Solving equations

Key vocabulary

Substitution
Formulae
Rearrange
Equation
BIDMAS
Inverse
Coefficient

Picture perfect

Solving simple two-step equations

To solve an equation, find the value that makes the equation true.

Solve 2x + 3 = 13

This means: $x \times 2 + 3 = 13$

To solve, we reverse the process:

$x \times 2 + 3 \rightarrow 13$
$x + 2 - 3 \rightarrow 13$

Use the opposite (inverse) operation and undo in reverse order.

$2x + 3 = 13$
$2x = 10$ (− 3)
$x = 5$ (÷ 2)

We have solved the equation when we get to a single value of x (here, x = 5).

Solve 4x + 6 = 14

$4x + 6 = 14$
$4x = 8$ (− 6)
$x = 2$ (÷ 4)

Solve 3x − 8 = 19

$3x − 8 = 19$
$3x = 27$ (+ 8)
$x = 9$ (÷ 3)

Always remember

Solve this equation to find x:

$$6x = 13$$
$$÷ 6 \qquad ÷ 6$$
$$x = \frac{13}{6}$$

Make x the subject of the formula:

$$ax = b$$
$$÷ a \qquad ÷ a$$
$$x = \frac{b}{a}$$

I am think of a number. I subtract 5 from it and then divide the result by 4.
The answer is 7. What number did I think of to start with?

Form an equation then

$$\frac{x - 5}{4} = 7$$

Solve the equation

$$\frac{x - 5}{4} = 7$$
$$x4 \quad x4$$
$$x - 5 = 28$$
$$+5 \quad +5$$
$$x = 33$$

Assessment style question

Hannah is n years old.
Her aunt Emily is three times older than Hannah.
Emily is 48 years old.
  (a) Write down an equation for this information.
  (b) Solve your equation to find how old Hannah is.

Sam thinks of a number, n.
He multiplies his number by 7 and then adds 3 to the result.
His final answer is 45.
  (a) Write down an equation for this information.
  (b) Solve your equation to find the number, n.

The sum of each row is given.
Find a, b, c and d.

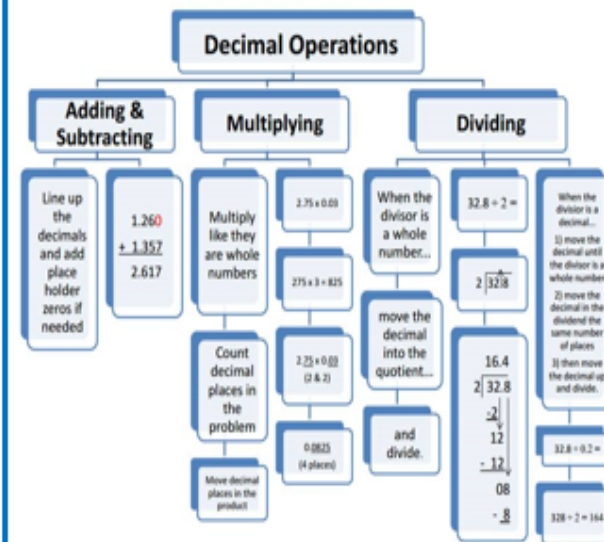|				
a	a	a	a	24
a	a	b	b	28
b	c	c	c	29
a	b	c	d	31

Calculating with decimals

Key vocabulary

Integer: A **whole number** that can be positive, negative or zero.

Decimal: A number with a **decimal point** in it. Can be positive or negative.

Decimal Point: a full point or dot placed after the figure representing units in a decimal fraction

Picture perfect

Decimal Operations

Adding & Subtracting — Multiplying — Dividing

Assessment style question

A grain of rice has a mass of 0.015g
How many grains are there in 300g of rice?

A type of pebble has a mass of 0.8g
How many pebbles are there in 40kg?

Class 8A are going on a trip to a windmill

The trip costs £3.70 each and there are 26 students in 8A.
How much money should be collected?

Mr.Jenkins is building a fence for his garden.
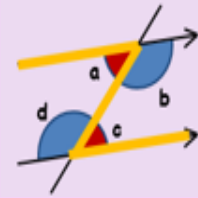The fence costs £12.60 per metre to build.
The fence is 5.3 metres long.

Work out the total cost of building the fence.

Always remember

To add decimals, follow these steps:
•Write down the numbers, one under the other, with the **decimal points lined up**
•Put in **zeros** so the numbers have the same length
•Then add using column addition, remembering to put the decimal point in the answer

Example: Add 1.452 to 1.3

Line the decimals up: 1.452
                           + 1.3

"Pad" with zeros: 1.452
                          + 1.300

Add: 1.452
                          + 1.300
                            2.752

To subtract, follow the same method: line up the decimals, then subtract

Example: What is 7.368 − 1.15 ?

Line the decimals up: 7.368
                          − 1.15

To check we can add the answer to the number subtracted

"Pad" with zeros: 7.368
                          − 1.150

Subtract: 7.368
                          − 1.150
                            6.218

Putting In Zeros

Why can we put in extra zeros?

A zero is really saying "there is no value at this decimal place".

