Pre-Algebra & Algebra

Metric System
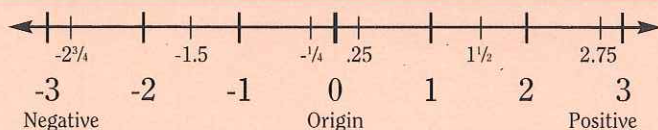
1 cm	= 10 mm	1 m	= 1000 mm
1 dm	= 10 cm	1 dm	= 0.1 m
1 m	= 10 dm	1 cm	= 0.01 m
1 m	= 100 cm	1 mm	= 0.001 m

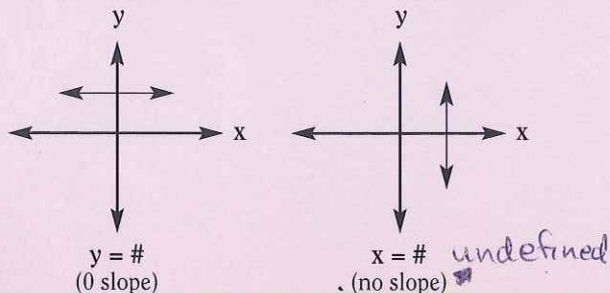*deci-* means 1/10   *centi-* means 1/100   *milli-* means 1/1000

Numbers

Prime - any number greater than one that can only be factored by itself and the number one

Composite - any number greater than one that has more than two factors

Natural - numbers used for counting: {1, 2, 3, 4, . . .}

Whole - the set of natural numbers, plus zero

Integers - any positive or negative whole number, plus zero

Real - includes all rational and irrational numbers, both positive and negative

Number Line

$-2\frac{3}{4}$ -1.5 $-\frac{1}{4}$ $.25$ $1\frac{1}{2}$ 2.75

-3   -2   -1   0   1   2   3

Negative   Origin   Positive

Special Lines

$y = \#$
(0 slope)

$x = \#$ undefined
(no slope)

Rules for Integers

1. When **adding** two numbers with the **same sign**, take the **sum** of the two numbers and keep the sign.
   Examples: $4 + 5 = 9$; $-6 + -2 = -8$

2. When **adding** two numbers with **different signs**, take the **difference** of the two numbers and use the sign of the larger number.
   Examples: $-14 + 8 = -6$; $8 + -5 = 3$

3. When **subtracting** two numbers, change the subtraction problem to an addition problem by adding the opposite of what was being subtracted. Follow steps "1" and "2" to finish the problem.
   Examples: $-10 - 4 = -10 + -4 = -14$; $5 - -3 = 5 + 3 = 8$

Table of Perfect Squares

n	n²	n	n²	n	n²	n	n²
1	1	6	36	11	121	16	256
2	4	7	49	12	144	17	289
3	9	8	64	13	169	18	324
4	16	9	81	14	196	19	361
5	25	10	100	15	225	20	400

Equation Solving Process

1. Is it a subtraction problem?
   no → yes → Change it to an addition problem.

2. Are there grouping symbols?
   no → yes → Distribute.

3. Are there variables on the right side?
   no → yes → Move them to the left side. • Add opposites
   Combine/simplify left side.

4. Is there a number <u>not</u> attached to the variable?
   no → yes → Move it to the right side. Add opp.
   Combine/simplify right side.

5. Is there a number attached to the variable?
   no → yes →
   1. If by "x", then "÷".
   2. If by "÷", then "x".
   3. If a fraction, use reciprocal.

   variable = #

   variable = #

General

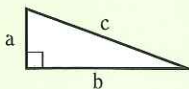|	
$d = r \times t$	d = distance r = rate t = time
$p = c \times n$	p = total price c = cost of item n = number of items
$u = \dfrac{p}{n}$	u = unit price p = total price n = number of units
$p = 100 \left(\dfrac{g - s}{g}\right)$	p = percent of discount g = original price s = sale price

Linear

$m = \dfrac{y_2 - y_1}{x_2 - x_1}$	slope definition (m = slope)
$y = mx + b$	slope-intercept formula (b = y-intercept)
$y_2 - y_1 = m(x_2 - x_1)$	point-slope formula
$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$	distance formula

Other

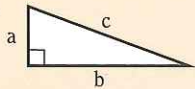|	
$ax^2 + bx + c = 0$	general formula of quadratic
$x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$	quadratic formula
$a^2 + b^2 = c^2$	Pythagorean Theorem

