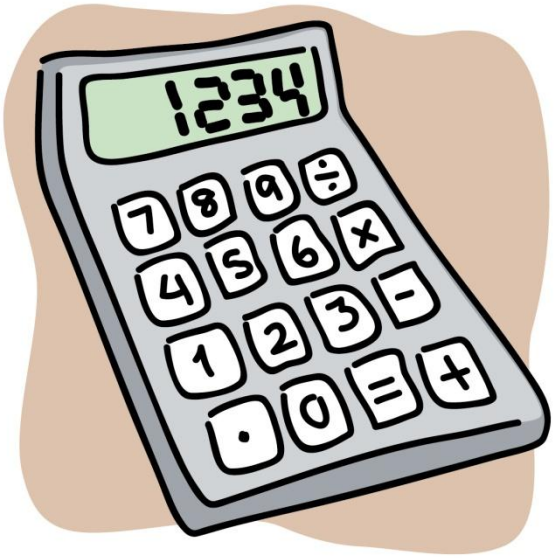
Name: _____

7th Grade Math Teacher: _____

8th Grade Math Teacher: _____

Hardin Middle School Math Cheat Sheets



You will be given only one of these books. If you lose the book, it will cost $5 to replace it.

Compiled by Shirk &Harrigan - Updated May 2013

Alphabetized Topics

Table of Contents

Mathematic Symbols Cheat Sheet

+	Plus or Positive
−	Minus or Negative
• * x $2(3)$	Multiplied by
÷ / $\frac{a}{b}$ $\sqrt{x}$	Divided by
=	Equal to
≠	NOT equal
≈	Approximately equal to
≅	Congruent to
<	Is less than
>	Is Greater than
≥	Is greater than or equal to
≤	Is less than or equal to
a/b a:b $\frac{a}{b}$	Ratio of a to be or a divided by b or the fraction a/b
(a, b)	Ordered pair
$\overleftrightarrow{AS}$	Line AS
$\overline{AS}$	Line segment AS
$\overrightarrow{AS}$	Ray AS
$\triangle ABC$	Triangle ABC
$\angle ABC$	Angle ABC
$\angle B$	Angle B
⌞	Right angle
⊥	Perpendicular to
||	Perpendicular to
°	Degree
%	Percent
Σ	Sum
$\sqrt{x}$	Square root of x
π	Pi (3.14.159)
!	Factorial
x^n	Nth power of x
∞	Infinity

Multiplication Table - 30x30

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	**1**	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
2	2	**4**	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60
3	3	6	**9**	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60	63	66	69	72	75	78	81	84	87	90
4	4	8	12	**16**	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80	84	88	92	96	100	104	108	112	116	120
5	5	10	15	20	**25**	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135	140	145	150
6	6	12	18	24	30	**36**	42	48	54	60	66	72	78	84	90	96	102	108	114	120	126	132	138	144	150	156	162	168	174	180
7	7	14	21	28	35	42	**49**	56	63	70	77	84	91	98	105	112	119	126	133	140	147	154	161	168	175	182	189	196	203	210
8	8	16	24	32	40	48	56	**64**	72	80	88	96	104	112	120	128	136	144	152	160	168	176	184	192	200	208	216	224	232	240
9	9	18	27	36	45	54	63	72	**81**	90	99	108	117	126	135	144	153	162	171	180	189	198	207	216	225	234	243	252	261	270
10	10	20	30	40	50	60	70	80	90	**100**	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300
11	11	22	33	44	55	66	77	88	99	110	**121**	132	143	154	165	176	187	198	209	220	231	242	253	264	275	286	297	308	319	330
12	12	24	36	48	60	72	84	96	108	120	132	**144**	156	168	180	192	204	216	228	240	252	264	276	288	300	312	324	336	348	360
13	13	26	39	52	65	78	91	104	117	130	143	156	**169**	182	195	208	221	234	247	260	273	286	299	312	325	338	351	364	377	390
14	14	28	42	56	70	84	98	112	126	140	154	168	182	**196**	210	224	238	252	266	280	294	308	322	336	350	364	378	392	406	420
15	15	30	45	60	75	90	105	120	135	150	165	180	195	210	**225**	240	255	270	285	300	315	330	345	360	375	390	405	420	435	450
16	16	32	48	64	80	96	112	128	144	160	176	192	208	224	240	**256**	272	288	304	320	336	352	368	384	400	416	432	448	464	480
17	17	34	51	68	85	102	119	136	153	170	187	204	221	238	255	272	**289**	306	323	340	357	374	391	408	425	442	459	476	493	510
18	18	36	54	72	90	108	126	144	162	180	198	216	234	252	270	288	306	**324**	342	360	378	396	414	432	450	468	486	504	522	540
19	19	38	57	76	95	114	133	152	171	190	209	228	247	266	285	304	323	342	**361**	380	399	418	437	456	475	494	513	532	551	570
20	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	320	340	360	380	**400**	420	440	460	480	500	520	540	560	580	600
21	21	42	63	84	105	126	147	168	189	210	231	252	273	294	315	336	357	378	399	420	**441**	462	483	504	525	546	567	588	609	630
22	22	44	66	88	110	132	154	176	198	220	242	264	286	308	330	352	374	396	418	440	462	**484**	506	528	550	572	594	616	638	660
23	23	46	69	92	115	138	161	184	207	230	253	276	299	322	345	368	391	414	437	460	483	506	**529**	552	575	598	621	644	667	690
24	24	48	72	96	120	144	168	192	216	240	264	288	312	336	360	384	408	432	456	480	504	528	552	**576**	600	624	648	672	696	720
25	25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475	500	525	550	575	600	**625**	650	675	700	725	750
26	26	52	78	104	130	156	182	208	234	260	286	312	338	364	390	416	442	468	494	520	546	572	598	624	650	**676**	702	728	754	780
27	27	54	81	108	135	162	189	216	243	270	297	324	351	378	405	432	459	486	513	540	567	594	621	648	675	702	**729**	756	783	810
28	28	56	84	112	140	168	196	224	252	280	308	336	364	392	420	448	476	504	532	560	588	616	644	672	700	728	756	**784**	812	840
29	29	58	87	116	145	174	203	232	261	290	319	348	377	406	435	464	493	522	551	580	609	638	667	696	725	754	783	812	**841**	870
30	30	60	90	120	150	180	210	240	270	300	330	360	390	420	450	480	510	540	570	600	630	660	690	720	750	780	810	840	870	**900**