- In a number like 10, the zero is saying "no ones"
- In a number like 2.50 the zero is saying "no hundredths"

So it is safe to take a number like 2.5 and make it 2.50 or 2.500 etc

But DON'T take 2.5 and make it 20.5, that is plain wrong.

How to Multiply Decimals

Just follow these steps:
•Multiply normally, ignoring the decimal points.
•Then put the decimal point in the answer - it will have as many decimal places as the two original numbers combined.
In other words, just count up how many numbers are after the decimal point in *both* numbers you are multiplying, then the answer should have that many numbers after *its* decimal point.

Example: Multiply 0.03 by 1.1

start with: 0.03×1.1
multiply without decimal points: $3 \times 11 = 33$
0.03 has **2 decimal places**,
and 1.1 has **1 decimal place**,
so the answer has **3 decimal places**:   0.033

Let us multiply the 0.2 by 10, which shifts the decimal point out of the way:

$0.2 \times 10 = 2$

But we must **also** do it to the 15:

$15 \times 10 = 150$

So $15 \div 0.2$ has become $150 \div 2$ (they are **both** 10 times larger):

$150 \div 2 = 75$

And so the answer is:

$15 \div 0.2 = 75$

How to Divide Decimals

The trick is to get rid of the decimal point from the number we are dividing by.
How? We can "shift the decimal point" out of the way by multiplying by 10, as many times as we need to.
But we must do the **same thing** to both numbers in the division.

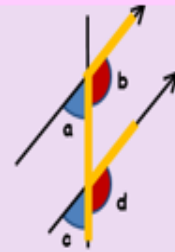### Example above: 15 divided by 0.2

Angles

Key vocabulary

Acute
Right angle
Obtuse
Reflex
Alternate
Corresponding
Co-Interior
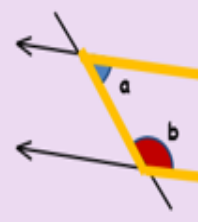Interior
Exterior
Vertically opposite
Protractor
Measure

Angles in parallel lines

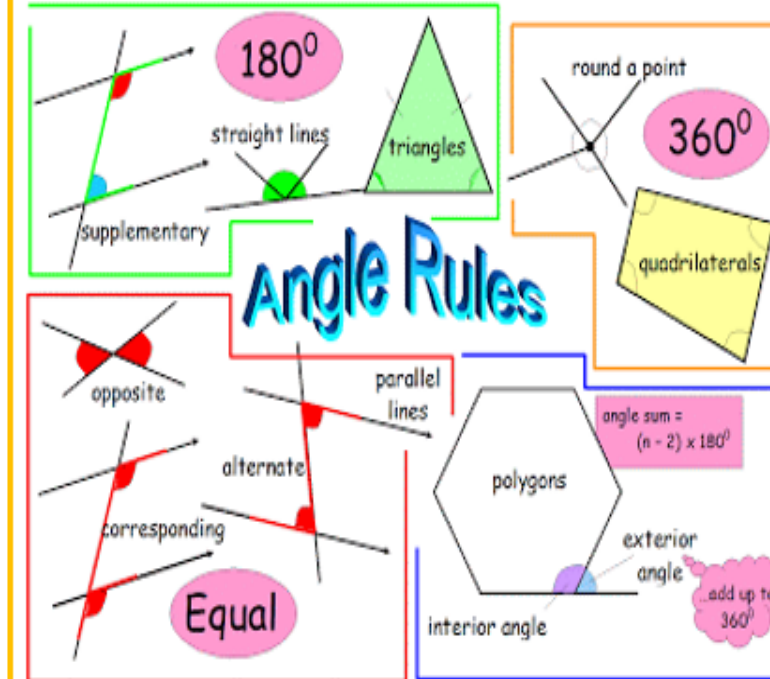Alternate angles are equal

Angle a = c and b = d

They make a Z shape

Corresponding angles are equal
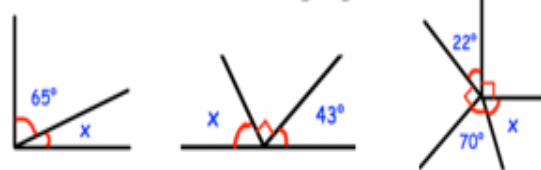
Angle a = c and b = d

They make an F shape

Supplementary angles add up to 180°

Angle a + b = 180°

They make a C shape

Always remember

180^0 straight lines

triangles

supplementary

round a point

360^0

quadrilaterals

Angle Rules

opposite

parallel lines

alternate

corresponding

Equal

angle sum = $(n - 2) \times 180^0$

polygons

exterior angle

add up to 360^0

interior angle

Angle Sum

$(n - 2) \times 180^0$

number of triangles

$4 \times 180^0 = 540^0$

Polygons

3 triangle
4 quadrilateral
5 pentagon
6 hexagon
7 - heptagon
8 octagon
9 - nonagon
10 - decagon

interior angle

$\frac{\text{angle sum}}{\text{number of sides}}$

OR

$180^0 - $ exterior angle

exterior angle

$\frac{360^0}{\text{number of sides}}$

OR

$180^0 - $ interior angle

Assessment style question

Calculate the size of the missing angles

65°   x

x   43°   70°

22°   x

Find the missing angle.
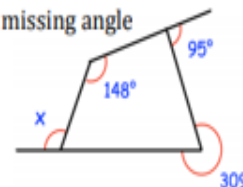Give reasons for your answer.

