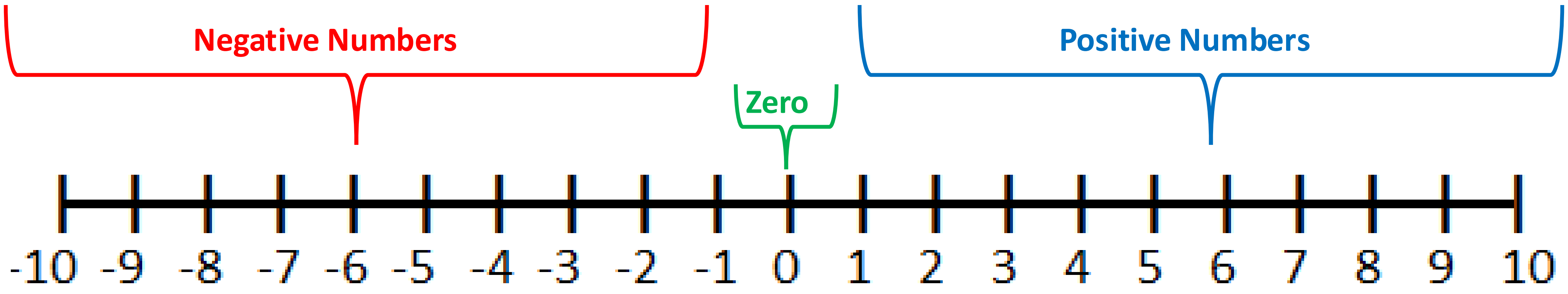
Unit 2

Signed Numbers & Integers

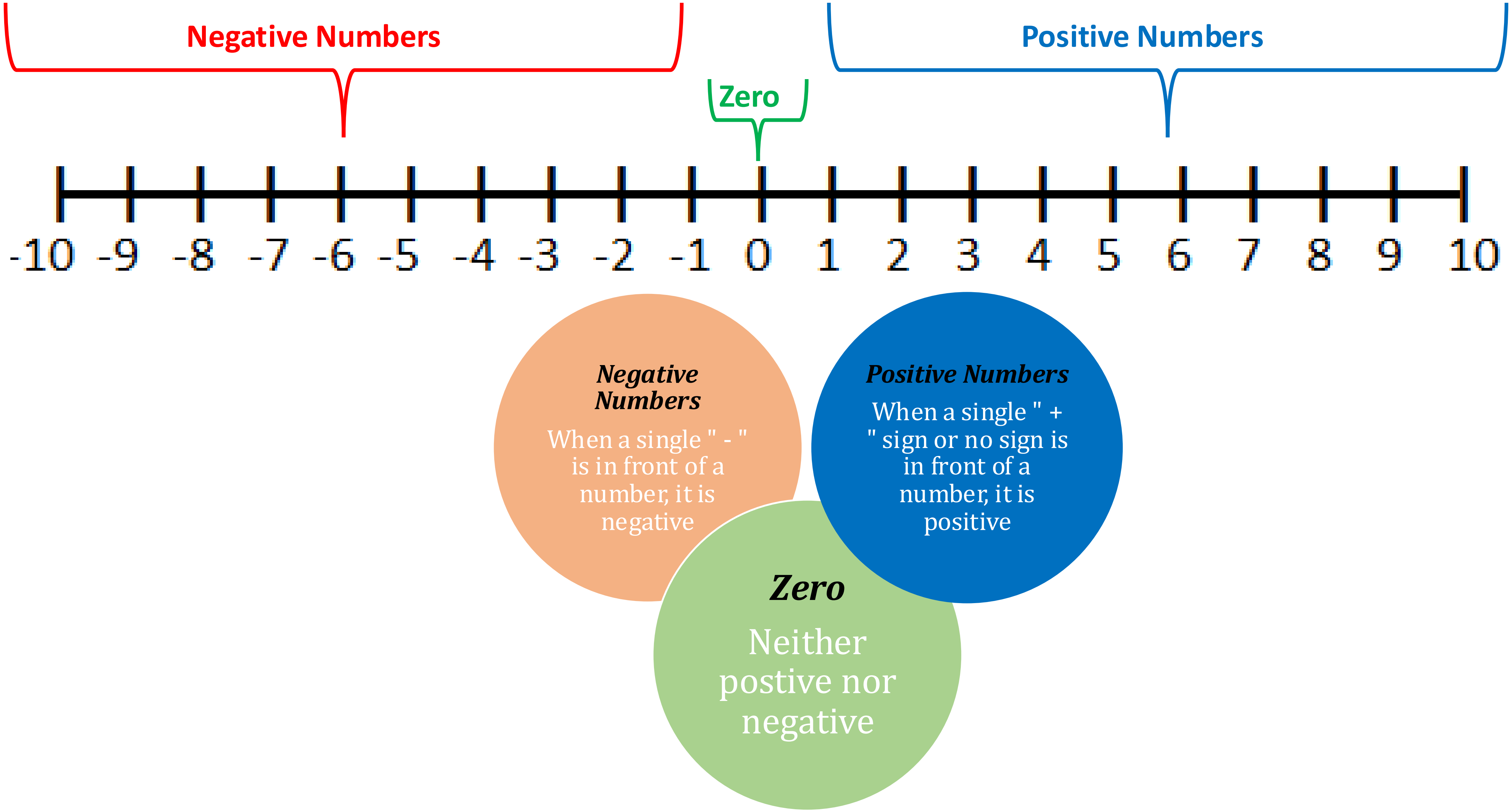


In order to represent situations like being "down" at the casino, or Canadian winters having temperatures of below zero, we need to extend our traditional number line to the left of 0, as seen above

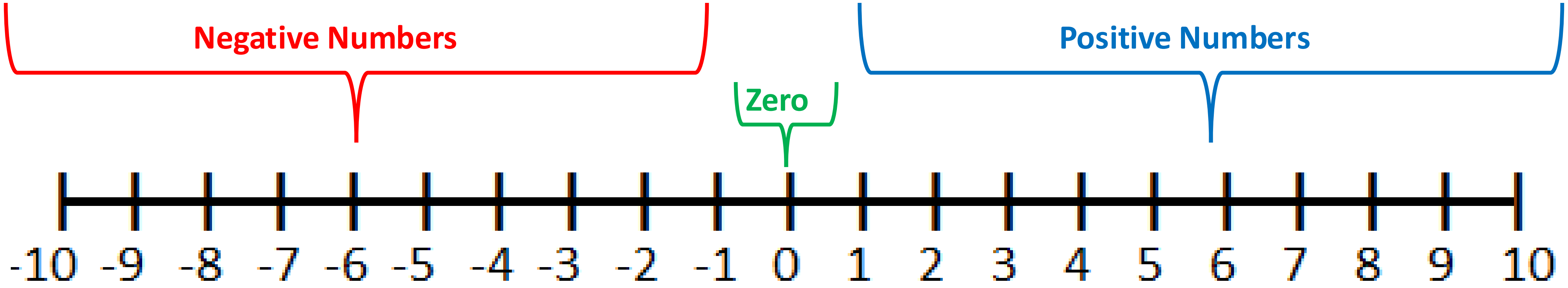
Together, the <u>negative numbers</u>, <u>positive numbers</u>, and <u>zero</u>, are known as the **Signed Numbers.**

Class Discussion: Where else in life do we use negative numbers to make sense of the world?

https://www.youtube.com/watch?v=ceWSgR8DuJ0



Negative Numbers
Positive Numbers
Zero
-10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10
Negative Numbers
When a single " - " is in front of a number, it is negative
