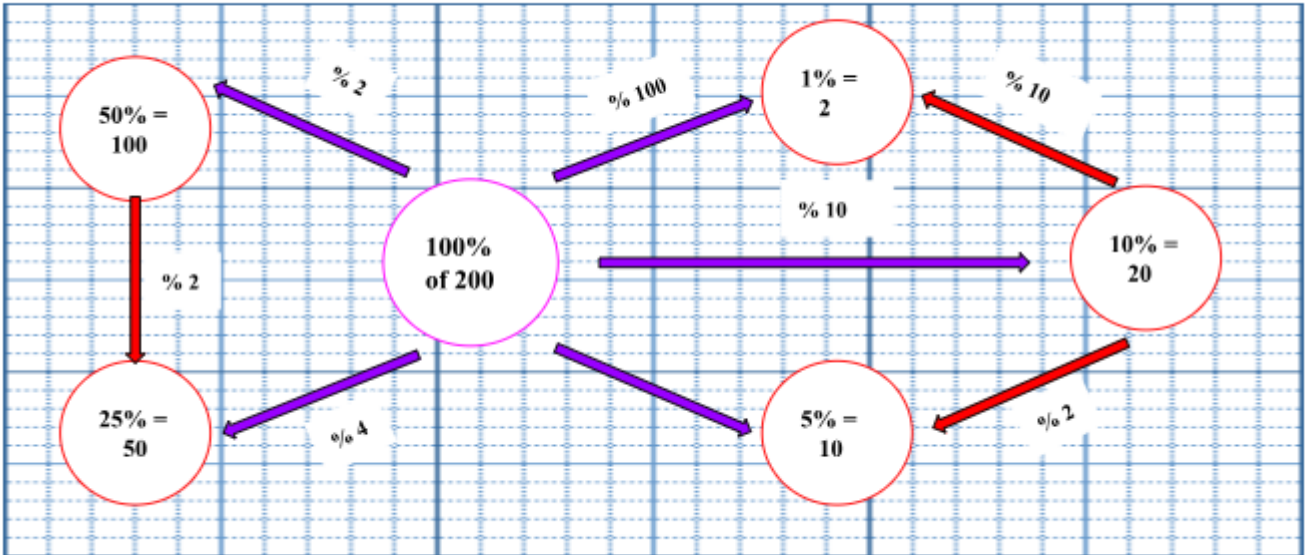


Examples by Cazoom Maths

Percentage of an amount

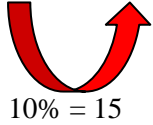
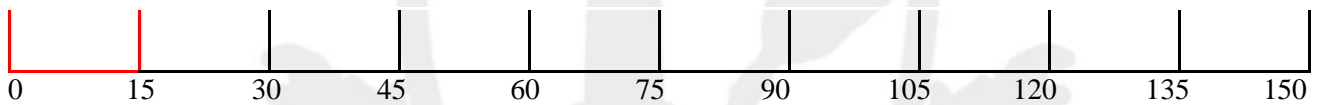
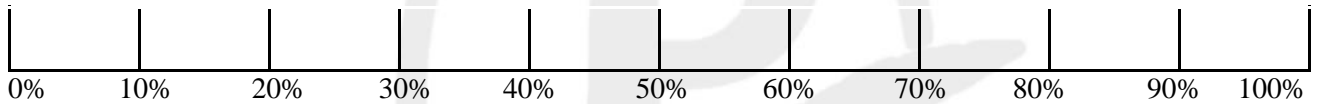
35% of 200 = ?

<p>10% of 200</p> <p>$200 \div 10 = 20$</p> <p style="text-align: center;">\downarrow</p> <p style="text-align: center;">$\div 2$</p> <p>$20 \div 2 = 10$</p> <p>5% = 10</p>	<p>$\times 3$</p> <p>\rightarrow</p> <p>\rightarrow</p>	<p>$20 \times 3 = 60$</p> <p>30% = 60</p> <p style="text-align: center;">\downarrow</p> <p>35% = 30% + 5%</p> <p>$60 + 10 = 70$</p> <p>so 35% of 200 = 70</p>
--	--	--



Percentages - Missing Values

Whole value (100%) of the bar model =?



We know $10\% = 15$ $10\% \times 10 = 100\%$ (the whole) so $15 \times 10 = 150$

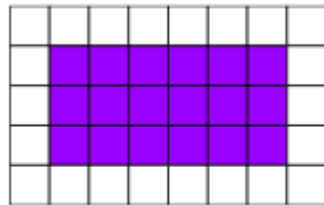
MPA International School

Unit (11) Measure - perimeter, area and volume

Key Vocabulary

<ul style="list-style-type: none"> • Perimeter • Area • Volume • Squared units (e.g., m²) • Cubic units (e.g., cm³) • Cube • Cuboid • Parallel lines • Perpendicular height 	<ul style="list-style-type: none"> • Base length • Width • Length • Height • Rectangle • Rectilinear • Parallelogram • Trapezium • Rhombus
--	---

Area of Rectangles

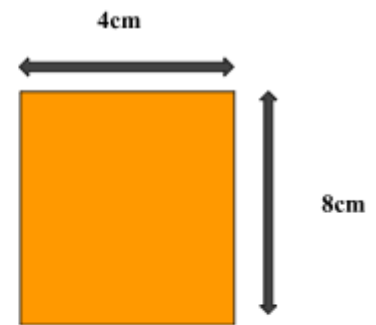


Counting squares:

$$\text{area} = 18\text{cm}^2$$

Useful formula:

$$\begin{aligned} 6\text{cm} &\times 3\text{cm} \\ \text{area} &= 18\text{cm}^2 \end{aligned}$$



$$\text{area} = 8\text{cm} \times 4\text{cm} = 18\text{cm}^2$$

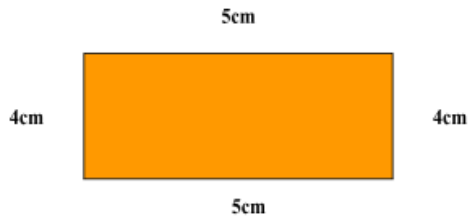
$$\text{Area} = \text{length} \times \text{width}$$

Perimeter of Rectangles

$$\text{Perimeter} = \text{length} + \text{width} + \text{length} + \text{width}$$

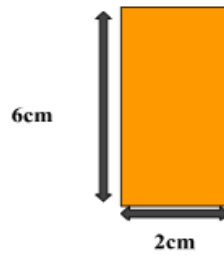
Or

$$\text{Perimeter} = (\text{length} + \text{width}) \times 2$$



$$\text{Perimeter} = 5 \text{ cm} + 4 \text{ cm} + 5 \text{ cm} + 4 \text{ cm} = 18 \text{ cm}$$

$$\text{Area} = 5 \text{ cm} \times 4 \text{ cm} = 20 \text{ cm}^2$$

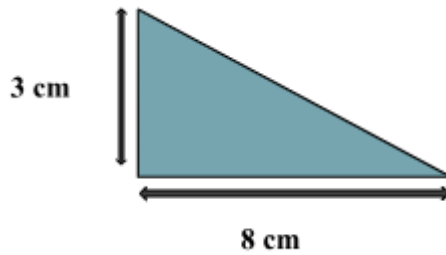


$$\text{Perimeter} = (6 \text{ cm} + 2 \text{ cm}) \times 2 = 8 \text{ cm} \times 2 = 16 \text{ cm}$$

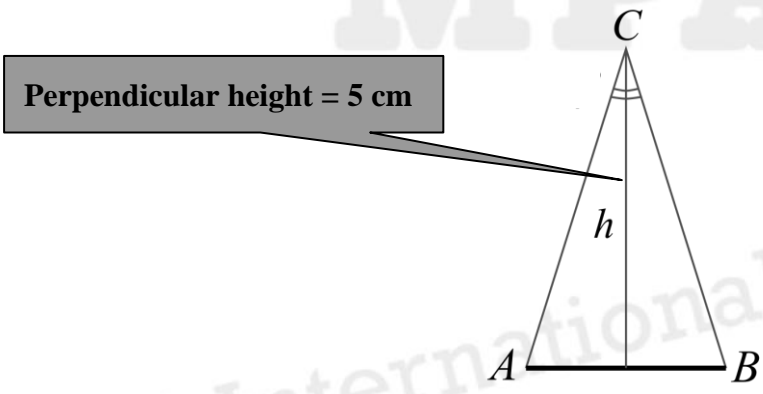
$$\text{Area} = 6 \text{ cm} \times 2 \text{ cm} = 12 \text{ cm}^2$$

Area of Triangles

$$\text{Area of triangle} = \frac{1}{2} \times \text{base length} \times \text{perpendicular height}$$

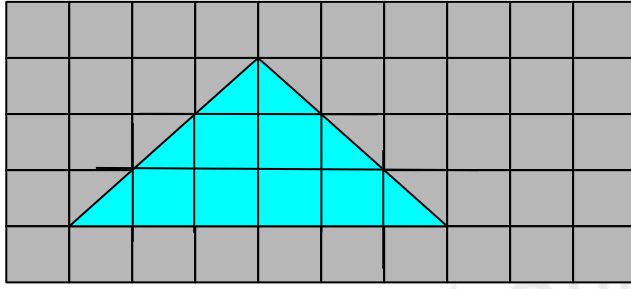


$$\begin{aligned} \text{Area} &= \frac{1}{2} \times 8 \text{ cm} \times 3 \text{ cm} \\ &= \frac{1}{2} \times 24 \text{ cm}^2 \\ &= 12 \text{ cm}^2 \end{aligned}$$



MPA International School

$$\begin{aligned} \text{Area of triangle} &= (6 \text{ cm} \times 5 \text{ cm}) \div 2 \\ &= 30 \text{ cm}^2 \div 2 \\ &= 15 \text{ cm}^2 \end{aligned}$$



Counting Squares:

6 whole squares = 6cm^2

6 half squares = 3cm^2

$6\text{cm}^2 + 3\text{cm}^2 = 9\text{cm}^2$

Area of triangle = 9cm^2


Using Formula:

Area = $(6\text{cm} \times 3\text{cm}) \div 2$

= $18\text{cm}^2 \div 2$

= 9cm^2


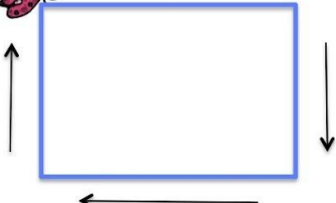
Perimeter & Area


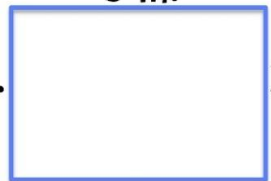


Perimeter

The distance around a shape

This is **Perry the Perimeter bug!** He loves to run bug races **around** the bug race track!