C   D

F   x   40°   E
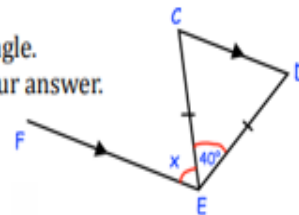
Shown is a regular pentagon.
Find y.

y
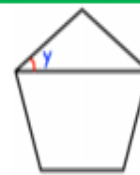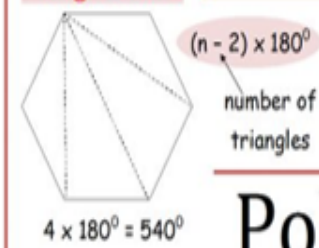
A regular polygon has 18 sides.
Calculate the size of each interior angle.
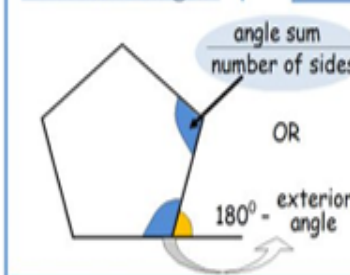
Calculate the size of the missing angle

95°

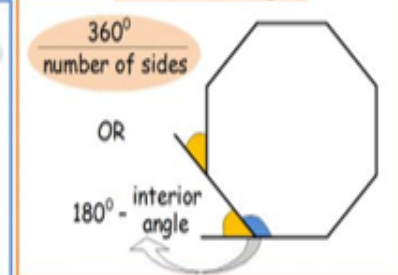148°   x

309°

Calculating with Fractions

Picture perfect

Assessment style question

| 13 | 9 | 21 | 5 | 2 |

Using the cards, create an improper fraction that is:

(a) between 1 and 2   (b) between 2 and 3
(c) between 4 and 5   (d) between 5 and 10
(e) greater than 10

The distance from Newtown to Milton is $7\frac{2}{3}$ miles.

The distance from Milton to Redville is $2\frac{2}{5}$ miles

Work out the distance from Newtown to Redville.

A wall measures $3\frac{3}{4}\,m$ by $4\frac{1}{3}\,m$

Each can of paint cover 2.5m² and costs £5.50

Work out the cost of painting the wall.

Shown is a rectangle.
Find the value of x

Area = 20cm² $2\frac{1}{6}$ cm

Always remember

There are three types of fraction:

Smaller → $\frac{3}{5}$ ← Larger   Larger (or equal) → $\frac{9}{5}$ ← Smaller (or equal) $2\frac{1}{3}$

Proper Fraction   Improper Fraction   Mixed Fraction
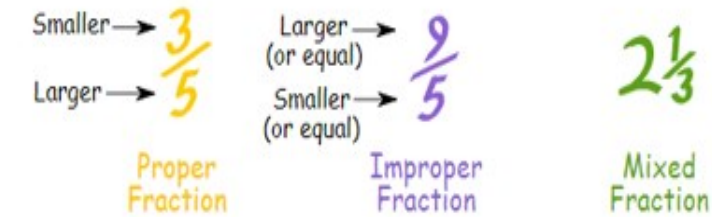
Mixed numbers to improper fractions and vice versa:

Mixed numbers are things like $3\frac{1}{3}$, with an integer part and a fraction part. Improper fractions are ones where the top number is larger than the bottom number. You need to be able to convert between the two.

EXAMPLES:

1. Write $4\frac{2}{3}$ as an improper fraction.

1) Think of the mixed number as an addition:
$4\frac{2}{3} = 4 + \frac{2}{3}$

2) Turn the integer part into a fraction:
$4 + \frac{2}{3} = \frac{12}{3} + \frac{2}{3} = \frac{12+2}{3} = \frac{14}{3}$

2. Write $\frac{31}{4}$ as a mixed number.

Divide the top number by the bottom.
1) The answer gives the whole number part.
2) The remainder goes on top of the fraction.

$31 \div 4 = 7$ remainder 3   so $\frac{31}{4} = 7\frac{3}{4}$

4 operations with mixed fractions – make it easy and convert to improper fractions first and then use methods below

Multiplying Fractions

Multiply the numerators
Multiply the denominators

$\frac{5}{6} \times \frac{1}{11} = \frac{5}{66}$

Dividing Fractions

Keep change flip

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

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

Adding and subtracting simple fractions

We can use equivalent fractions to add fractions that do not have the same denominator.

For example:

$\frac{3}{4} + \frac{1}{8}$

We need to change $\frac{3}{4}$ into an equivalent fraction with a denominator of 8.

$\frac{3}{4} = \frac{6}{8}$ (×2)

Now we have:

$\frac{6}{8} + \frac{1}{8} = \frac{7}{8}$