Positive Numbers
When a single " + " sign or no sign is in front of a number, it is positive
Zero
Neither postive nor negative



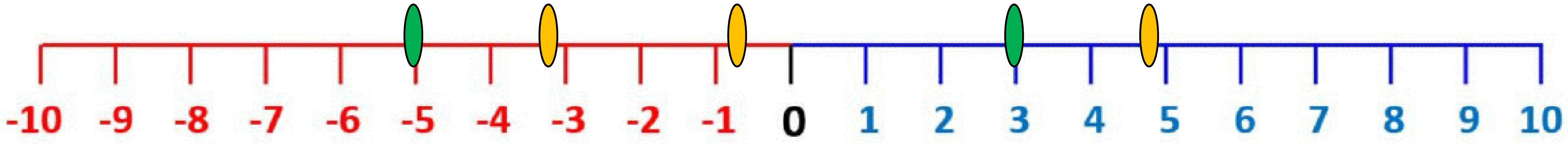
Note:

- -4 indicates “negative four,” or four to the left of 0
- 6 and $+6$ both indicate “positive six,” or six to the right of 0
- 0 is neutral, meaning it is neither positive nor negative

Graphing Signed Numbers & Integers

Graph the following numbers on the number line

$$-3\frac{1}{4}\ ,\ -5\ ,\ -\frac{3}{4}\ ,\ 3\ ,\ \text{and } 4.75$$

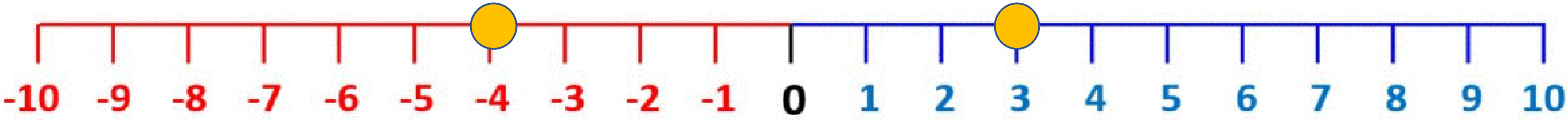


Some of these signed numbers can also be classified as **integers** (*3* & *-5*), which are a group of numbers that include 0, the natural numbers, as well as the opposites of those same natural numbers. Integers are always whole numbers.