Types of Numbers – Cheat Sheet

Prime Number – A number that has exactly two (2) factors

- Zero (0) and One (1) are neither prime nor composite because they only have one factor (itself)

Composite Number – A number that has three (3) or more factors

Prime Number Chart

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Even Numbers

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Even Numbers end in

Odd Numbers

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Odd Numbers end in

Even

- Numbers ending in 0, 2, 4, 6, 8

Odd

- Numbers ending in 1, 3, 5, 7, or 9

Divisibility Rules

- **Divisible by 2** – All even numbers are divisible by 2. Even numbers end in 0, 2, 4, 6, or 8 and all are divisible by 2.

- **Divisible by 3** – If the sum of the digits is divisible by 3 so is the number. Add up the digits in the number, if the answer is divisible by 3 so is the number.

- **Divisible by 4** – Odd numbers are ***NEVER*** divisible by 4. Odd numbers end in 1, 3, 5, 7, or 9, so any number ending with one of this will ***NOT*** be divisible by 4.

  Even numbers MAY be divisible by 4. To check, look at the last 2 digits of the number. If the number formed by the last 2 digits is divisible by 4, then the number is divisible by 4.

- **Divisible by 5** – If a number ends in a 5 or a zero then it is divisible by 5

- **Divisible by 6** – If a number is divisible by 2 AND 3, it is divisible by 6.

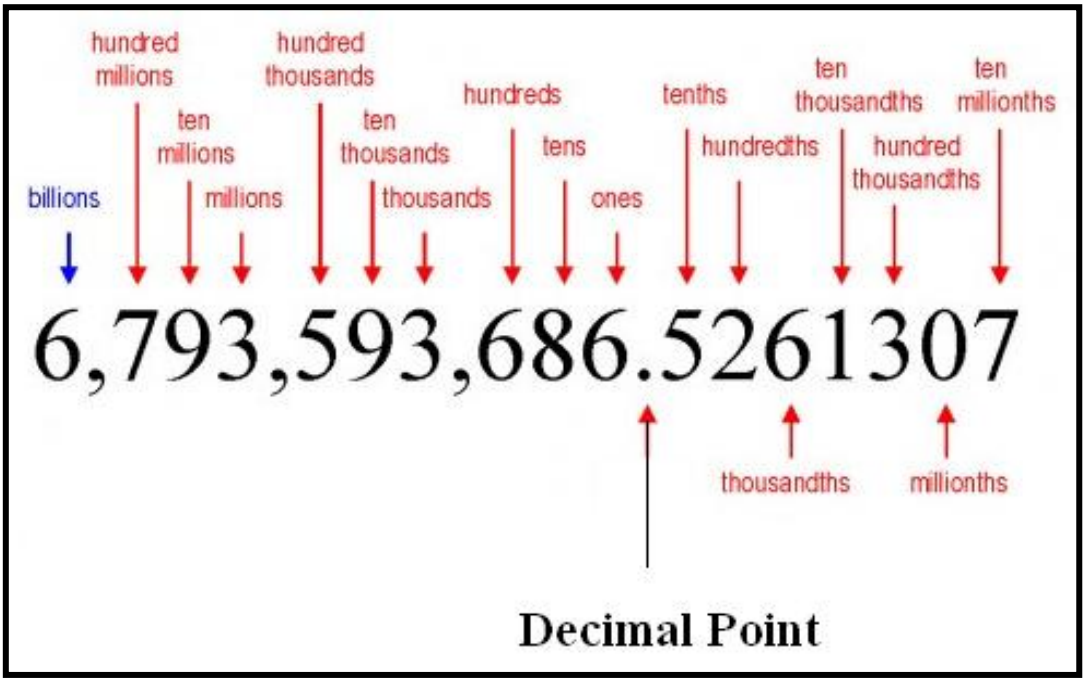
- **Divisible by 9** – – If the sum of the digits is divisible by 9 so is the number. Add up the digits in the number, if the answer is divisible by 9 so is the number.

