Chapter 2

NATURAL NUMBERS (counting numbers) 1, 2, 3, 4, 5,…

1 2 3 4 5 6 7 8 9 10

WHOLE NUMBERS **0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, …**

0 1 2 3 4 5 6 7 8 9 10

INTEGERS…-3, -2, -1, 0, 1, 2, 3, …

-6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10

RATIONAL NUMBERS Integers, Repeating and ending Decimals, and Fractions **-3, $-2\frac{7}{8}$, 0, 3, 5.7, 4.33333…**

-5.5 $0\ \frac{1}{2}\ 1$

IRRATIONAL NUMBERS

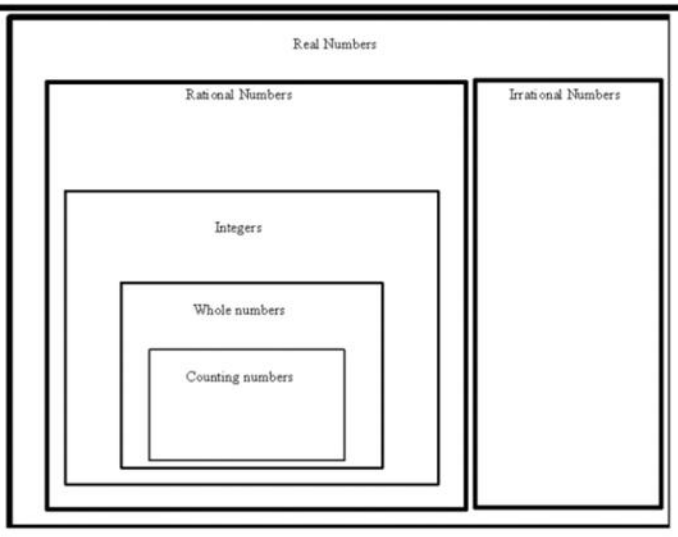
Decimals that don't repeat or end. We don't know exactly where they are on the number line. Like **radicals**, π, e, 1.235698425624… there is no pattern.

REAL NUMBERS **All of the previous numbers**

REAL — RATIONAL — INTEGERS — WHOLE NUMBERS — NATURAL

REAL — IRRATIONAL

So all natural numbers are whole numbers, all whole numbers are integers, all integers are rational, and all rational are real. The real numbers are all the numbers on the real number line.



$\left\{2,3,-1,.5,234.\overline{12},0,\sqrt{3},\pi\right\}$

List all of the numbers that are:

1) whole numbers

2) Integers

3) Irrational

4) Rational

5) Real

Absolute Value- Distance from Zero

a) $|-3|$

3

b) $|-3|+|4|$

3 + 4

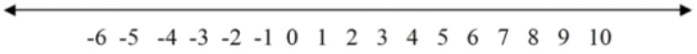
7

c) $|4-2|$

grouping

|2|

2



Opposite- The number the same distance from zero on the opposite side. **CHANGE SIGN** $-(\ )$

a) $-(4)$

-4

b) $-(-5)-(2)$ (opposite, negative, minus)

5 − (2)

3

c) $-|-5|$

−(|−5|)

−(5)

−5

d) $-|7|$

-7

e) $|-3|-|-2|$

3 − 2

1

f) $|-5|+|-5|-|5|$

5 + 5 − 5

10 − 5

5

Give me some real life things that we can assign negative numbers to.

overdraft, debt, down, below, below sea level, below 0°

Inequalities

<, > ← less than ← greater than

Give me a phrase using less than and one using greater than

larger > smaller

larger

= ← equal

$-4<4$	$17<15$	$3=3$

$-5 \_\_ |-5|$

$-5 < 5$

$-|-5| \_\_ 5$

$-5 < 5$

$-|-6| \_\_ -(-6)$

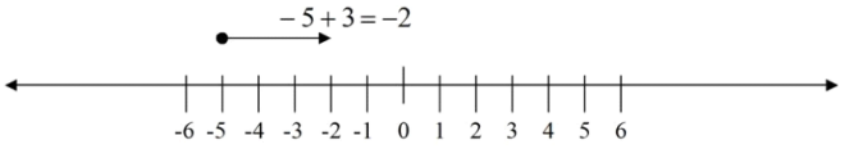
$-6 < 6$

Negative numbers can be traced back to the Chinese between 200 B.C. and 200 A.D. Mathematicians at first found negative numbers ugly and unpleasant, even though they kept cropping up in the solutions of problems.

You owe $5 on your credit card bill. You pay off $3 of it. Therefore, you still owe $2.

-5 $+3$ -2

From the following sentence you can see that $-5+3=-2$



Adding and Subtracting integers

Different signs (you are paying off your cards)
(one -)

$4-5=4+(-5)$

a) larger number decides the sign
(in this case the 5 is larger than 4 so it's -)
b) subtract the smaller from the larger.

$$\begin{array}{r} -5 \\ \underline{4} \\ -1 \end{array}$$

Same signs (you owe a lot of money)
(two – or no -)

$-4-5=-4+(-5)$

a) add
b) keep the sign

$-4-5=-9$

* **$3-(-4)=3+4$** opposite of subtact is add

$-3+5$ $2-3$ $-7+(-2)$

$-3+5$ $-2-3$ $-7+(-2)$

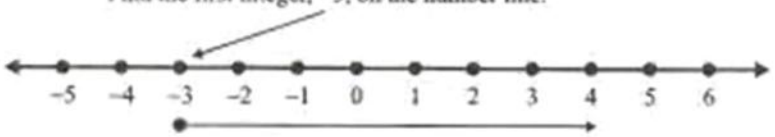
-1 1
-1 1
-1 1
1
1

ADDING INTEGERS

First, we will see how to add integers on the number line; then, we will learn rules for working the problems without using a number line.

