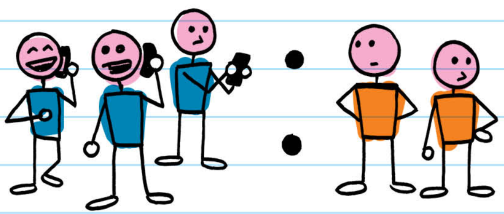
Chapter 15

RATIOS

A **RATIO** is a comparison of two quantities. For example, you might use a ratio to compare the number of students who have cell phones to the number of students who don't have cell phones. A ratio can be written a few different ways.



The ratio 3 to 2 can be written:

3:2 or $\frac{3}{2}$ or 3 to 2

Use "a" to represent the first quantity and "b" to represent the second quantity. The ratio a to b can be written:

$a:b$ or $\frac{a}{b}$ or a to b

A fraction can also be a ratio.

EXAMPLES: Five students were asked if they have a cell phone. Four said yes and one said no. What is the ratio of students who do not have cell phones to students who do?

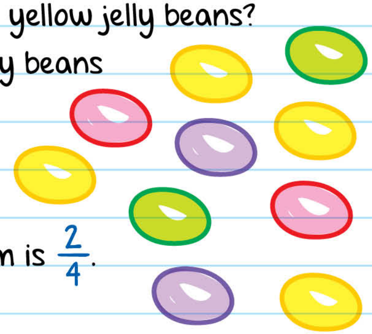
1:4 or $\frac{1}{4}$ or 1 to 4.

(Another way to say this is, "For every 1 student who does not have a cell phone, there are 4 students who do have a cell phone.")

What is the ratio of students who have cell phones to total number of students asked?

4:5 or $\frac{4}{5}$ or 4 to 5.

EXAMPLE: Julio opens a small bag of jelly beans and counts them. He counts 10 total. Among those 10, there are 2 green jelly beans and 4 yellow jelly beans. What is the ratio of green jelly beans to yellow jelly beans? And what is the ratio of green jelly beans to total number of jelly beans?

