RWM101: Foundations of Real World Math

FOUR TYPES OF NUMBERS

$\mathbb{N}$ Natural numbers : all positive whole numbers : $\mathbb{N} = \{1, 2, 3, 4, 5 \ldots\}$

$\mathbb{Z}$ Integers : all pos & neg whole number (& zero too!) : $\mathbb{Z} = \{\ldots, -3, -2, -1, 0, 1, 2, 3\}$

$\mathbb{Q}$ Rational numbers : all pos & neg fractions (including integers) : $\mathbb{Q} = \{a/b$, where a & b are integers$\}$

$\mathbb{R}$ Real numbers : all positive & negative numbers : $\mathbb{R}$

UNIT 1: NUMBER PROPERTIES

COMMUTATIVE LAW OF ADDITION & MULTIPLICATION

Tells us that the order you use to add or multiply numbers does not matter

if a and b are real numbers, then

$$a + b = b + a$$
$$a \cdot b = b \cdot a$$

When you change order it does not matter

EXAMPLE

$5 + 3 = 3 + 5$
$8 \qquad 8$

$5 \cdot 3 = 3 \cdot 5$
$15 \qquad 15$

ASSOCIATIVE LAW OF ADDITION & MULTIPLICATION

Tell us that no matter how we group or "associate" the numbers we add or multiply, the outcome remains the same

· if a, b, c are real numbers, then

$$(a + b) + c = a + (b + c)$$
$$(a \cdot b) \cdot c = a \cdot (b \cdot c)$$

EXAMPLE

$(7 + 8) + 2 = 7 + (8 + 2)$
$15 + 2 = 7 + 10$
17

$(5 \cdot \frac{1}{3}) \cdot 3 = 5 \cdot (\frac{1}{3} \cdot 8)$
$(\frac{5}{3}) \cdot 3 = 5 \cdot 1$
5

ADDITIVE IDENTITY

Simply states that there is an additive called zero

$0 + 5 = 5$
$0 + (-7) = -7$

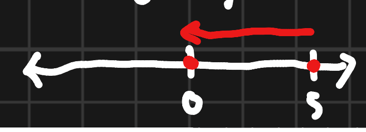
INVERSE PROPERTY OF ADDITION

for any real number a, "always returns 0"

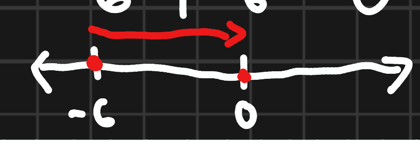
$$a + (-a) = 0$$

$-a$ is the additive inverse of a

$5 + (-5) = 0$



$-6 + 6 = 0$



MULTIPLICATIVE IDENTITY PROPERTY

States that if you multiply any number by 1, the answer is simply the number you started with

$1 \times 3 = 3 \qquad (-5) \times 1 = -5$

INVERSE PROPERTY OF MULTIPLICATION

for any real number $a \neq 0$

$$a \cdot \frac{1}{a} = 1$$ "always returns 1"

$\frac{1}{a}$ is the multiplicative inverse of a

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

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

UNIT 1: NUMBER PROPERTIES

MULTIPLICATION BY ZERO

Multiplying with zero is always zero, why?
One way to consider 5 plates with zero cookies

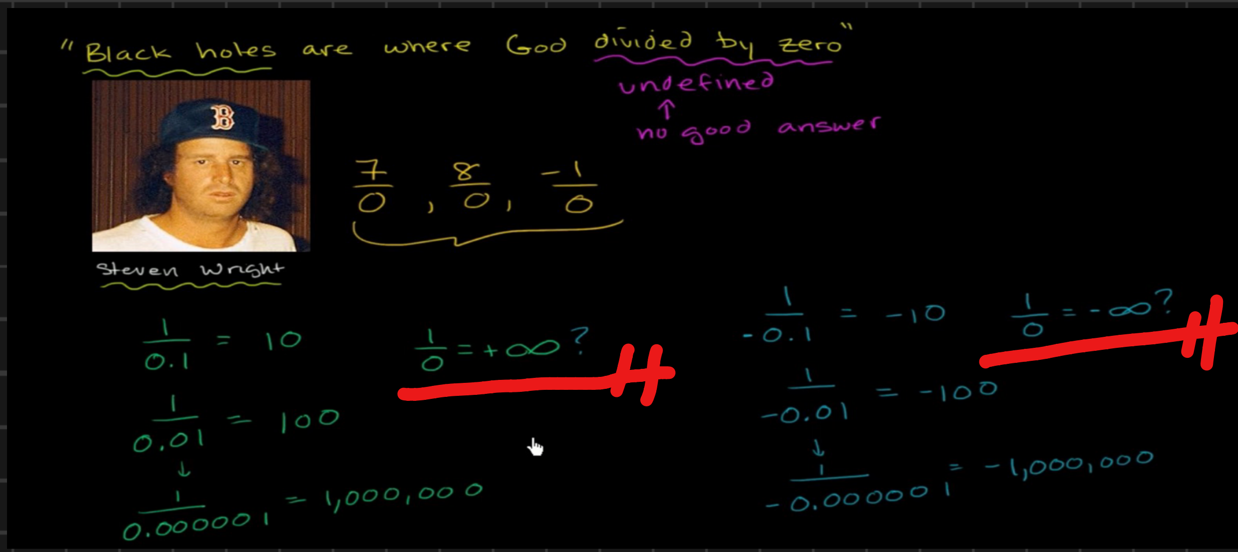
$0 + 0 + 0 + 0 + 0 = 5$, which is $5 \times 0 = 0$

