Slide 1

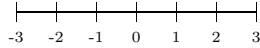**Doing Math: Absolute Values**

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.

$$-3 \quad -2 \quad -1 \quad 0 \quad 1 \quad 2 \quad 3$$

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

Thus:

$$|4| + |-2| = 4 + 2 = 6$$
$$|3| + |-3| = 3 + 3 = 6$$
$$|3| - |-3| = 3 - 3 = 0$$

Slide 2

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:

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

Slide 3

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?

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

Slide 4

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

Slide 5

Doing Math: Averaging

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

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

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

What is the average weight loss for the women?

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

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

Slide 7

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) $=$

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

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

Slide 6

Doing Math: Multiplying and Dividing Negative Numbers

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

If signs are the <u>same</u>, the answer is <u>positive</u>.

If signs are <u>opposite</u>, the answer is <u>negative</u>.

Examples:

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

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

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

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

Slide 8

Practice with Negative Numbers: Using a Calculator

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

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

$-12 \times 2 =$

$-11 \cdot -2 =$

$-3 * 4 * -2 =$

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

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

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

Slide 9

Useful Rules - "The Properties of Real Numbers"

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

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

Slide 10

Useful Rules - "The Properties of Real Numbers"

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

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

Slide 11

Useful Rules - "The Properties of Real Numbers"

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

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

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

Slide 12

Useful Rules - "The Properties of Real Numbers"

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

4 and -4 are called additive inverses

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

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

Useful Rules - "The Properties of Real Numbers"

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

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

Doing Math: Squares, Cubes, etc.

$$\begin{array}{rcll} a^2 & = & a \times a & \text{"a squared"} \\ a^3 & = & a \times a \times a & \text{"a cubed"} \end{array}$$

etc.

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

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

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

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: Negative Powers

$$\begin{array}{rcl} 2^{-2} & = & \dfrac{1}{2^2} = \dfrac{1}{4} \\[2ex] 10^{-2} & = & \dfrac{1}{10^2} = \dfrac{1}{100} = 0.01 \end{array}$$

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

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

How to compute square roots? On your calculator!

Practice (check your answers by squaring them):

$$\sqrt{5} \quad =$$
$$\sqrt{0} \quad =$$
$$\sqrt{0.045} \quad =$$

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: 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

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!