- if $c^2 > a^2 + b^2$, then <u>obtuse</u> Δ
- if $c^2 < a^2 + b^2$, then <u>acute</u> Δ
- if $c^2 = a^2 + b^2$, then <u>right</u> Δ

SOH - CAH - TOA

$$sine = \frac{opposite}{hypotenuse}, \quad \sin \emptyset = \frac{a}{c}$$

$$cosine = \frac{adjacent}{hypotenuse}, \quad \cos \emptyset = \frac{b}{c}$$

$$tangent = \frac{opposite}{adjacent}, \quad \tan \emptyset = \frac{a}{b}$$


Rules for Exponents

Definition: $a^n = a \times a \times a$ ("n" times)

$a^m a^n = a^{m+n}$ keep the base, add the exponents

$(a^m)^n = a^{mn}$ keep the base, multiply the exponents

$(ab)^m = a^m b^m$ distribute exponent to sign, number and variable

$\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$ distribute exponent to sign, number and variable

$\frac{a^m}{a^n} = a^{m-n}$ when m > n

$\frac{a^m}{a^n} = \frac{1}{a^{n-m}}$ or a^{m-n} (negative exponent)   when m < n

$\frac{a^m}{a^n} = 1$ when m = n

$a^0 = 1$

Factoring Patterns

- **Common Terms**
  $ax + ay = a(x + y)$

- **Difference of Two Squares**
  $a^2 - b^2 = (a + b)(a - b)$

- **Perfect Square Trinomial**
  $a^2 + 2ab + b^2 = (a + b)^2$
  $a^2 - 2ab + b^2 = (a - b)^2$

- **Basic Trinomial**
  $ax^2 + bx + c = 0$ (will vary)

- **Sum/Difference of Cubes**
  $a^3 + b^3 = (a + b)(a^2 - ab + b^2)$
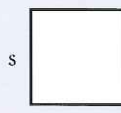 $a^3 - b^3 = (a - b)(a^2 + ab + b^2)$

Perimeter

Rectangle
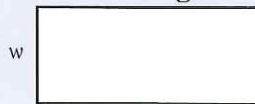
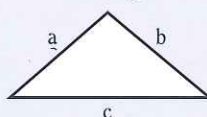$$P = 2l + 2w$$
P = perimeter
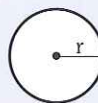l = length
w = width

Square

$$P = 4s$$
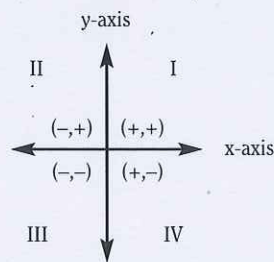s = side

Triangle

$$P = a + b + c$$
p = perimeter

Circle

$$C = 2\pi r$$
C = circumference
π = 3.14159 or $^{22}/_7$
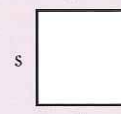r = radius

Coordinate System

Area

Rectangle
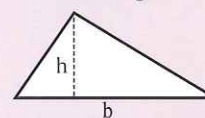

$$A = lw$$
A = area
l = length
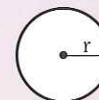w = width

Square

$$A = s^2$$
a = area
s = side

Triangle

$$A = \tfrac{1}{2}bh$$
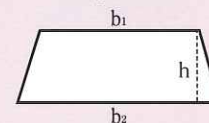A = area
b = base
h = height

Circle

$$A = \pi r^2$$
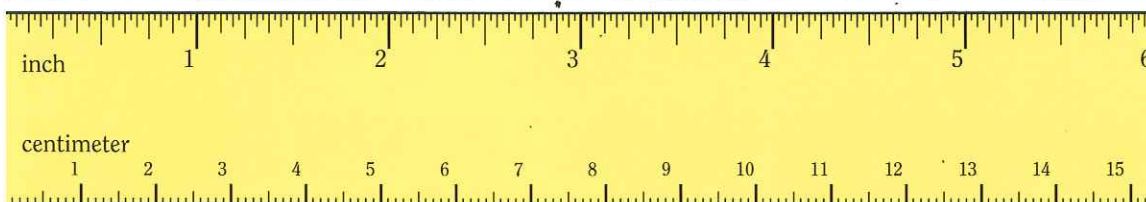A = area
π = 3.14159 or $^{22}/_7$
r = radius

Trapezoid

$$A = \tfrac{1}{2}h(b_1 + b_2)$$
A = area
b = base
h = height