- **Divisible by 10** – Numbers that are divisible by 10 end in with a zero.

Place Value Cheat Sheet

Understanding Place Value										
Short Word Form:	1 thousand	1 hundred	Ten	One	DECIMAL POINT	1 tenth	1 hundredth	1 thousandth	1 ten-thousandth	1 hundred-thousandth
Decimal:	1,000	100	10	1	.	0.1	0.01	0.001	0.0001	0.00001
Fraction:	$\frac{1000}{1}$	$\frac{100}{1}$	$\frac{10}{1}$	$\frac{1}{1}$		$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$	$\frac{1}{10,000}$	$\frac{1}{100,000}$
Hints:	➢ The part of the number to the left of the decimal is greater than 0.				.	➢ The part of the number to the right of the decimal is less than 0. ➢ The part of the number to the right of the decimal ends with a "th" or "ths" sound.				

From Billions to Ten-millionths



Place Value & Rounding
Comparing & Ordering Decimals

Rounding Rules	Example	Example
1. Underline the determined value	4<u>2</u>.3	5<u>7</u>6.8
2. Draw an arrow to number to the right of underlined number	42.3 	576.8 
3. **0 – 4 = Round Down** (Keep the underline number the same) a. All numbers to the left of underlined number stay the same b. Underlined number stays the same c. All numbers to the right of underlined number go to zero	Round Down 4<u>2</u>.3 ≈ 42.0	Round Up 5<u>7</u>6.8 ≈ 580.0
4. **5 – 9 = Round Up** (Underline number goes up 1) a. All numbers to the left of the underline number stay the same b. Underline number goes up 1 c. All numbers to the right of underlined number go to zero		
Comparing Decimal Rules		
1. Line up the decimals using their decimal point	** If you do not see a decimal point, it is at the end of the number Example = 423 = 423.0	
2. Fill in zeros so that all numbers have the same place value		
3. Compare each number in their "lanes" (from left to right)		
4. Determine greatest to least or least to greatest		

Billions			**Millions**			**Thousand**			**Ones**			.	**Decimals**					
Hundred Billion	**Ten-Billions**	**Billions**	**Hundred-Millions**	**Ten-Millions**	**Millions**	**Hundred-Thousand**	**Ten-Thousands**	**Thousands**	**Hundreds**	**Tens**	**Ones**	.	Tenths	Hundredths	Thousandths	Ten-Thousandths	Hundred-Thousandths	Millionths
												.						
												.						

Measures of Central Tendency: The Mean, Median, Mode, and Range

When finding the measures of central tendency the first step is to place the numbers in order from <u>least</u> to <u>greatest</u>.

<u>Mean</u> (Average): Add up a list of values in a set of data and divide by the number of values you have.

6, 4, 4, 3, 8

Step 1	Put in order from least to greatest	**3, 4, 4, 6, 8**
Step 2	Add up all the numbers	**3 + 4 + 4 + 6 + 8 = 25**
Step 3	Divide by the number of values you have	**25 ÷ 5 = 5**
Answer		**The mean is 5**

<u>Median</u> (Middle): The middle value in a set of data when the values are written in order. If there are 2 values in the middle, find the mean of the two.

6, 4, 4, 3, 8

Step 1	Put in order from least to greatest	**3, 4, 4, 6, 8**
Step 2	Find the middle number **If there are an odd number of data values	**3, 4, *<u>4</u>*, 6, 8**
Answer		**The median is 4**

6, 4, 4, 3, 8, 5

Step 1	Put in order from least to greatest	**3, 4, 4, 5, 6, 8**
Step 2	Find the middle number **If there are an even number of data values then there will be two middle numbers	**3, 4, *<u>4, 5</u>*, 6, 8**
Step 3	Find the mean of the two middle numbers	**4 + 5 = 9** **9 ÷ 2 = 4.5**
Answer		**Median = 4.5**

<u>Mode</u> (MOST): The value in a set of data that is repeated most often. A set of data could have no mode, one mode, or more than one mode.