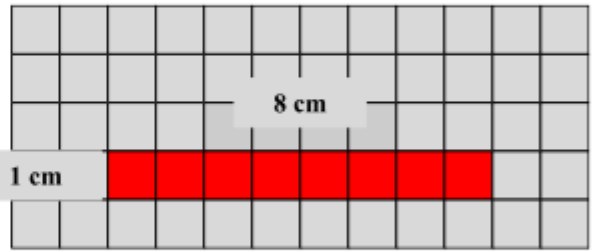
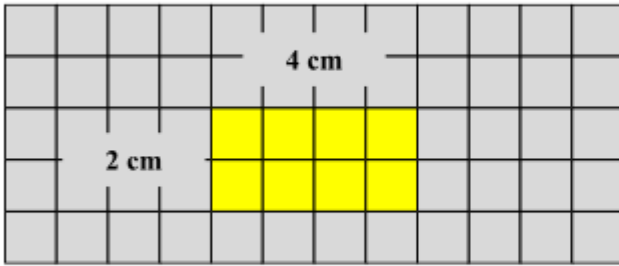



To find how far Perry runs (the perimeter), add up the sides!

$5 + 5 + 3 + 3 = 16$ inches around

Shapes with the same area can have different perimeters.



Area = 8 cm^2

Perimeter = 12 cm

Area = 8 cm^2

Perimeter = 18 cm

Area = 8 cm^2

Perimeter = 12 cm

Area = 8 cm^2

Perimeter = 18 cm

Area

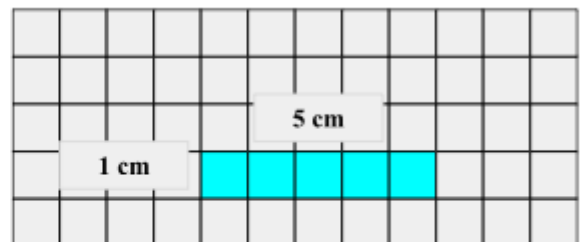
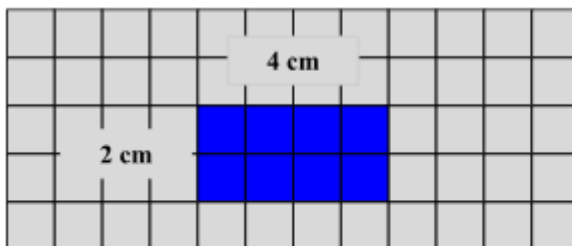
To find area: count the squares inside the shape or just multiply the length times the width

area

the amount of space inside a shape

length x width = area square-ia
 $5 \times 10 = 50 \text{ square feet}$

Shapes with the same perimeter can have different areas.



Area = 8 cm^2

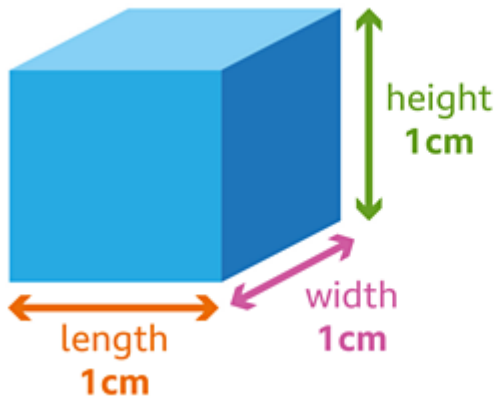
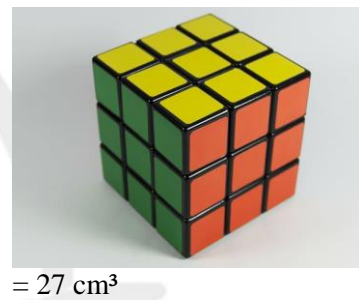
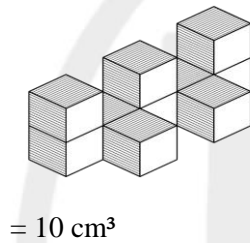
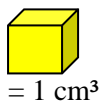
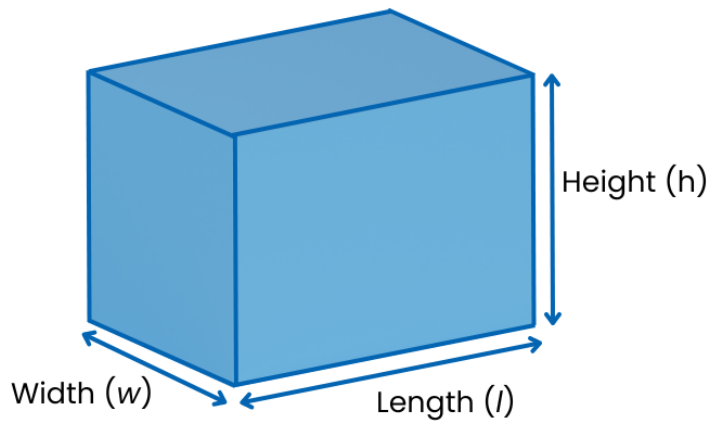
Perimeter = 12 cm

Area = 5 cm^2

Perimeter = 12 cm

Definition:

Volume is the amount of space an object occupies, measured in cubic units like cubic meters or liters.



Volume = 1cm³

$$\text{Volume of a cuboid} = \text{Length} \times \text{width} \times \text{height}$$

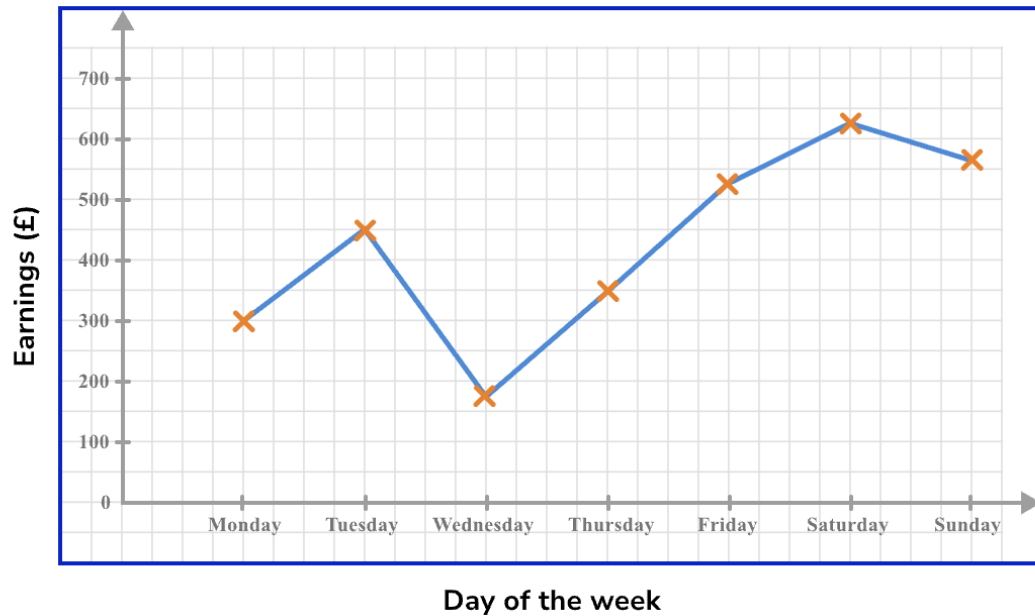
MPA International School

What is a line graph?

A **line graph** is a way of displaying data to easily see a trend over time.

To draw a line graph, we need to **plot individual items** of data onto a set of axes and then connect each **consecutive data** point with a **line segment**.

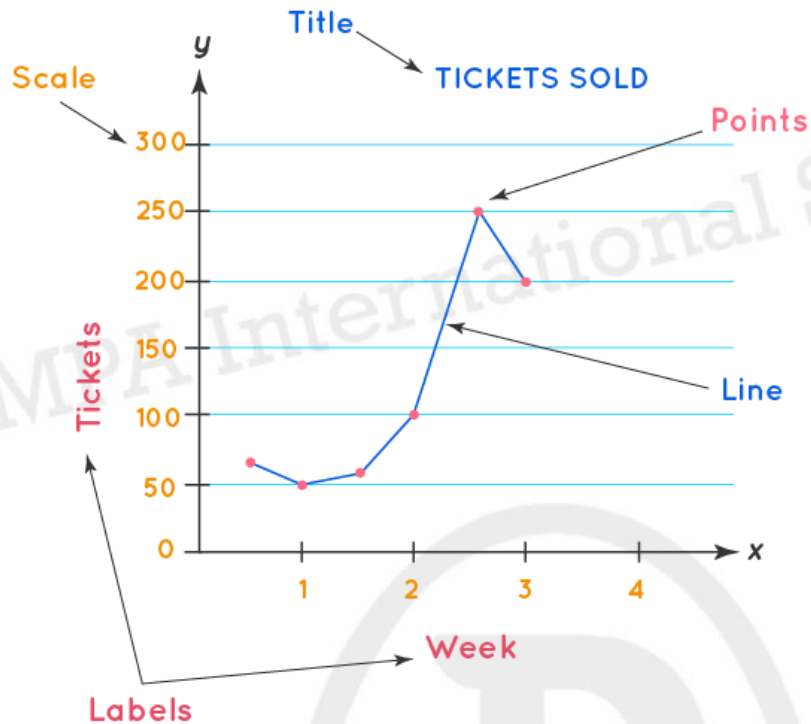
The **x-axis** or **horizontal axis** is labelled as time, and the **y-axis** or **vertical axis** is the variable that is being measured or tracked (ice cream sales, hours spent on homework, earnings, number of births etc).



How to draw a line graph

To draw a line graph:

- Label the axes and add an axis title.
- Plot each data point accurately.
- Connect each pair of consecutive points with a straight line.



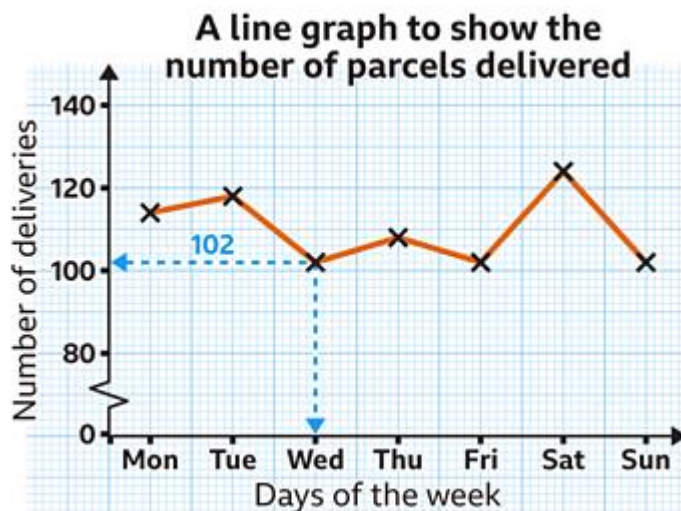
Title: Represents the title of the graph using a keyword. The line graph shown here talks about the tickets sold in 4 weeks.