The <u>*integers*</u> *are the signed whole numbers (positive or negative), and 0*: *…, -3, -2, -1, 0, 1, 2, 3, …*

Comparing Signed Numbers

3 and -4 have been graphed on the number line below



For any two signed numbers graphed on a number line, the number to the right is always the greater number and the number on the left is always the smaller number

Since 3 is to the right of -4, we can conclude that

3 is greater than -4

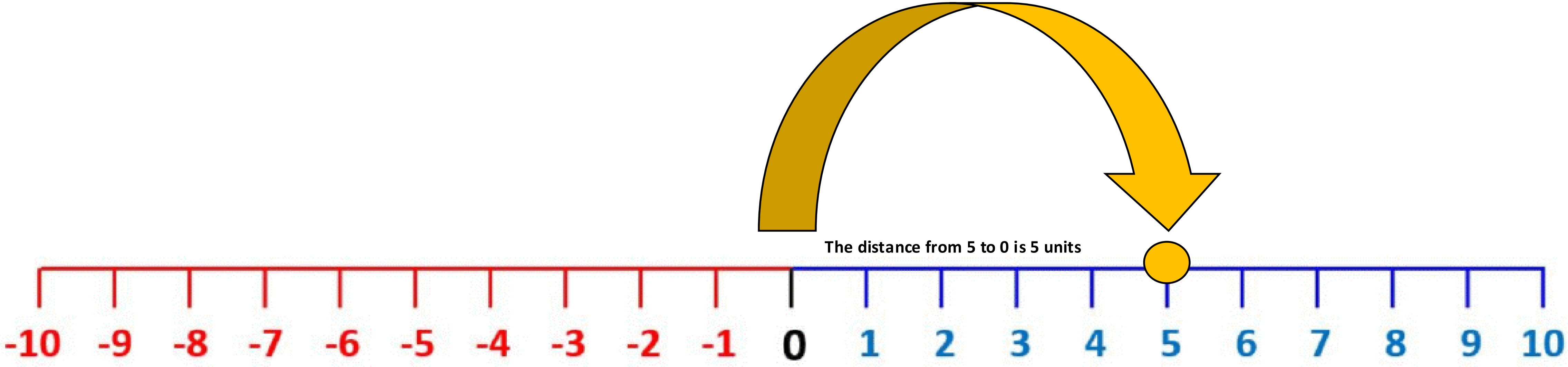
-4 is less than 3

$\therefore 3 > -4$ "Three is greater than negative four"

Absolute Value

Absolute Value describes the **distance from zero** that a number is on the number line, without considering direction. The absolute value of a number is never negative.

The absolute value of 5 is: **5** because



Absolute Value

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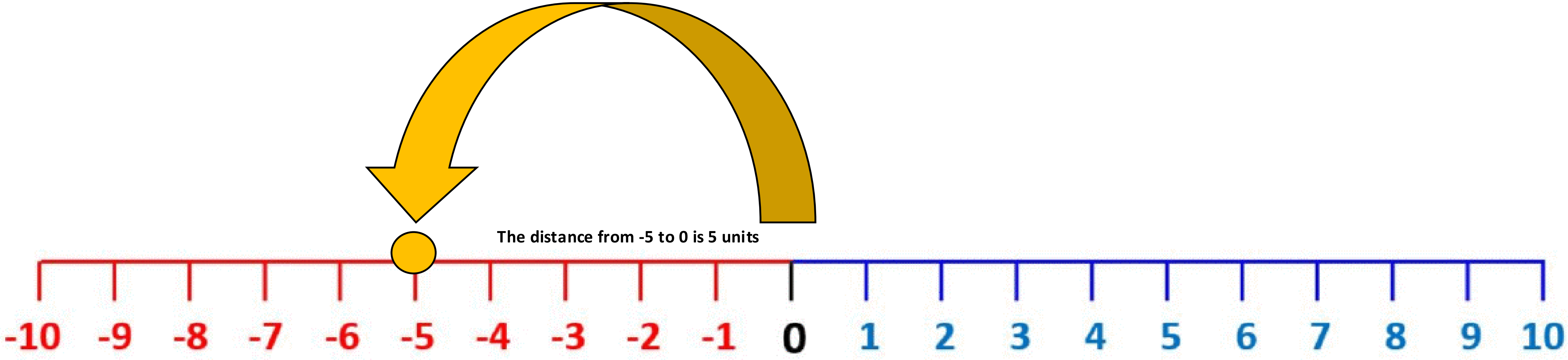
The absolute value of -5 is: **5** because



Absolute Value

Absolute Value describes the **distance from zero** that a number is on the number line, without considering direction. The absolute value of a number is never negative.