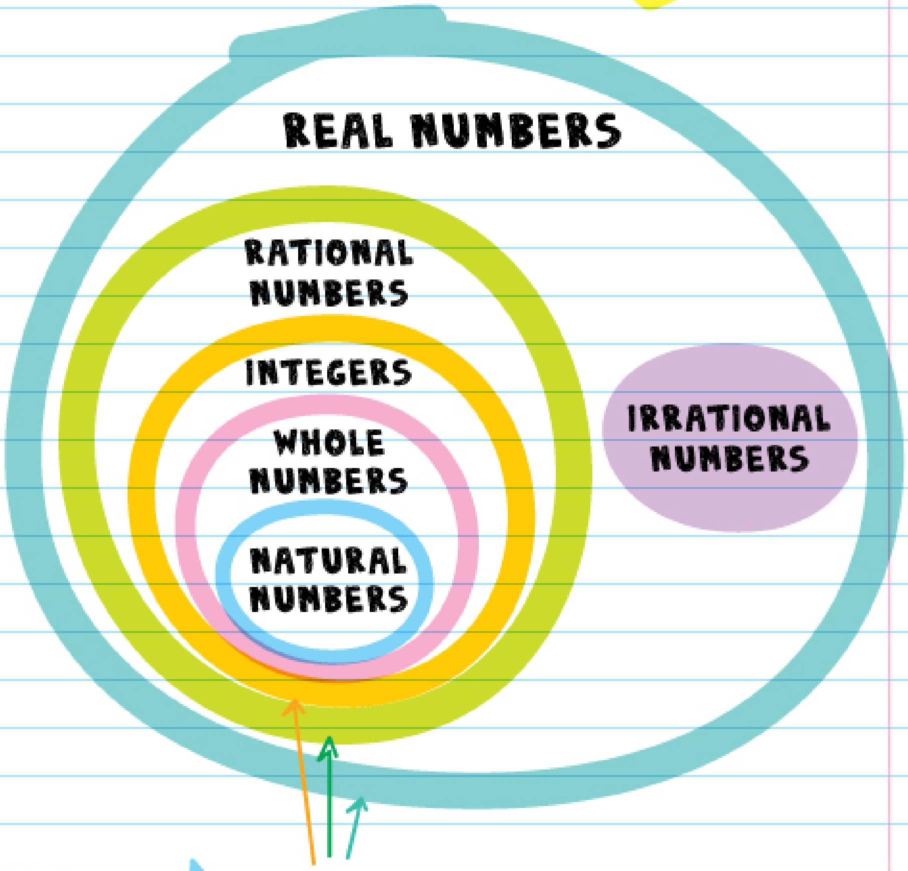


The ratio of green jelly beans to yellow jelly beans in fraction form is $\frac{2}{4}$. That can be simplified to $\frac{1}{2}$.

So, for every 1 green jelly bean, there are 2 yellow jelly beans.

Every number has a decimal expansion. For example, **2** can be written **2.000...** However, you can spot an irrational number because the decimal expansion goes on forever without repeating.

Here's how all the types of numbers fit together:



EXAMPLE: −2 is an integer, a rational number, and a real number!

SOME OTHER EXAMPLES:

46 is a natural number, a whole, an integer, rational, and real.

0 is whole, an integer, rational, and real.

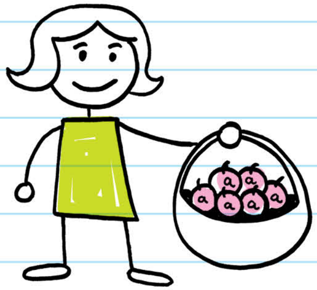
$\frac{1}{4}$ is rational and real.

6.675 is rational. (Terminating decimals are rational.)

4.9836542987502985089762919... is irrational and real. (Nonrepeating decimals that go on forever are irrational.)

We **COLLECT LIKE TERMS** (also called **COMBINING LIKE TERMS**) to simplify an expression—meaning, we rewrite the expression so that it contains fewer numbers, variables, and operations. Basically, you make it look more "simple."

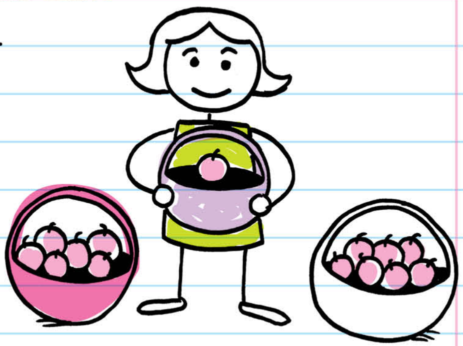
EXAMPLE: Denise has 6 apples in her basket. Let's call each apple "a."



We could express this as $a + a + a + a + a + a$, but it would be much simpler to write $6a$. When we put $a + a + a + a + a + a$ together to get $6a$, we are collecting like terms. (Each term is the variable a, so we can combine them with the coefficient of 6, which tells us how many a's we have.)

When combining terms with the same variable, add the coefficients.

EXAMPLE: Denise now has 6 apples in her pink basket, 1 apple in her purple basket, and 7 apples in her white basket.



We could express this as $6a + a + 7a$ but it would be much simpler to write $14a$.

A variable without a coefficient actually has a coefficient of 1. So "m" really means "$1m$" and "k^3" really means "$1k^3$." (Remember the identity property of multiplication!)

EXAMPLE: $9x - 3x + 5x$

(When there is a "−" sign in front of the term, we have to subtract.)

$9x - 3x + 5x = 11x$

If two terms do NOT have the exact same variable, they cannot be combined.

EXAMPLE: $7m + 3y - 2m + y + 8$

(The $7m$ and $-2m$ combine to make $5m$, the $3y$ and y combine to make $4y$, and the constant 8 does not combine with anything.)

$7m + 3y - 2m + y + 8 = 5m + 4y + 8$

REMEMBER: A term with a variable cannot be combined with a constant.

$3ab$ can combine with $4ba$, because the **commutative property of multiplication** tells us that ab and ba are equivalent!