Scale: Represents the total number of units in the horizontal x-axis & vertical y-axis. For example, the space between two lines in the y-axis represents 50 units.

Points: Represents the amount of data for value along the x-axis. For example, in the first week, 50 tickets were sold.

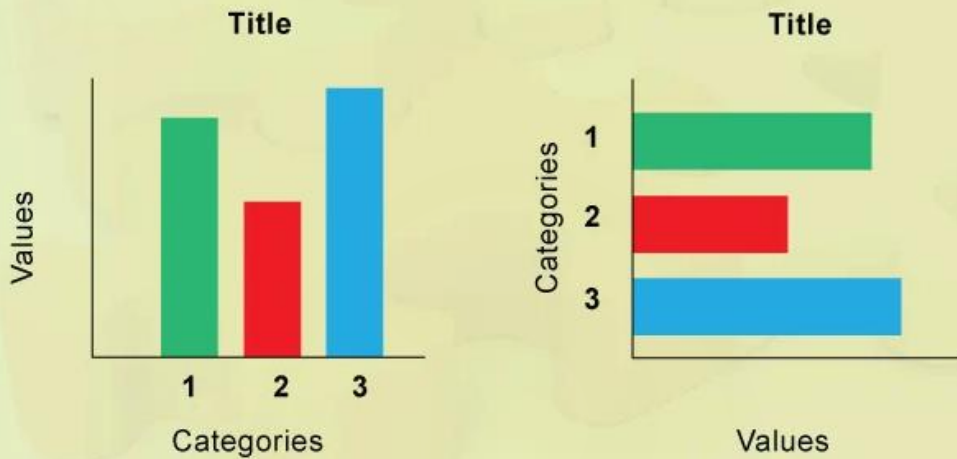
Labels: Represents what kind of data is shown in the x-axis and y-axis. For example, in the line graphs, the x-axis represents the number of the weeks and the y-axis represents the number of tickets sold in that particular week.

Line: Line segments connecting two or more individual data points on the graph forms a line.



Definition

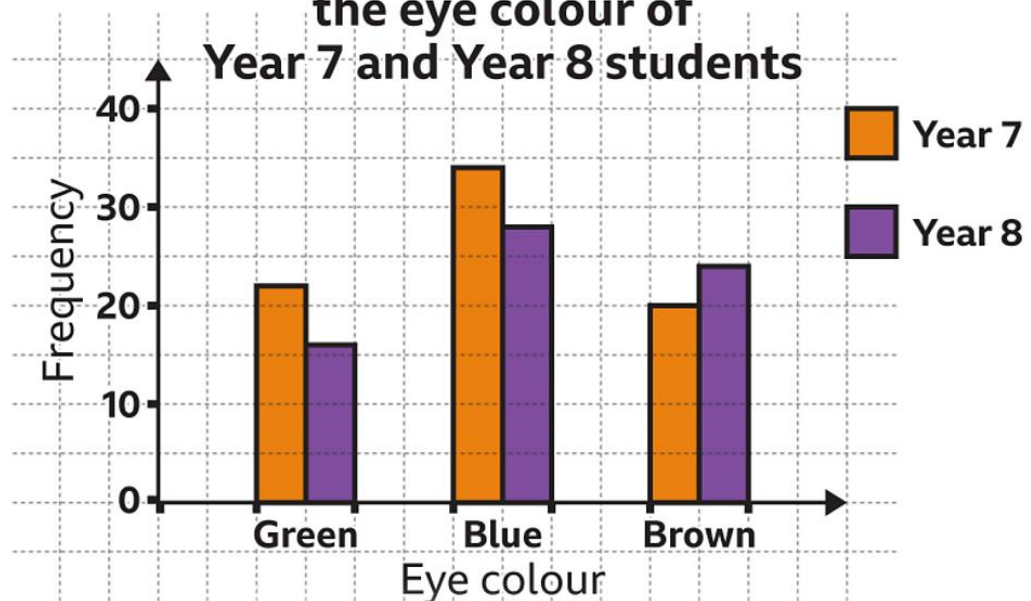
Bar Graph A graphical display of categorical data, in which values are shown as horizontal or vertical bars.



Dual bar chart

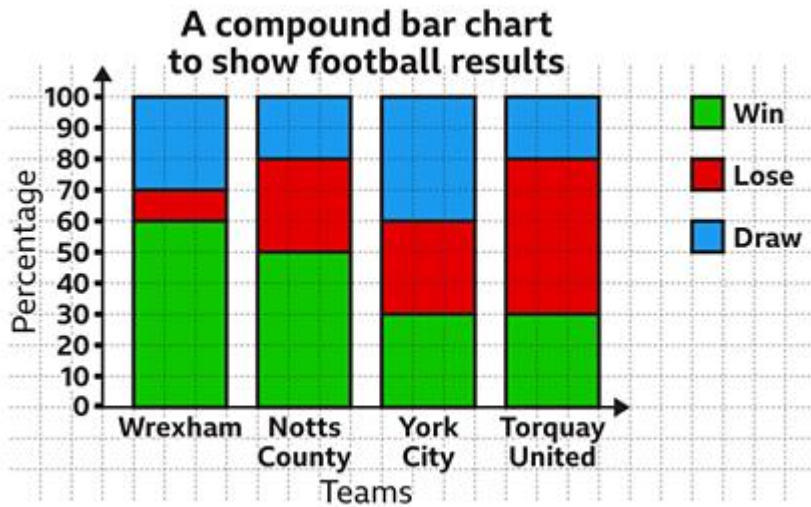
A dual bar chart (or double bar graph) is a data visualization tool that displays two related sets of data side-by-side for each category on the x-axis, allowing for direct comparison.

A dual bar chart to show the eye colour of Year 7 and Year 8 students



Compound bar chart

A compound bar chart (also known as a grouped, composite, or segmented bar chart) is a data visualization tool that displays two or more sets of data side-by-side or stacked within a single category.



Frequency Table

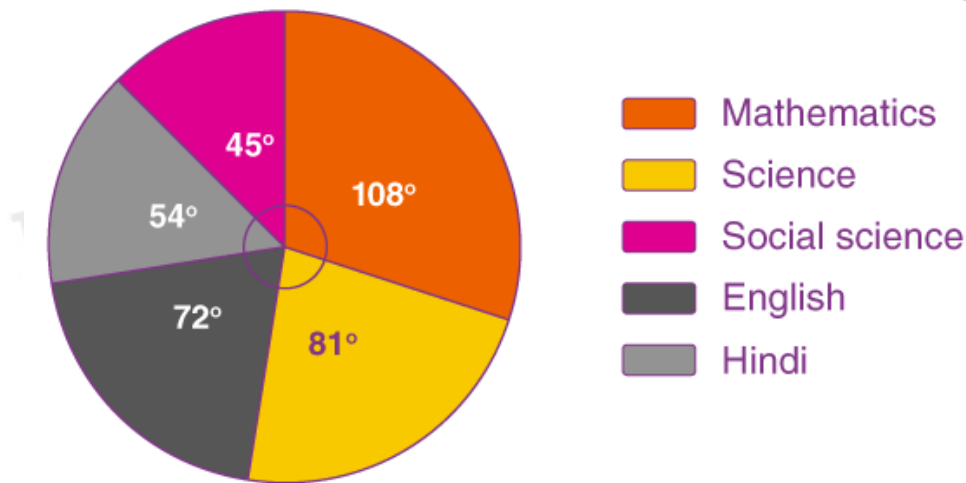
Eye colour	Tally	Frequency
brown		6
blue		8
green		3
grey		4
hazel		5

- Tally marks are used to help count things.
- Each vertical line represents one unit.
- The fifth tally mark goes down across the first four to make it easier to count.

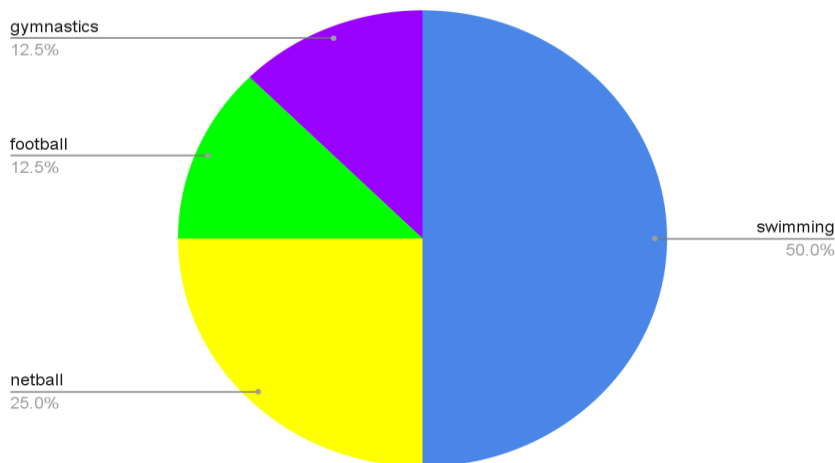
The frequency column is completed after all the data has been collected.

Pie chart

A pie chart is a circular statistical graphic divided into slices, where each slice represents a numerical proportion of a whole. All slices add up to 100% and 360 degrees. It is primarily used to display static categorical data, such as market share or demographic breakdowns.



A pie chart to show children's favourite sports



24 children were asked in total.