The most common way to represent the absolute value of a number or expression is to surround it with the absolute value symbol: two vertical straight lines → $|\ x\ |$

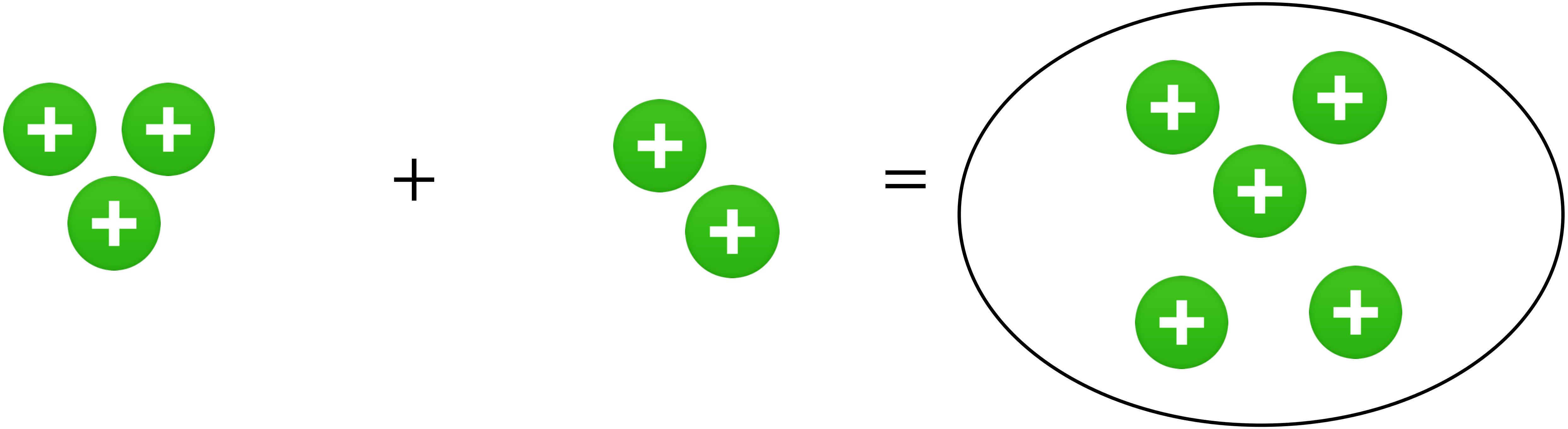
$| 6 | = 6$ “the absolute value of 6 is 6”

$|-6| = 6$ “the absolute value of -6 is 6”

$-| 6 | = -6$ “the negative of the absolute value of 6 is -6”

Adding Integers – “combine”

$$+3 \quad + \quad +2 \quad = \quad +5$$



Adding Integers – “combine”

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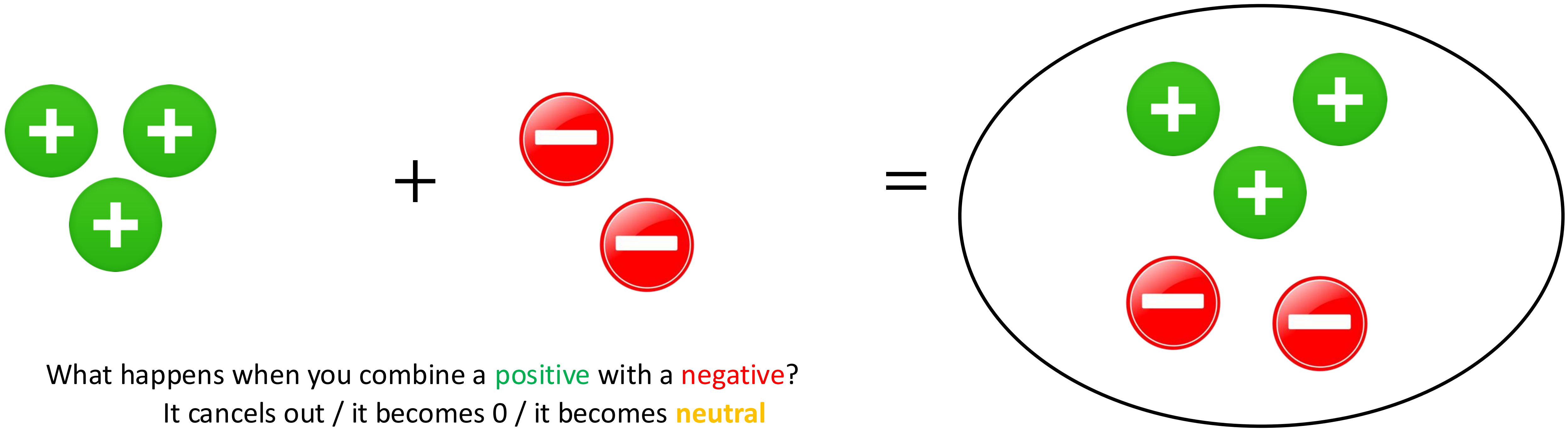
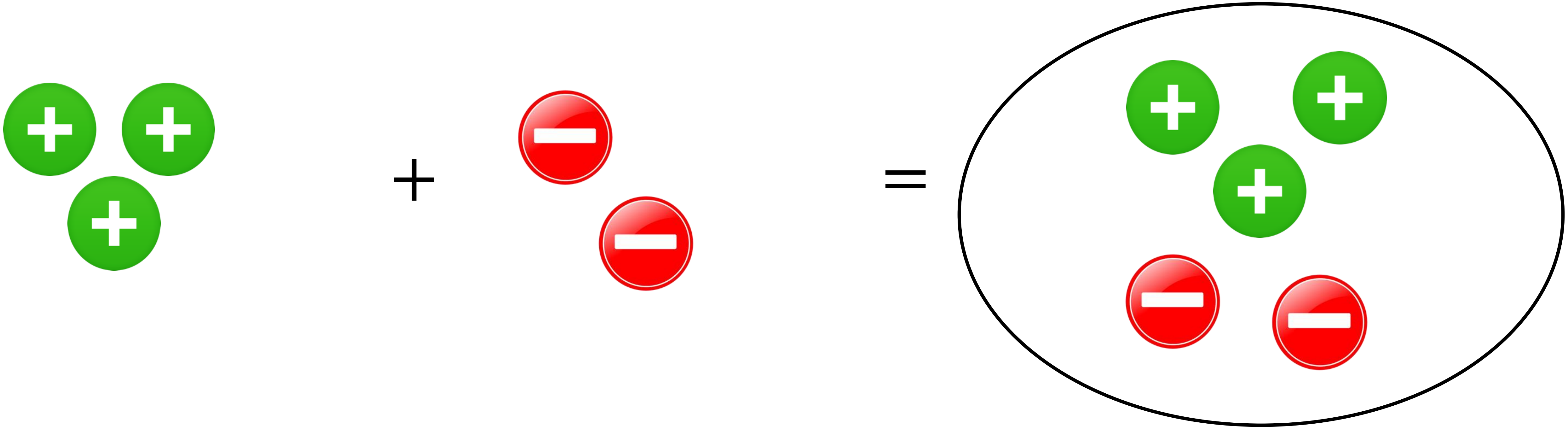


