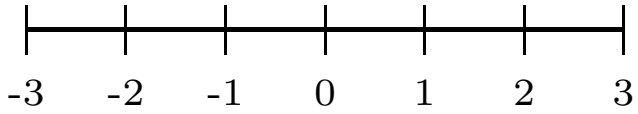
Doing Math: Absolute Values

Absolute Value is a term used to refer to a number's distance from 0 on the real number line. The direction of the distance is not important.



$$|-3| = 3 \qquad |2| = 2 \qquad |0| = 0$$

Thus:

$$|4| + |-2| = 4 + 2 = 6$$

$$|3| + |-3| = 3 + 3 = 6$$

$$|3| - |-3| = 3 - 3 = 0$$

Doing Math: Adding and Subtracting Negative Numbers

Add numbers with the same sign:

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

Subtract numbers with different signs and give the sign of the larger number:

$$(-3) + 4 = 4 - 3 = 1$$

Doing Math: Negative Numbers

In total, how much weight did the Caucasian women lose?

$$(-5) + (-25) = -30 \text{ lbs}$$

(Lost -30 lbs, or gained 30 lbs)

How much weight did the men lose?

$$45 + 50 = 95 \text{ lbs}$$

How much weight did the women lose?

$$\underbrace{(-5) + 15 + (-25)}_{group\ terms\ with\ same\ sign} = 15 - 30 = -15 \text{ lbs} \rightarrow \text{gained } 15 \text{ lbs}$$

Doing Math: Negative Numbers

How much weight did the entire group lose?

$$(-5) + 15 + 45 + 50 + (-25) = 110 - 30 = 80 \text{ lbs}$$

What is the difference in weight loss between men and women?

("Difference" means "Subtract")

$$95 - (-15) = 95 + 15 = 110 \text{ lbs}$$

Subtract a negative = Add a positive

Subtract a positive = Add a negative

Doing Math: Averaging

What is the average weight loss per participant in the group?

$$average = \frac{total}{number\ of\ items\ totaled}$$

$$\text{average weight loss} = \frac{80 \text{ lbs}}{5 \text{ participants}} = 16 \text{ lbs per participant}$$

What is the average weight loss for the women?

$$\text{average weight loss} = \frac{(-5) + 15 + (-25)}{3} = \frac{-15}{3} = -5 \text{ lbs}$$

$\rightarrow$ average gain of 5 lbs per female participant

Doing Math: Multiplying and Dividing Negative Numbers

First, do the math as if the signs were positive.

If signs are the same, the answer is positive.

If signs are opposite, the answer is negative.

Examples:

$$(-5) \times (+3) = -15 \rightarrow \textit{signs opposite}$$

$$(-5) \times (-5) = 25 \rightarrow \textit{signs the same}$$

$$(-3) \times 2 \times 2 = -12$$

$$(-4) \times 3 \times (-3) = 36$$

Practice with Negative Numbers: Hand Calculations

$-4 + 3 - 2 + 5 - 8 =$

$12 - 15 + 18 - 27 + 17 =$

$-12 \times 2 =$

$-11 \cdot -2$ ($\cdot$ means multiply) $=$

$-3 * 4 * -2$ (* means multiply) $=$

$(7)(-7)(2)$ (( ) means multiply) $=$

$(2)(-2)(-3)(3) =$

$(-3)(-2)(-3)(2) =$

Practice with Negative Numbers: Using a Calculator

$-4 + 3 - 2 + 5 - 8 =$

$12 - 15 + 18 - 27 + 17 =$

$-12 \times 2 =$

$-11 \cdot -2 =$

$-3 * 4 * -2 =$

$(7)(-7)(2) =$

$(2)(-2)(-3)(3) =$

$(-3)(-2)(-3)(2) =$

Useful Rules - "The Properties of Real Numbers"

$$\left.\begin{array}{c} a+b=b+a \\ 3+2=2+3 \\ 5=5 \end{array}\right\} \text{The commutative property of addition}$$

$$\left.\begin{array}{c} a*b=b*a \\ (3)(-2)=(-2)(3) \\ -6=-6 \end{array}\right\} \text{The commutative property of multiplication}$$

Useful Rules - "The Properties of Real Numbers"

$$\left.\begin{array}{c}(a+b)+c=a+(b+c)\\(3+4)+5=3+(4+5)\\7+5=3+9\\12=12\end{array}\right\}\text{The associative property of addition}$$

$$\left.\begin{array}{c}(a*b)*c=a*(b*c)\\(3*4)*5=3*(4*5)\\12*5=3*20\\60=60\end{array}\right\}\text{The associative property of multiplication}$$

Useful Rules - "The Properties of Real Numbers"

$$\left.\begin{array}{l} a+0=0+a=a \\ 3+0=0+3=3 \end{array}\right\} \text{The addition property of zero}$$

$$\left.\begin{array}{l} a*0=0*a=0 \\ 3*0=0*3=0 \end{array}\right\} \text{The multiplication property of zero}$$

$$\left.\begin{array}{l} a*1=1*a=a \\ 5*1=1*5=5 \end{array}\right\} \text{The multiplication property of one}$$