- Swimming = $\frac{1}{2}$ so $\frac{1}{2}$ of 24 = 12 children
- Netball = $\frac{1}{4}$ so $\frac{1}{4}$ of 24 = 6 children
- Football = $\frac{1}{8}$ so $\frac{1}{8}$ of 24 = 3 children
- Gymnastics = $\frac{1}{8}$ so $\frac{1}{8}$ of 24 = 3 children

Read and interpret pie charts

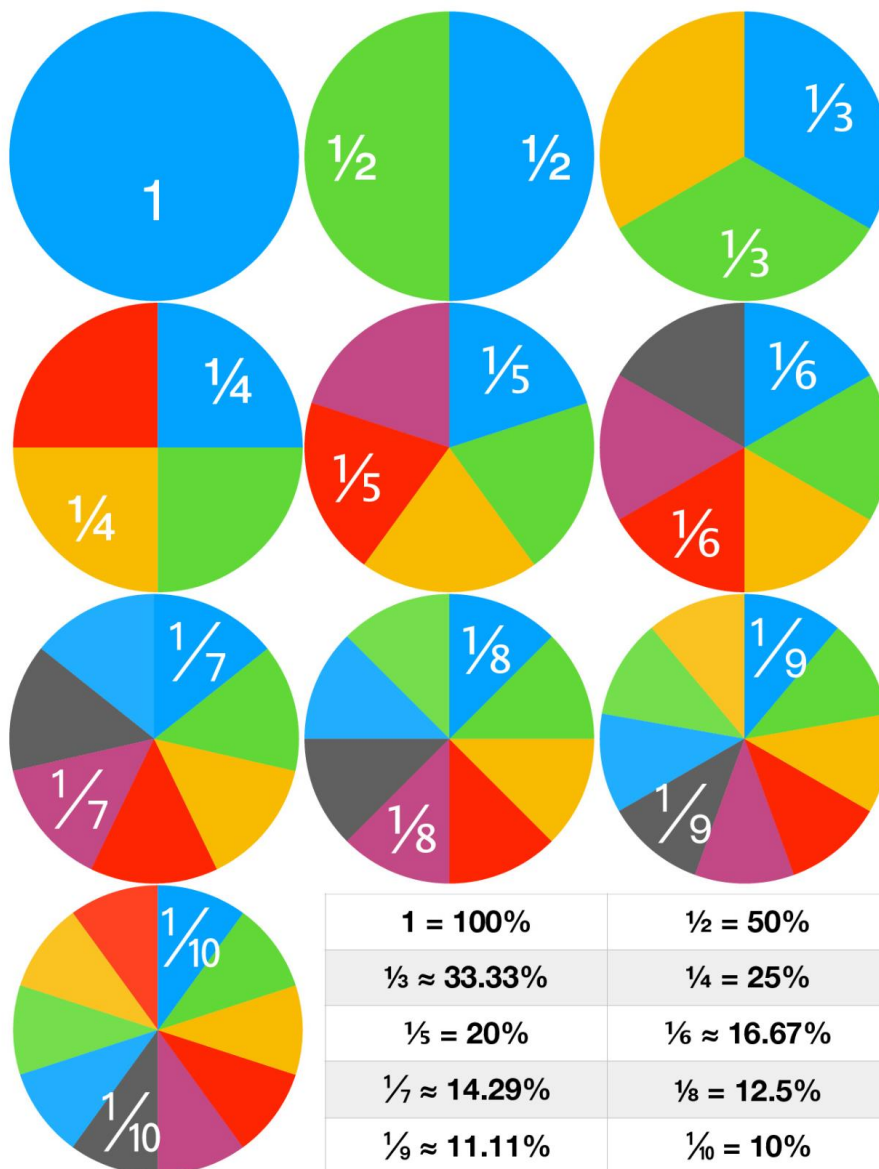
To read and interpret a pie chart, you must look at the relative sizes of the slices (sectors) to understand how a total data set is divided into smaller categories. The entire circle represents the whole (100% of the data or a complete 360 degrees, while each individual slice represents a specific part of that whole.

Pie charts and fractions

Every pie chart is governed by three primary structural rules:

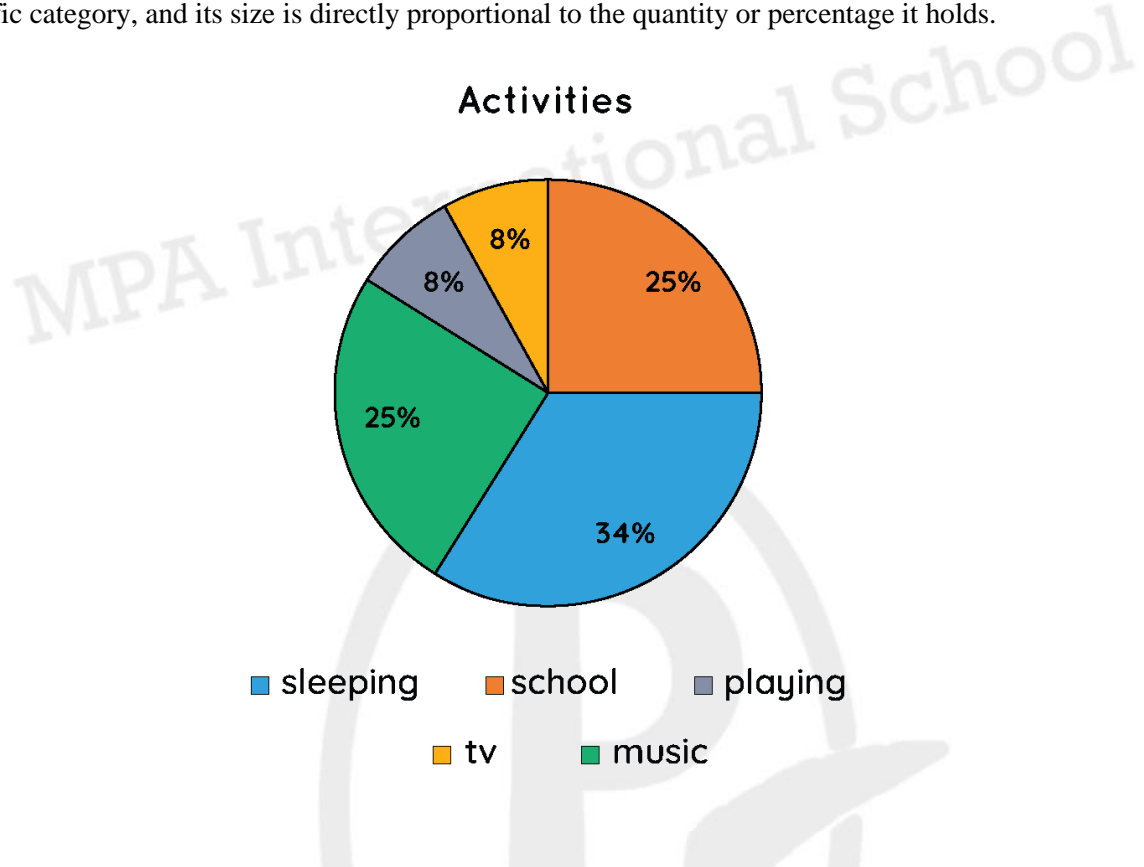
- **The Whole:** The entire circle represents 1 whole.
- **Total Degrees:** A full turn around the circle is exactly 360°.
- **Fraction Sum:** The individual fractions of all sectors must equal $\frac{1}{1}$.

Fraction Pies: From One to One Tenth



Pie charts and percentages

A pie chart is a circular graphic divided into slices (sectors) to illustrate numerical proportions, where the entire circle always represents 100% of the data and measures exactly 360 degrees. Each slice represents a specific category, and its size is directly proportional to the quantity or percentage it holds.



HOW To CONSTRUCT

Favorite Summer Activities	FRACTION	PERCENTAGE	DEGREES
Hiking 5	$\frac{5}{20}$	25%	90°
Fishing 3	$\frac{3}{20}$	15%	54°
Surfing 2	$\frac{2}{20}$	10%	36°
Camping 10	$\frac{10}{20}$	50%	180°
Total 20	1	100%	360°

PIE CHART

Mean

Average

Find the total of all the numbers, then divide by the amount of numbers.

2, 2, 3, 5, 8

$$2 + 2 + 3 + 5 + 8 = 20$$

$$20 \div 5 = 4$$

$$\text{Mean} = 4$$

© Operation Maths 2018

Median

Middle

The middle value when numbers are in order.

1, 3, **6**, 8, 9 Median = 6

2, 3, **5, 5**, 7, 9 Median = 5

1, 4, **5, 6**, 8, 9

$$\text{Median} = (5 + 6) \div 2 = 5.5$$

© Operation Maths 2018

Mode

Mode = Most

The value which is written the most.

2, 4, 4, 5, 6 Mode = 4

3, 3, 3, 4, 6, 6 Mode = 3

1, 1, 2, 2, 2, 4, 5 Mode = 2

4, 5, 7, 7, 8 Mode = 7

© Operation Maths 2018

Range

LARGEST – smallest

The largest number subtract the smallest number.

1, 1, 3, 5, 6 Range = $6 - 1 = 5$

3, 6, 6, 8 Range = $8 - 3 = 5$

2, 3, 4, 4 Range = $4 - 2 = 2$

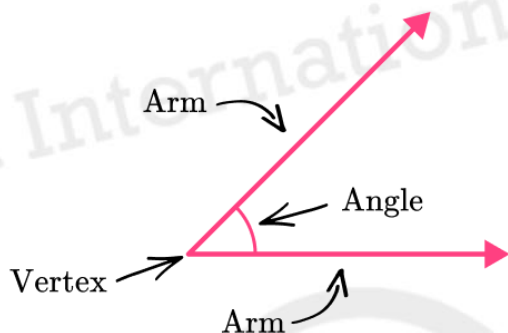
© Operation Maths 2018

Unit (13) Geometry - properties of shapes

What is an angle?

An angle is the measure of turn between two lines that meet at a point.

Parts of an angle:



Types of angles

Type of Angle	Description	Example
Acute Angle	An angle that is less than 90°	
Right Angle	An angle that is exactly 90°	
Obtuse Angle	An angle that is greater than 90° and less than 180°	
Straight Angle	An angle that is exactly 180°	
Reflex Angle	An angle that is greater than 180° and less than 360°	
Full Angle	An angle that is exactly 360°	

How to Measure Angles with a Protractor

Follow these four absolute rules to ensure a perfect measurement every time:


1. Center the Vertex: Place the exact crosshair (central midpoint) of your protractor directly over the angle's vertex.
2. Align the Baseline: Turn the protractor so its 0° baseline lies flat on top of one of the angle's arms.
3. Choose the Correct Scale: Find where that first arm points to 0. If the zero is on the inside scale, count up using the inside numbers. If it is on the outside scale, count up using the outside numbers.
4. Read the Second Arm: Follow the scale up from zero to where the second arm crosses the edge. Count the individual tick marks carefully for precise degrees.

How to Use a Protractor

Follow these steps to make sure you are using your protractor to measure angles accurately.

Step 1 Put the cross or circle at the point (vertex) of the angle that you are measuring.	Step 2 Line up one of the sides that forms the angle with the zero on the outer edge of the protractor.
Step 3 Read around the outer scale of the protractor from the zero to where the other side meets the edge of the protractor.	Step 4 Count the degrees lines carefully to get an accurate measurement.