What happens when you combine a positive with a negative?

It cancels out / it becomes 0 / it becomes neutral

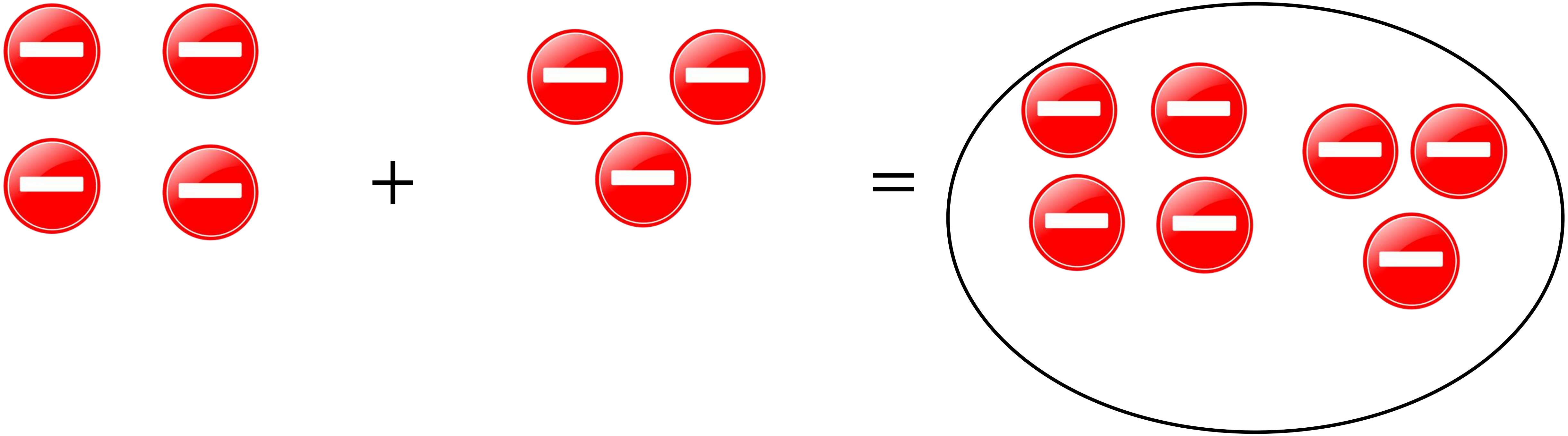
Adding Integers – “combine”