DIVISION BY ZERO IS UNDEFINED

Any number divided by zero, the answher is undefined

$5/0 =$ undefined

$0/5 = 5$



DISTRIBUTIVE PROPERTY

encoded in the distributed law. This property tells how to distribute a multiplication across a sum (we write the sum in parenthesis)

abstract statement of distributed law:

$$a \times (b + c) = (a \times b) + (a \times c)$$

as its name suggest, we are distributing the multiplied number 'a' to each number in the sum

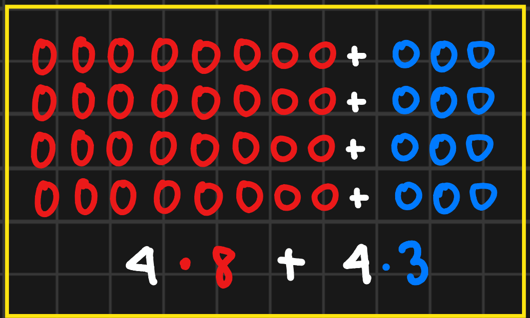
$4(8+3) \rightarrow 4(11) \rightarrow 44$

distributive

$4 \cdot 8 + 4 \cdot 3$

$32 + 12$

$= 44$



$5(9-4) \rightarrow 5(25) = 25$

$5 \cdot 9 - 5 \cdot 4$

$45 - 20$

$= 25$

UNIT 2: COMMON MULTIPLES & COMMON FACTORS

GREATEST COMMON FACTOR

WHAT IS A FACTOR?

Its a number that divides another number exactly with no remainder or multiples

factors of 10: → because (1×10, 2×5 all = 10)
1, 2, 5, 10
so, the factors of 10 is 1, 2, 5, 10

GCF?

Is the largest number that divides 2 or more numbers exactly with no remainder
or simpler "It's the biggest factor they share"

EXAMPLE

GCF of 12 & 18:
12: 1, 2, 3, 4, 6, 12
18: 1, 2, 3, 4, 9, 18
Common factor: 1, 2, 3, 6
Greatest: 6

PRIME FACTOR

Is a number that has only 2 factor 1 and itself
3 → factors are 1 & 3
5 → factors are 1 & 5
7 → factors are 1 & 7

COMPOSITE (NOT PRIME)

Numbers with more than 2 factors
4 → 1, 2, 4 (three factors) - not prime
8 → 1, 2, 4, 8 (four factors) - not prime
6 → 1, 2, 3, 6 (four factors) - not prime

LEAST COMMON MULTIPLE

WHAT IS A MULTIPLE?

A multiple of a number is the result of multiplying that number by an integer

its a multiple of another number n when m = n x (another integer)
multiples of 3:
3 = 3×1
6 = 3×2
9 = 3×3
12 = 3×4

LCM?

Collection of numbers is the smallest (or least) multiple shared by every number in the collection

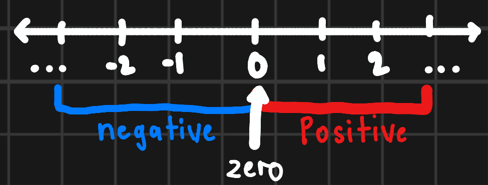
EXAMPLE

LCM of 12 & 8:
12: 12 24 36 48 60 72
8: 8 16 24 32 40 48

UNIT 3: THE ORDER OF OPERATIONS

INTRODUCTION TO INTEGERS

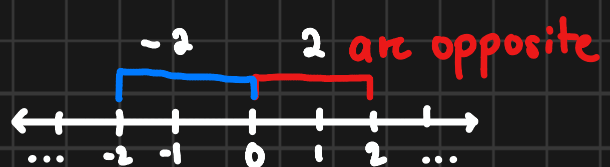
An Integer is any whole number positive, negative, or zero



NEGATIVE NUMBER

OPPOSITE

The opposite of a number is the number that is the same distance from zero on the number line, but opposite side of zero



OPPOSITE NOTATION

$-a$ means the opposite of the number a
The notation $-a$ is read opposite of a

ADDING NEGATIVE NUMBER

Rule 1: Adding negative = subtraction
- $a + (-b) = a - b$
- $-a + b = a - b$

Rule 2: Adding two negatives = negative
- $a + b = a + b$
- $(-a) + (-b) = a + b$

EXAMPLE

$9 + (-4) = 5$
$0 + (-7) = -7$

$-3 + (-5) = -8$
$10 + (-7) = -3$

$14 + (-4) + (-3) = 7$

SUBTRACTING NEGATIVE NUMBER

positive − positive = subtract normally
- $10 - 10 = 0$

positive − negative = becomes addition
- $10 - (-10) = 20$

negative − positive = more negative
- $-10 - (-10) = -20$

negative − negative = becomes addition
- $-10 - (-10) = -10 + 10 = 0$

MULTIPLYING & DIVIDING w/ DIFFERENT SIGNS