Helpful hint: Use what you already know about angles to estimate the size of the angle you are measuring. Ask yourself: is it bigger than a right angle or smaller than a right angle? Then, check your measurement - is it a logical answer?



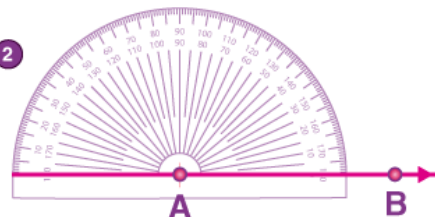
CONSTRUCTING AN ANGLE OF A GIVEN MEASURE



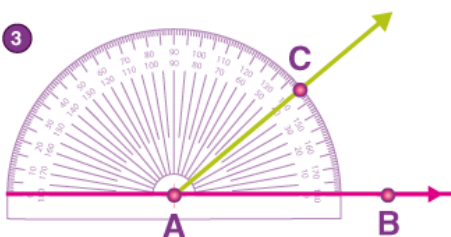
1



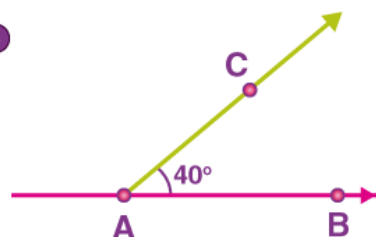
2



3

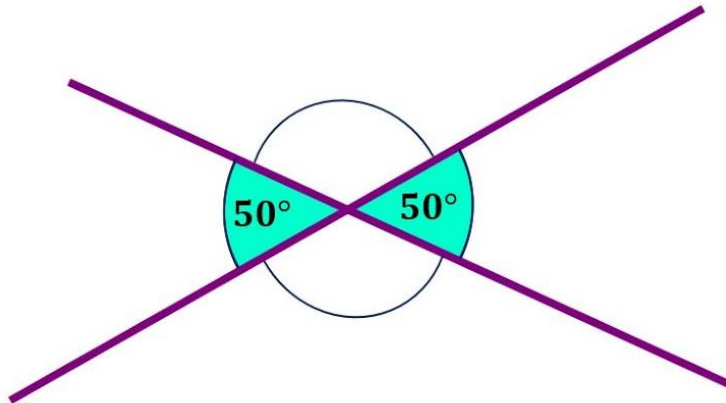


4



Vertically opposite angles

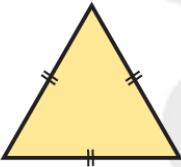

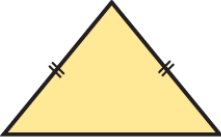

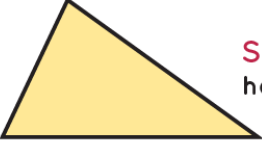
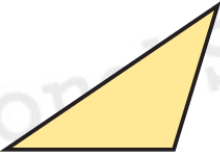
Vertically opposite angles are the pairs of angles that sit directly across from each other when two straight lines cross. In Year 6 geometry, the most important rule to remember is that vertically opposite angles are always equal to each other.

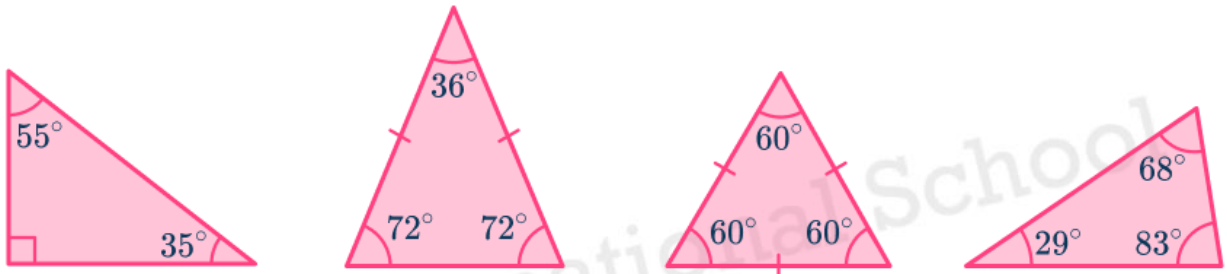


Important :

Vertically Opposite Angles are always equal.

Angles in a triangle

By Side	By Angle
 <p>Equilateral Triangle has three equal sides</p>	 <p>Acute Triangle has three angles $< 90^\circ$</p>
 <p>Isosceles Triangle has two equal sides</p>	 <p>Right Triangle has one angle = 90°</p>
 <p>Scalene Triangle has no equal sides</p>	 <p>Obtuse Triangle has one angle $> 90^\circ$</p>

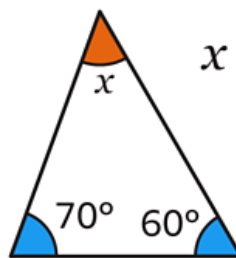
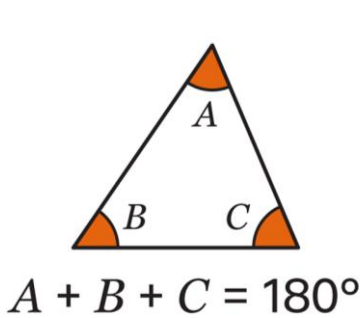
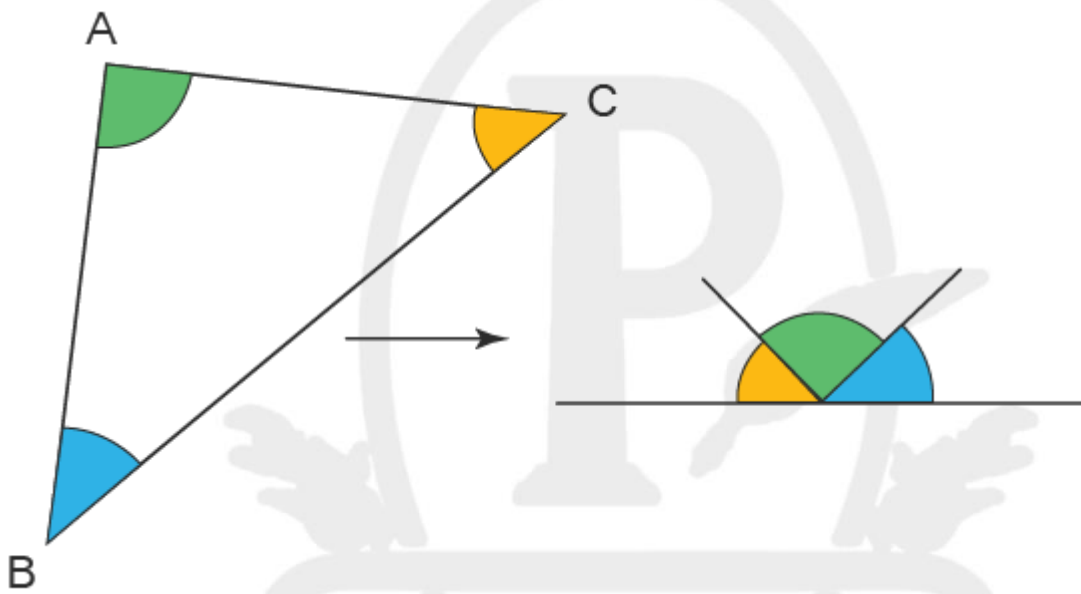


Right triangle
 One right angle
 $90 + 55 + 35 = 180^\circ$

Isosceles triangle
 Two equal sides & angles
 $72 + 72 + 36 = 180^\circ$

Equilateral triangle
 Three equal sides & angles
 $60 + 60 + 60 = 180^\circ$

Scalene triangle
 All sides & angles different
 $83 + 68 + 29 = 180^\circ$



$$\begin{aligned}
 x + 70^\circ + 60^\circ &= 180^\circ \\
 x + 130^\circ &= 180^\circ \\
 -130^\circ \quad -130^\circ \\
 x &= 50^\circ
 \end{aligned}$$

Angles in a quadrilateral

Angles in a quadrilateral are the four angles that occur at each vertex within a four-sided shape.

The sum of the four angles of any quadrilateral is 360° .

We can prove this using the angle sum of a triangle.



This is the same for all types of quadrilaterals.



Angles in polygons

Angles in polygons

We can work out the **angle sum of any polygon** by splitting it into triangles. Remember that the angles in a triangle = 180° .