$$+3 \quad + \quad -2 \quad = \quad +1$$



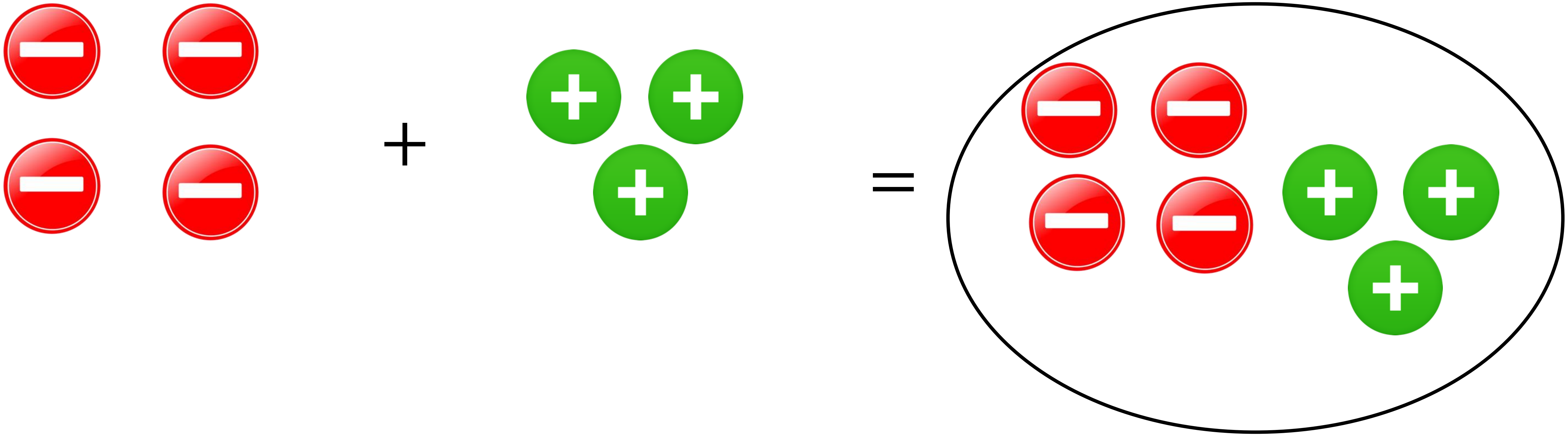
Adding Integers – “combine”

$$-4 \quad + \quad -3 \quad = \quad -7$$



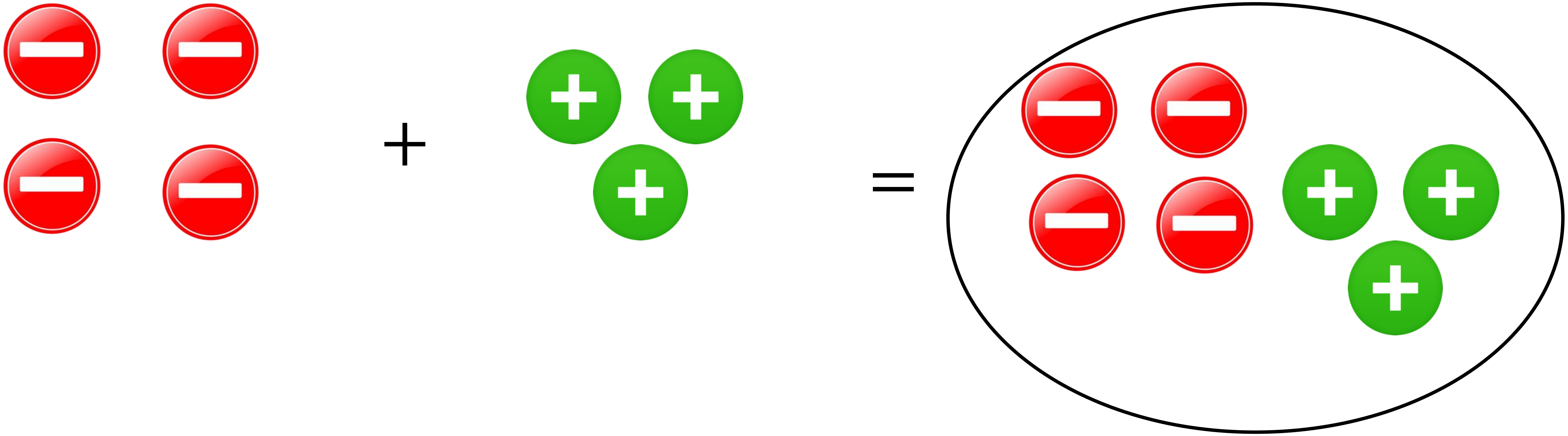
Adding Integers – “combine”

$$-4 \quad + \quad +3 \quad =$$



Adding Integers – "combine"

$$-4 \quad + \quad +3 \quad = \quad -1$$



Subtracting Integers – “take away”