Useful Rules - "The Properties of Real Numbers"

$$\left.\begin{array}{c} a+(-a)=(-a)+a=0 \\ 4+(-4)=(-4)+4=0 \end{array}\right\} \text{The inverse property of addition}$$

4 and -4 are called additive inverses

$$\left.\begin{array}{c} a*\frac{1}{a}=\frac{1}{a}*a=1, a\neq 0 \\ 4*\frac{1}{4}=\frac{1}{4}*4=1 \end{array}\right\} \text{The inverse property of multiplication}$$

4 and $\frac{1}{4}$ are called multiplicative inverses

Useful Rules - "The Properties of Real Numbers"

$$\left.\begin{array}{c} a(b+c) = ab + ac \\ 3(4+5) = 3*4 + 3*5 \\ 3*9 = 12 + 15 \\ 27 = 27 \end{array}\right\} \text{The distributive property}$$

$$\left.\begin{array}{c} (b+c)a = ba + ca \\ (4+5)2 = 4*2 + 5*2 \\ 9*2 = 8 + 10 \\ 18 = 18 \end{array}\right\} \text{The distributive property}$$

Division Properties of Zero and One

- Zero divided by any number other than zero is zero.

$$\text{For } a \neq 0, \frac{0}{a} = 0$$

$$\frac{0}{4} = 0$$

- Division by zero is not defined.

$$\frac{a}{0} \text{ is undefined}$$

$$\frac{4}{0} \text{ is undefined}$$

- Any number other than zero divided by itself is 1.

$$\text{For } a \neq 0, \frac{a}{a} = 1$$

$$\frac{-7}{-7} = 1$$

Doing Math: Squares, Cubes, etc.

$$\begin{aligned} a^2 &= a \times a && \text{“a squared”} \\ a^3 &= a \times a \times a && \text{“a cubed”} \\ &\text{etc.} \end{aligned}$$

The little number is called an *exponent*, or a “power”.

$$\begin{aligned} 2^2 &= 2 \times 2 = 4 \\ 10^2 &= 10 \times 10 = 100 \\ 10^3 &= 10 \times 10 \times 10 = 100 \times 10 = 1000 \end{aligned}$$

For 10’s, exponent represents number of 0’s to the right of 1

Doing Math: Negative Powers

$$\begin{aligned} 2^{-2} &= \frac{1}{2^2} = \frac{1}{4} \\ 10^{-2} &= \frac{1}{10^2} = \frac{1}{100} = 0.01 \end{aligned}$$

for 10's, exponent represents number of places to the right of 1, so if exponent is negative, decimal is to the left of 1.

Doing Math: Square Roots

$$\begin{aligned}
\sqrt{a} &= \text{“What number, when multiplied by itself,} \\
&\quad \text{will result in } a\text{?”} \\
\sqrt{4} &= 2, \text{ because } 2 \times 2 = 4 \\
a^{\frac{1}{2}} &= \sqrt{a}
\end{aligned}$$

How to compute square roots? On your calculator!

Practice (check your answers by squaring them):

$$\begin{aligned}
\sqrt{5} &= \\
\sqrt{0} &= \\
\sqrt{0.045} &=
\end{aligned}$$

Example: Compute Your Body Mass Index

$$\text{BMI} = \frac{Wt}{Ht^2}$$

where Wt is body weight in kilograms and Ht is height in meters.

To convert pounds to kilograms, multiply by 0.45 (1 lb = 0.45 kg)

To convert inches to centimeters, multiply by 2.54 (1 in = 2.54 cm)

To convert centimeters to meters, divide by 100 (1 cm = 0.01 m)

Here's a unit converter on the web:

http://calc.entisoft.com/scripts/UnitsCGI.Exe

How to interpret your Body Mass Index

< 18.5	Underweight
18.5 - 24.9	Normal Range
25.0 - 29.9	Overweight
30.0 - 39.9	Obese
≥ 40	Extremely Obese

For more information: National Heart, Lung and Blood Institute's Clinical Guidelines

http://www.nhlbi.nih.gov

Example: BMI

What is the BMI of someone who weighs 150 lbs and is 5 feet 7 inches tall?

150 lbs $\times$ 0.45 kg/lb = 67.5 kg

5 feet 7 inches = (5 feet $\times$ 12 inches/foot) + 7 inches = 67 inches

67 inches $\times$ 2.54 cm/in = 170.2 cm

170.2 cm $\times$ 0.01 m/cm = 1.7 m

$$\text{BMI} = \frac{67.5}{(1.7)^2} = \frac{67.5}{(1.7)(1.7)} = \frac{67.5}{2.89} = 23.4$$

Normal!