Triangle

$1 \times 180^\circ = 180^\circ$

Quadrilateral

$2 \times 180^\circ = 360^\circ$

Pentagon

$3 \times 180^\circ = 540^\circ$

Hexagon

$4 \times 180^\circ = 720^\circ$

Heptagon

$5 \times 180^\circ = 900^\circ$

Octagon

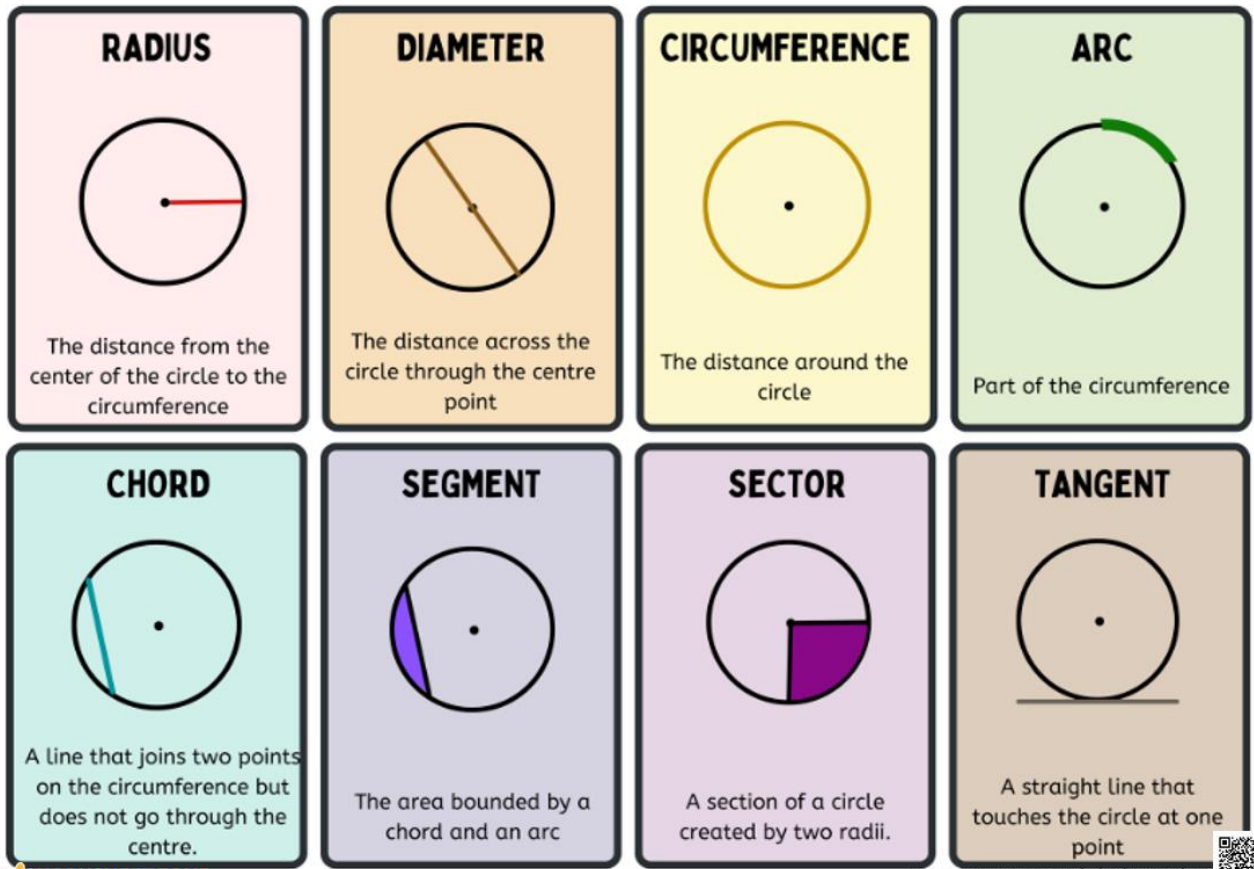
$6 \times 180^\circ = 1080^\circ$

If the polygon has n sides, there will be $(n - 2)$ triangles inside.

Angle sum = $(n - 2) \times 180$

Circles

A circle is a closed two-dimensional figure in which the set of all the points in the plane is equidistant from a given point called the “centre”.



WORKSHEET ZONE

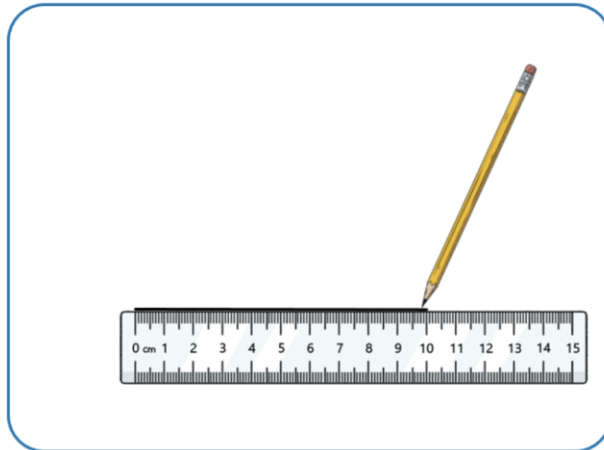
Scan Here For Digital Version



MPA International School

Side - Angle - Side (Two sides and one angle)

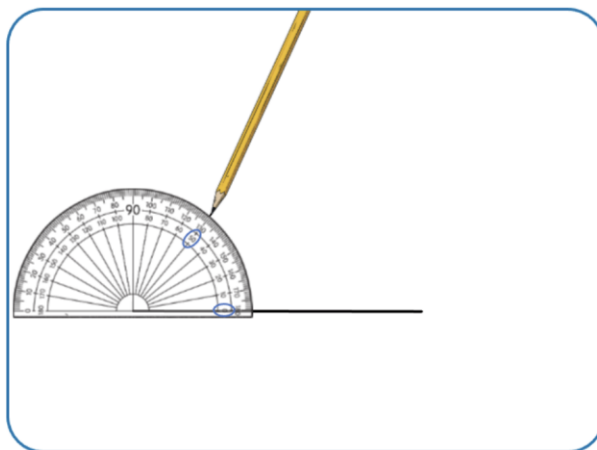
Step 1 Draw the Baseline



Use a ruler to measure and draw the first line.

This can be either of the two sides but we have drawn the 10cm line.

Step 2 Mark the Angle

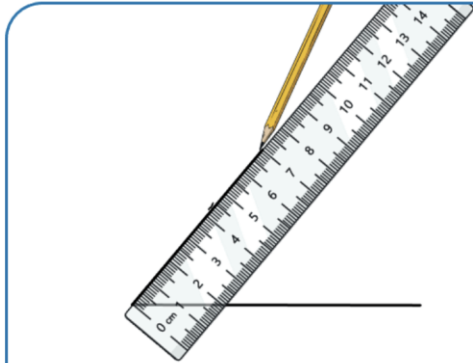


Line up your protractor on one end of the line.

Measure upwards from 0 to the angle you're drawing, in this case, 50°.

Use a pencil to mark this point then remove the protractor.

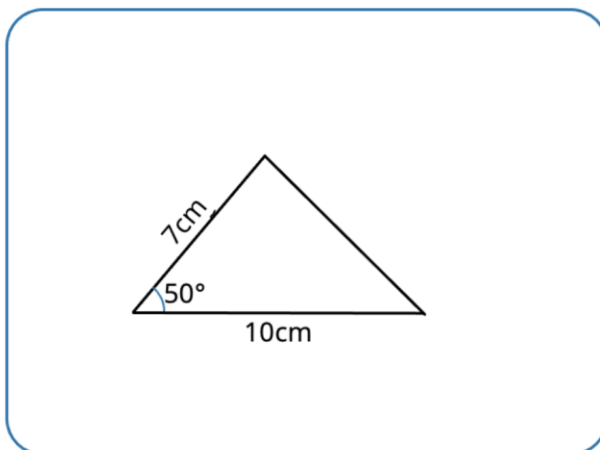
Step 3 Measure the Second Line



Line up your ruler so 0cm is at the base line and it passes through your pencil mark.

Carefully measure and draw the second side; this is a 7cm line.

Step 4 Drawing the Final Side

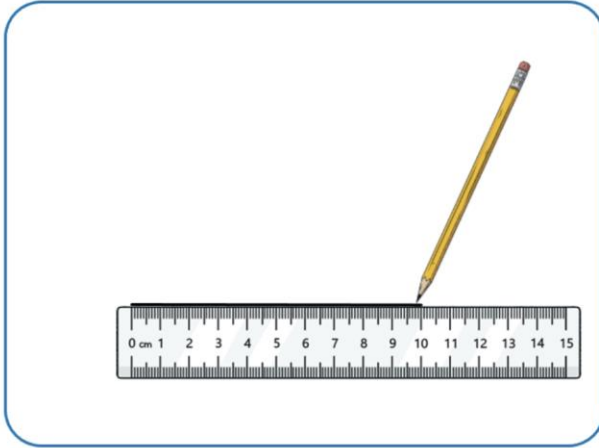


Line your ruler up with the ends of each of the sides you've drawn and join them up.

Finally, label the two sides and the angle.

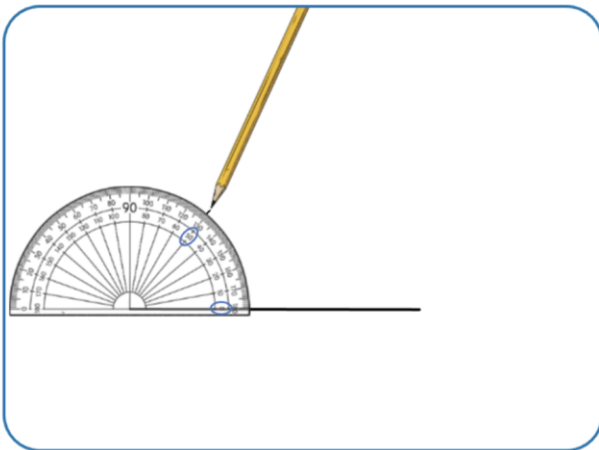
Angle - Side - Angle (Two angles and one side)

Step 1 Draw the First Side



Use a ruler to measure and draw the side you're given - in this case a 10cm line.

Step 2 Mark the First Angle



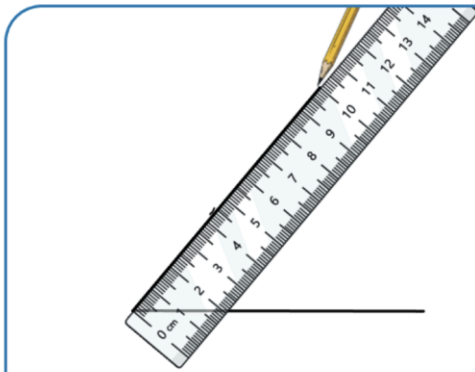
Line up your protractor on one end of the line.

Measure upwards from 0 to the angle you're drawing, in this case, 50°.

Use a pencil to mark this point then remove the protractor.

MPA International School

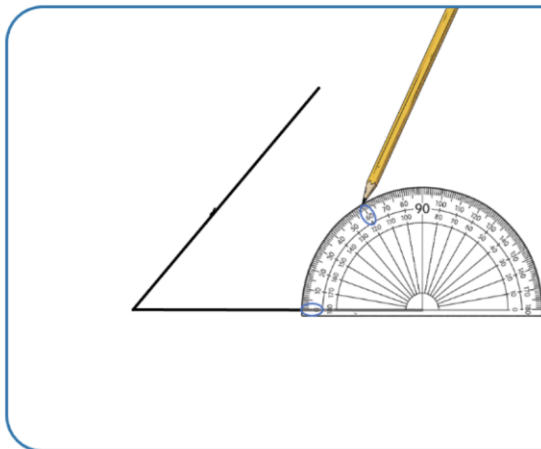
Step 3 Draw the Second Side



Line your ruler up so 0cm is at the base line and it passes through your pencil mark.

Draw the second side; you don't know the length so make it quite long. You can always erase some or add to it if you need.

Step 4 Mark the Second Angle



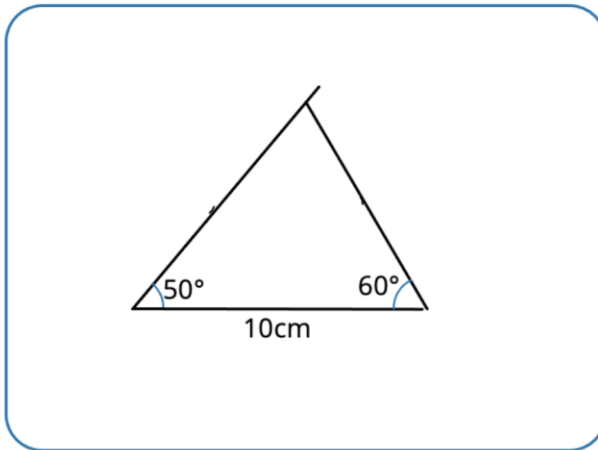
Line up your protractor on the other end of the base line.