EXAMPLE 1: Add: $(-3) + 7$

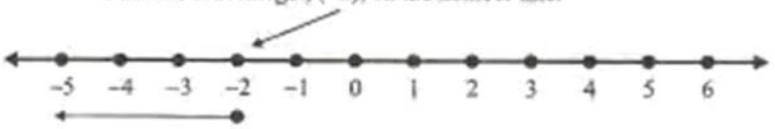
Step 1: The first integer in the problem tells us where to start.
Find the first integer, -3, on the number line.



Step 2: $(-3) + 7$ The second integer in the problem, $+7$, tells us the direction to go, positive (toward positive numbers), and how far, 7 places.
$(-3) + 7 = 4$

EXAMPLE 2: Add: $(-2) + (-3)$

Step 1: Find the first integer, (-2), on the number line.



Step 2: $(-2) + (-3)$ The second integer in the problem, (-3), tells us the direction to go, negative (toward the negative numbers), and how far, 3 places.
$(-2) + (-3) = (-5)$

Solve the problems below using this number line.

1. $2 + (-3) =$ _____
2. $4 + (-2) =$ _____
3. $(-3) + 7 =$ _____
4. $(-4) + 4 =$ _____
5. $(-1) + 5 =$ _____
6. $(-1) + (-4) =$ _____
7. $3 + 2 =$ _____
8. $(-5) + 8 =$ _____
9. $3 + (-7) =$ _____
10. $(-2) + (-2) =$ _____
11. $6 + (-7) =$ _____
12. $2 + (-5) =$ _____
13. $(-5) + 3 =$ _____
14. $(-6) + 7 =$ _____
15. $(-3) + (-3) =$ _____
16. $(-8) + 6 =$ _____
17. $(-2) + 6 =$ _____
18. $(-4) + 8 =$ _____
19. $(-7) + 4 =$ _____
20. $(-5) + 8 =$ _____
21. $-2 + (-2) =$ _____
22. $8 + (-6) =$ _____
23. $5 + (-3) =$ _____
24. $1 + (-8) =$ _____

Multiplying and Dividing integers

– in multiplication means opposite

$-(-4)=4$ opposite of -4 is 4

$-(4)=-4$ opposite of 4 is -4

Rules

a) $-\times-=+$ $\quad \frac{-}{-}=+$

b) $-\times+=-$ $\quad \frac{-}{+}=\frac{+}{-}=-$

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

Same signs positive, different signs negative.

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

The **opposite** of **bad** is *good*

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

The **opposite** of *good* is **bad**

$-4(5)$	$-4(-5)$	$4(-5)$	$4(5)$
-20	20	-20	20
$-4\cdot5$	$-4(-5)$	$4(-5)$	$4\cdot5$
-20	20	-20	20

Exponents

x^5 $\quad xxxxx$

2^5 $\quad 2\cdot2\cdot2\cdot2\cdot2$

-2^4 leading negative $\quad -2\cdot2\cdot2\cdot2$ $\quad -16$

$(-2)^4$ $\quad (-2)(-2)(-2)(-2)$ $\quad 16$

b^2+3b, for b=-2

$(-2)^2+3(-2)$

$4+3(-2)$

$4+(-6)$

-2

$-5abc+1$ for a=-2, b=-1, and c=3

$-5(-2)(-1)(3)+1$

$10(-1)(3)+1$

$-10(3)+1$

$-30+1$

-29

SOLVING EQUATIONS-------Eliminate

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

$-2 + X = 4$ $\quad +2 \quad +2$ $\quad x = 6$

$-3X = 15$ $\quad -3 \quad -3$ $\quad x = -5$

$\frac{X}{-2} = -3$ $\quad (-2) \quad (-2)$ $\quad x = 6$

$-2 - X = 4$

Try:

1)

2)

3)

4)

5)

6)

7)

8)

9)

$D = rt$ $C = \frac{5}{9}(F - 32)$ profit= revenue-cost Retail price = cost + markup

1) Find the distance covered by a jet if it travels for 3 hours at 550 mph.

$D = (550)(3)$ t r

$D = 1650$ miles

2) Find the Celsius temperature reading if the Fahrenheit reading is -103°?

$C = \frac{5}{9}((-103) - 32)$ $(-103) - 32$

$C = \frac{5}{9}(-135)$ -135

$C = 5(-15) = -75°C$ $9\overline{)135}$ $\frac{9}{45}$

3) For the month of June, a florist's cost of doing business was $3795. If June's revenues totaled $5,115, what was her profit for the month of June?

4) You find a shoe for $10 at a yard sale and you sell the shoe for **a loss** of $2. revenue?