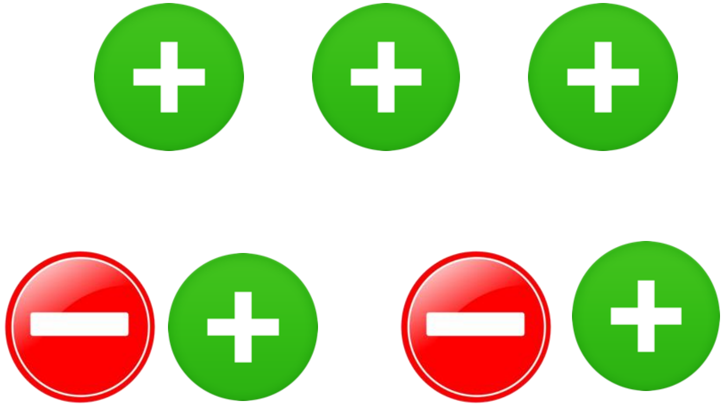
$$+3 \quad - \quad +2 \quad = \quad +1$$

Are we able to “take away” two positives?

Yes!

Subtracting Integers – “take away”

$$+3 \quad - \quad -2 \quad =$$

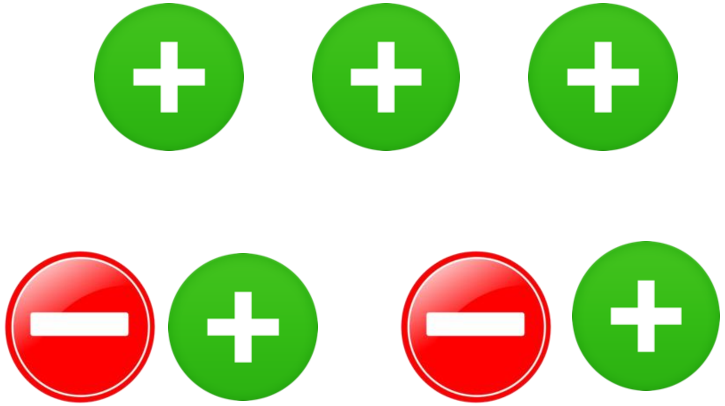


Are we able to “take away” two negatives?

No, so we have to “make” them

Subtracting Integers – "take away"

$$+3 \quad - \quad -2 \quad = \quad +5$$

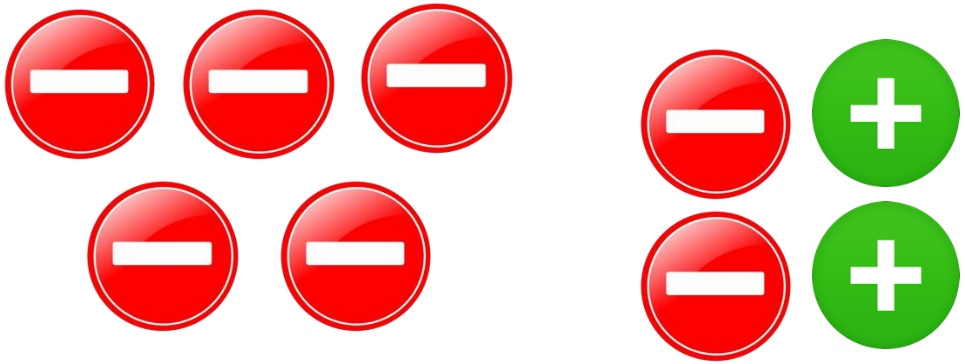


Can we "take away" two negatives now?

Yes!

Subtracting Integers – "take away"

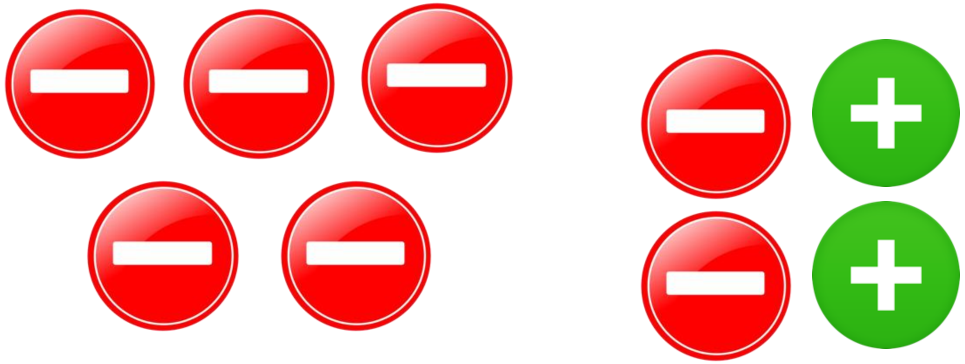
$$-5 \quad - \quad +2 \quad =$$



Currently, there aren't any positives to take away.
So, we will make some by adding zeros again.