Measure upwards from 0 to the angle you're drawing, in this case, 60° .

Use a pencil to mark this point then remove the protractor.

MPA International School

Step 5 Draw the Final Side



Line your ruler up at the end of the base line so it passes through your pencil mark.

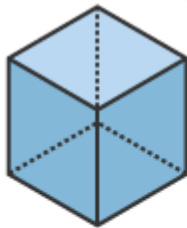
Draw the final side; it should be long enough to meet the second side.

Label the two angles and the side.

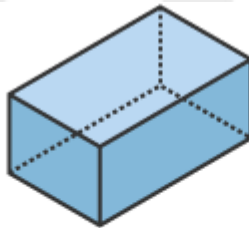
Nets of 3D shapes



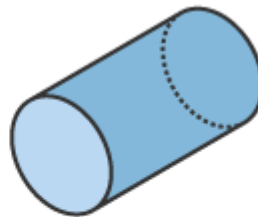
Sphere



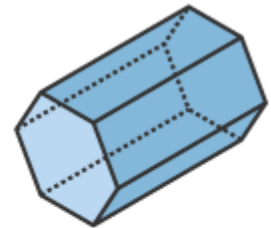
Cube



Cuboid



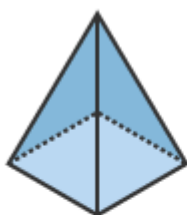
Cylinder



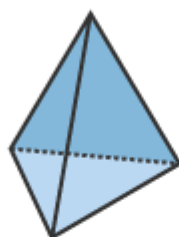
Hexagonal prism



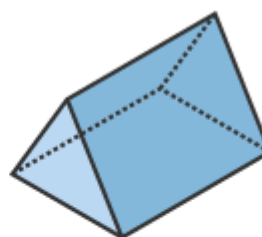
Cone



Square-based pyramid

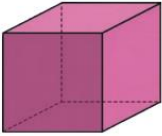

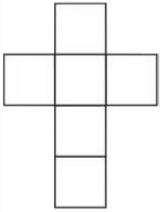
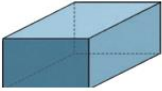

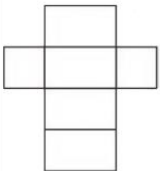
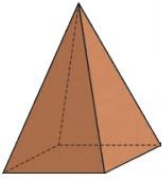

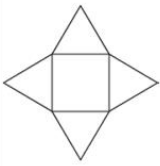
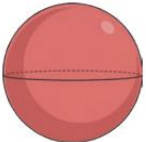

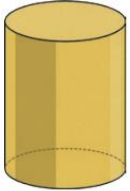

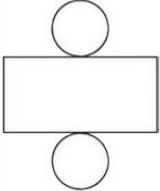


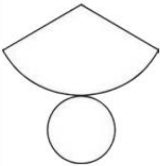


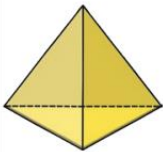

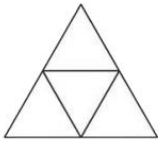
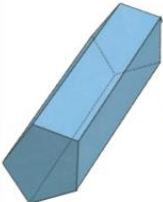

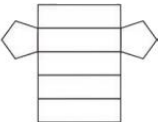
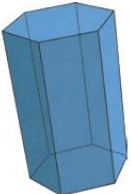

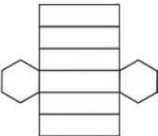


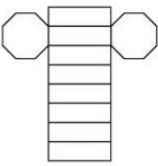


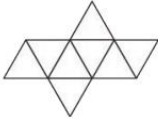
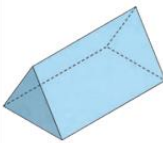

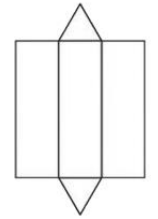
Tetrahedron
(triangle-based pyramid)



Triangular prism

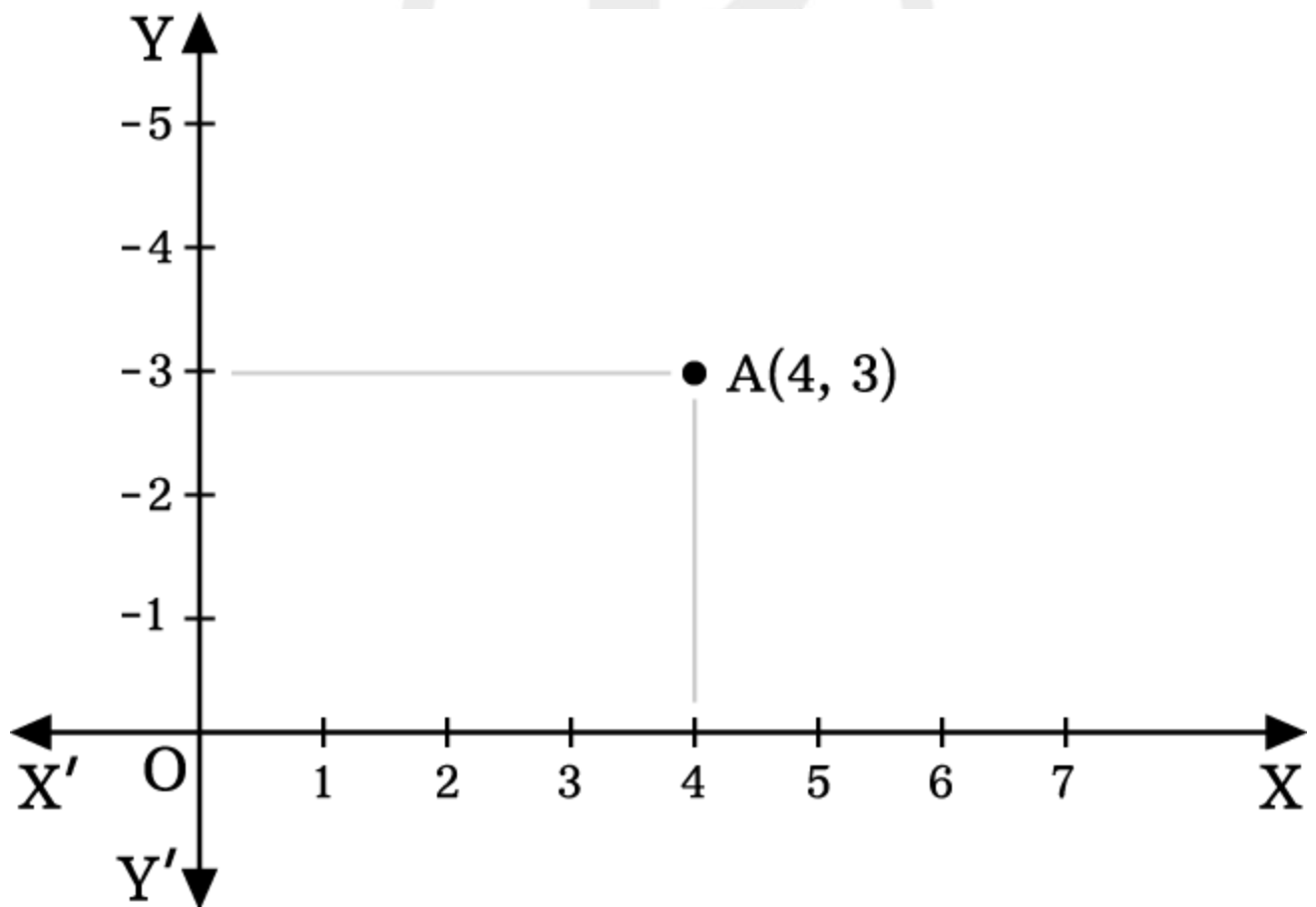
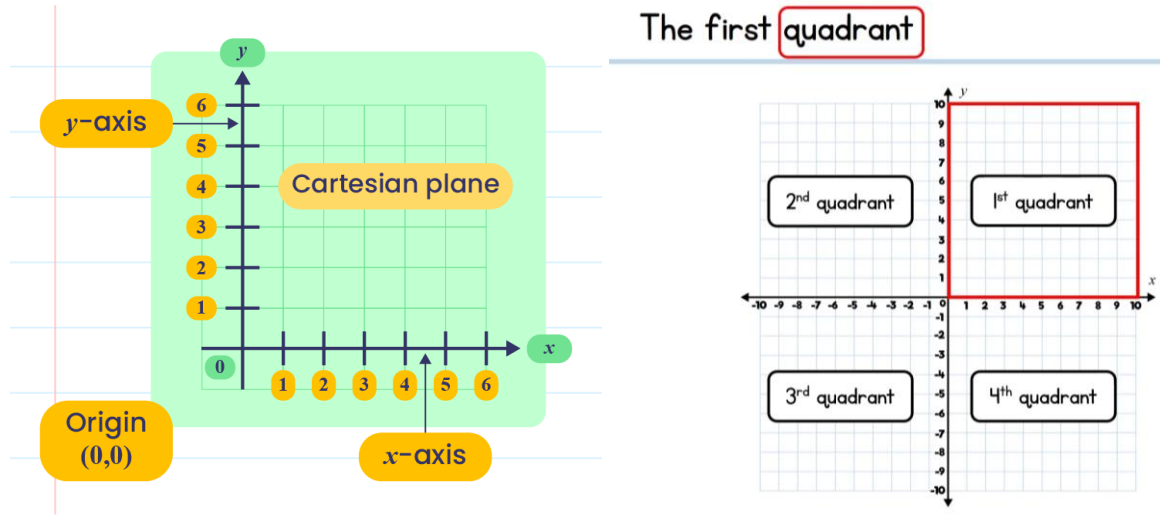
MPA International