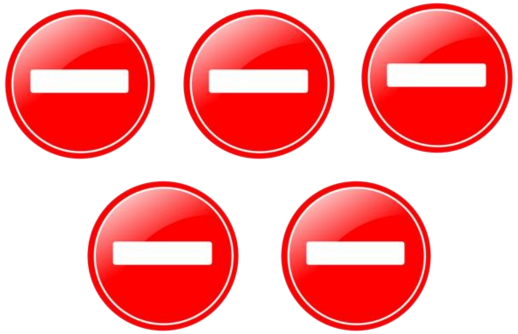
Subtracting Integers – “take away”

$$-5 \quad - \quad +2 \quad = \quad -7$$



Subtracting Integers – "take away"

$$-5 \quad - \quad -2 \quad = -3$$



Key Points for Success

* Your starting point/starting number is important and will dictate if your solution changes signs

* **Subtracting a negative is like adding a positive**

$$5 \quad + \quad +5 \;=\; 10$$

Multiplying Signed Numbers

$$(+) \times (+) = (+)$$

$$(-) \times (-) = (+)$$

Common signs always produce **positive** answers

$$(+) \times (-) = (-)$$

$$(-) \times (+) = (-)$$

Different signs always produce **negative** answers

Multiplying Signed Numbers

Multiplying Signed Numbers	Product (solution)
$7 \times (-3)$	$= -21$
$(-8)(2)$	$= -16$
-10×-4	$= +40$
9×2	$= +18$
$0.25(-2)$	$= -0.5$
$(-6)^2$	$= +36$
-6^2	$= -36$

Dividing Signed Numbers

$(+) \div (+)$ or $\frac{(+)}{(+)} = (+)$

$(-) \div (-)$ or $\frac{(-)}{(-)} = (+)$

Common signs always produce positive answers

$(+) \div (-)$ or $\frac{(+)}{(-)} = (-)$

$(-) \div (+)$ or $\frac{(-)}{(+)} = (-)$

Different signs always produce negative answers

Dividing Signed Numbers

Dividing Signed Numbers	Quotient (solution)
$\frac{-30}{6}$	-5
$100 \div (-4)$	-25
$72 \div 9$	$+8$
$\frac{-16}{-8}$	$+2$
$\frac{-3}{4}$	-0.75
$0 \div -8$	0

Dividing Signed Numbers

Divide and show your solution in decimal form.

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

$$\frac{2}{5} \times -\frac{3}{4}$$

$$\frac{2}{5} \times \frac{-3}{4}$$

$$\frac{-6 \;\div 2}{20 \;\div 2} = \frac{-3}{10} = \mathbf{-0.3}$$

Order of Operations - BEDMAS

BEDMAS	
B	Brackets
E	Exponents/Square Roots
D	Division
M	Multiplication
A	Addition
S	Subtraction

Solve.

$$50 - 3 + (-3)^3$$

$$50 - 3 + (-27)$$

$$50 \; - 30$$

$$= 20$$

Order of Operations - BEDMAS

BEDMAS	
B	Brackets
E	Exponents/Square Roots
D	Division
M	Multiplication
A	Addition
S	Subtraction

Solve.

$$\frac{10-(-18)}{(-1)+(5)}$$

$$\frac{28}{4}$$

$$= 7$$

Order of Operations - BEDMAS

BEDMAS	
B	Brackets
E	Exponents/Square Roots
D	Division
M	Multiplication
A	Addition
S	Subtraction

Solve.

$$(-4) \times |-3| + (-8) + (-6)^2$$

$$(-4) \times 3 + (-8) + (-6)^2$$

$$(-4) \times 3 + (-8) + 36$$

$$-12 + (-8) + 36$$

$$-20 + 36$$

$$= 16$$

Let’s Play a Game!

Michael and **McKayla** play a game that that involves rolling 2 dice. One is **green** and the other is **red**. In the game, each person rolls both dice 5 times. The person who has the highest sum after the 5 rolls is declared the winner.

The green die counts as positive numbers and the red die count as negative numbers. For example, if 5 is on the green die and 3 is on the red die (as is the case in Michael’s first roll), then the score for that roll is +**2** because:

$$(+5) \;+\; (-3) \;= +2$$

Michael and McKayla’s score cards are shown:

a) Who won the game?
b) By how much?
c) What is the best possible score you could achieve after 5 rolls?

Michael		
		
Roll 1	5	3
Roll 2	3	6
Roll 3	1	1
Roll 4	6	5
Roll 5	3	4

McKayla		
		
Roll 1	4	6
Roll 2	3	2
Roll 3	5	1
Roll 4	2	4
Roll 5	5	1

Time Zones

The sun rises at different times in different parts of the world. This is because of the earth's rotation. Some parts are still in darkness while others are in daylight. The world has been divided into 24 different time zones. Each place in the same zone has the same time of day. Times in different places are compared with how far ahead or behind they are in comparison to London, England.

You can use a number line to show time zones. 0 represents London. Positive numbers tell you how many hours a city is ahead of London, while negative numbers tell you how many hours a city is behind London. The number line below shows time in different citites as compared to London.

It is 8:00AM in London. What time is it in

a) Los Angeles?
b) Toronto?
c) Moscow?
d) Singapore?