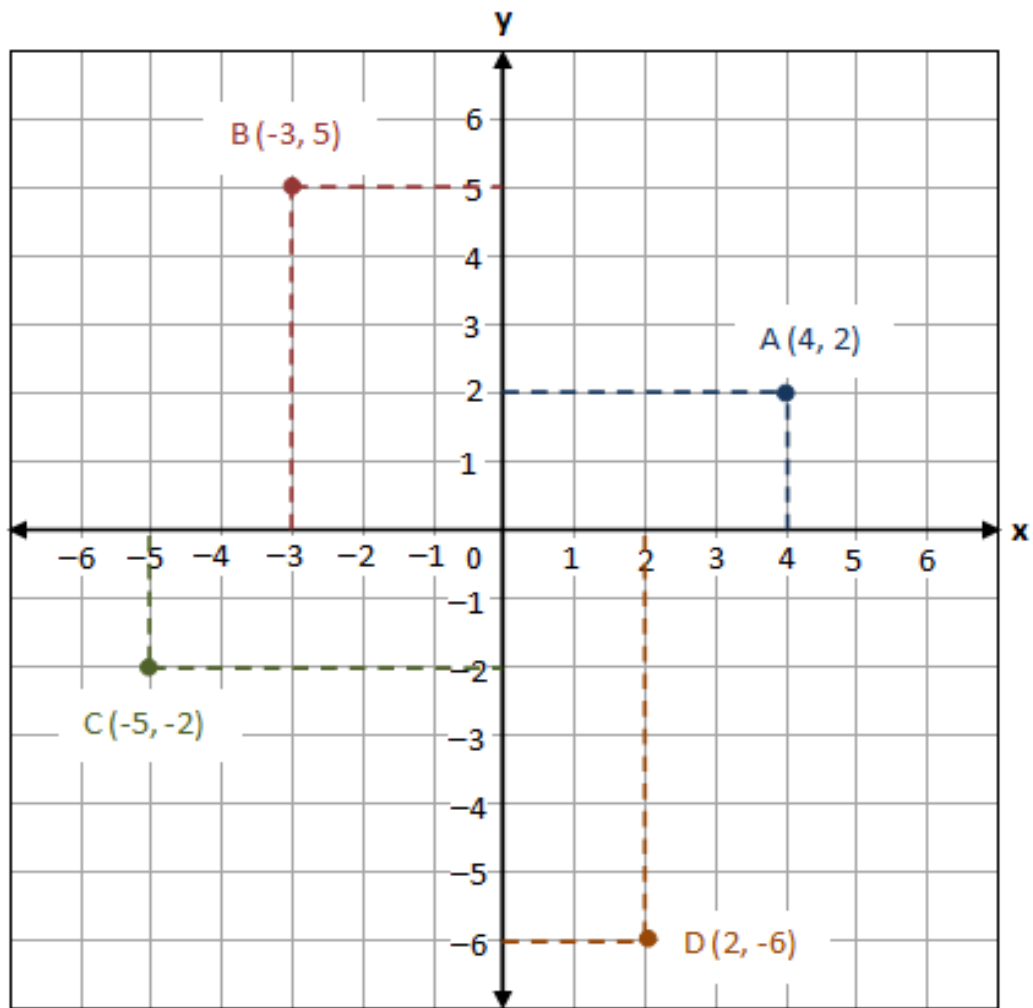
Name	Diagram	In Real Life	Corners (vertices)	Faces	Edges	Net
cube			8	6	12	
cuboid			8	6	12	
square-based pyramid			5	5	8	
sphere			0	1	0	There is no net for a sphere because there are no flat surfaces.
cylinder			0	3	2	
cone			1	2	1	

Name	Diagram	In Real Life	Corners (vertices)	Faces	Edges	Net
tetrahedron		 Tada Images - Shutterstock.com	4	4	6	
pentagonal prism			10	7	15	
hexagonal prism			12	8	18	
octagonal prism			16	10	24	
octahedron			6	8	12	
triangular prism			6	5	9	

TADA International

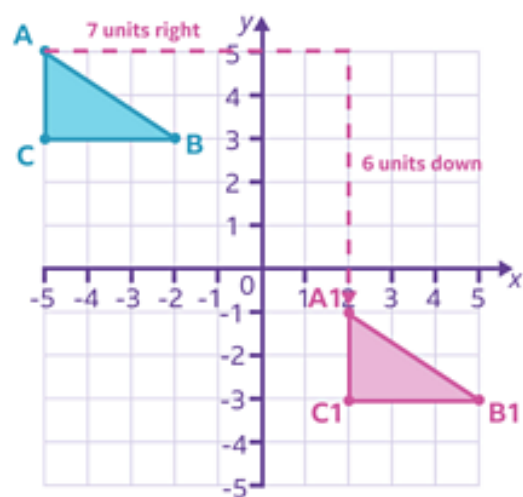
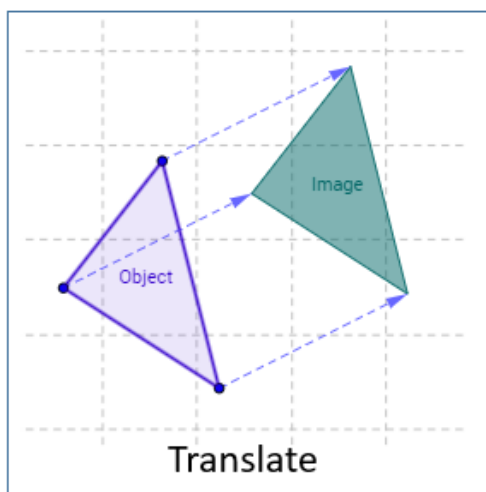
The first quadrant





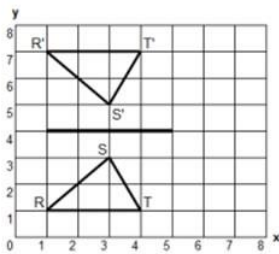
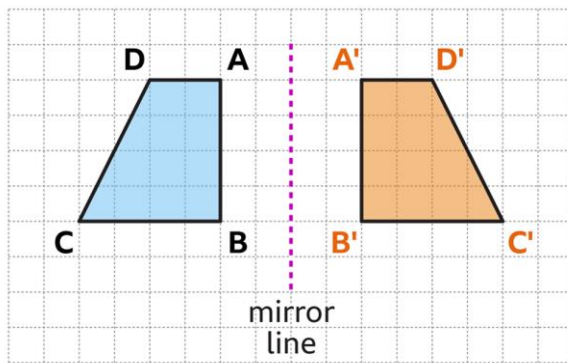
Translations

Translation means sliding a shape on a coordinate grid to a new position without turning, flipping, or resizing it. Every point on the shape moves the same distance in the same direction (e.g. 3 squares right, 2 squares down).

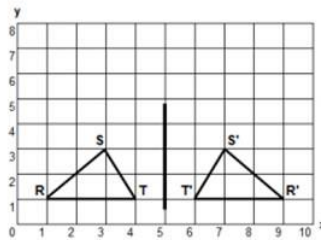


Reflections

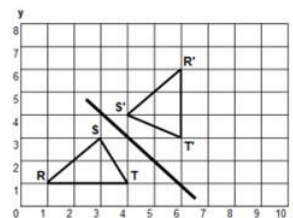
Reflection is a type of transformation that flips a shape in a mirror line (also called a line of reflection) so that each point is the same distance from the mirror line as its reflected point.



Horizontal mirror line



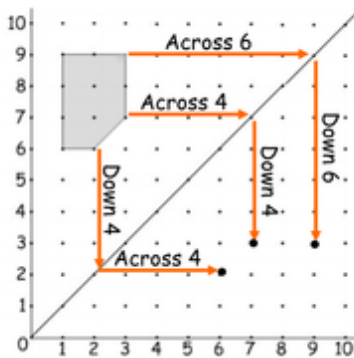
Vertical mirror line



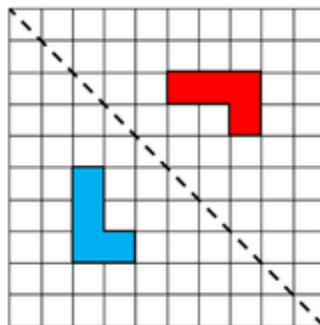
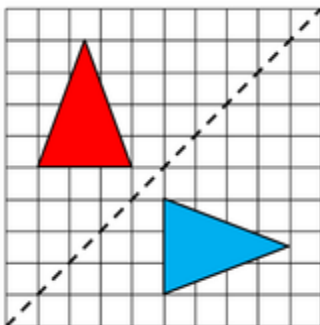
Diagonal mirror line

Facts for the diagonal mirror line

Diagonal Reflections

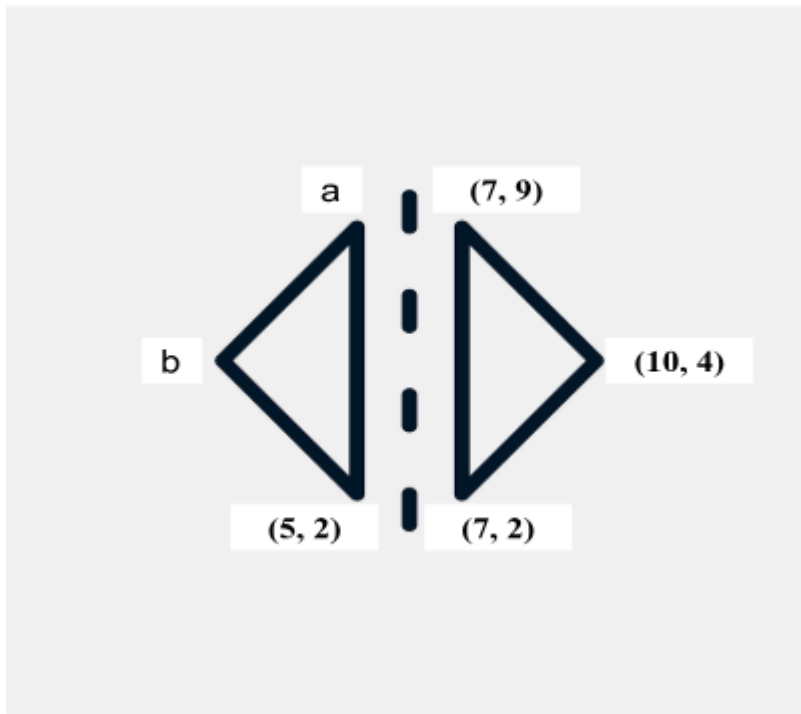


- Step 1:**
From a point on the shape, count across or down to the mirror line.
- Step 2:**
Because it's a mirror, do the opposite on the other side.
E.g. Across by 4 → Down by 4
Or Down by 5 → Across by 5



Missing Coordinates

- Shapes can be shown on unmarked grids.



- Point a is in the same position along the x-axis as (5, 2) and in the same position on the y-axis (7, 9).

Point a (5, 9)

- Point b is in the same position on the y-axis as (10, 4). Both triangles will have the same width. The width of the right-angled triangle is 3. This means that the width of the left-hand triangle is also 3.

Point b (2, 4)