6, 4, 4, 3, 8

Step 1	Put in order from least to greatest	**3, 4, 4, 6, 8**
Step 2	Find the number that occurs most often	**3, *<u>4</u>*, *<u>4</u>*, 6, 8**
Answer		**The mode is 4**

<u>Range</u>: The largest number minus the smallest number

6, 4, 4, 3, 8

Step 1	Put in order from least to greatest	**3, 4, 4, 6, 8**
Step 2	Subtract the largest number minus the smallest number	**8 - 3**
Answer		**The Range = 5**

Properties

1. Commutative Property

- **Numbers can be added or multiplied in any order and the answer is still the same.**

Examples:

Commutative Property of Addition: $3 + 2 = 2 + 3$ $a + b = b + a$

Commutative Property of Multiplication: $5(4) = 4(5)$ $ab = ba$

2. Associative Property

- **When adding OR multiplying 3 or more numbers, they can be grouped in any way and the answer remains the same.**

Examples:

Associative Property of Addition: $(2 + 4) + 9 = 2 + (4 + 9)$ $a + (b + c) = (a + b) + c$

Associative Property of Multiplication: $(5x4)x2 = 5x(4x2)$ $(cd)e = c(de)$

3. Identity Property of Addition

- **When you add 0 to any number your answer is that number.**

Examples: $5 + 0 = 5$ $0 + 1{,}253 = 1{,}253$ $a + 0 = a$ $0 + b = b$

4. Identity Property of Multiplication

- **When you multiply any number by 1 your answer is that number.**

Examples: $4 \cdot 1 = 4$ $1 \times 746 = 746$ $1 \times a = a$ $b \times 1 = b$

5. Property of Zero

- **Any number multiplied by zero is zero.**

Examples: $0 \times 8 = 0$ $52 \cdot 0 = 0$ $a \cdot 0 = 0$ $0 \times b = 0$

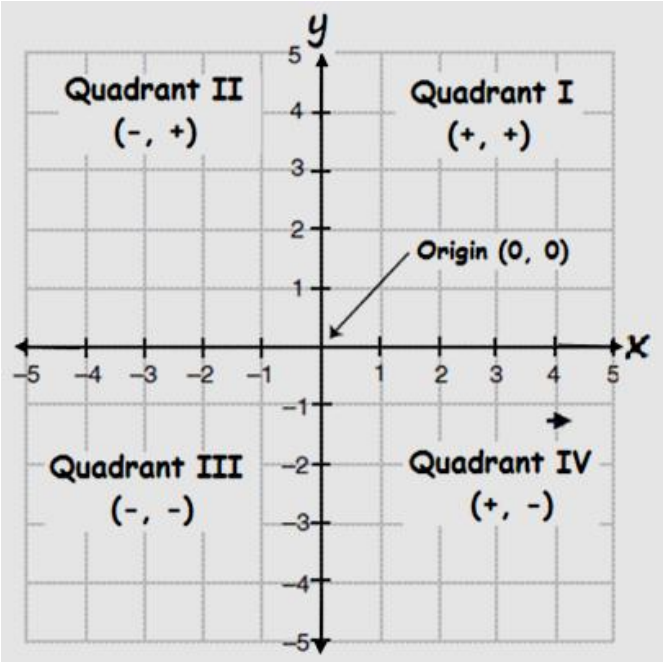
6. Distributive Property

- **Multiplying a sum by a number is the same as multiplying each addend by the number and then adding the products.**

Examples: $2(3 + 4) = 2 \cdot 3 + 2 \cdot 4$ $a \times (b + c) = (a \times b) + (a \times c)$

Coordinate Plane Cheat Sheet

This is a **coordinate plane**. Sometimes it is referred to as a **coordinate graph**. It has two axes and four quadrants. The two number lines form the axes. The horizontal number line is called the **x-axis (↔)** and the vertical number line is called the **y-axis (↕)**.



The **coordinate plane** is divided into 4 part called quadrants. See the figure to the right to see the location and name of each quadrant.

You can describe points on this graph by using a coordinate pair. A coordinate pair has an ***x*-coordinate** and a ***y*-coordinate** and looks like this: (x, y). The center of the coordinate plane is called the **origin**.
The **origin** has coordinates of (0, 0).

Locating Points on a Coordinate Graph

Locating points on a coordinate graph is very similar to playing the game Battle Ships. The coordinates tell you exactly where the point will be located. The x- and y-coordinates in the coordinate pair tell you which way to go and how far to go.

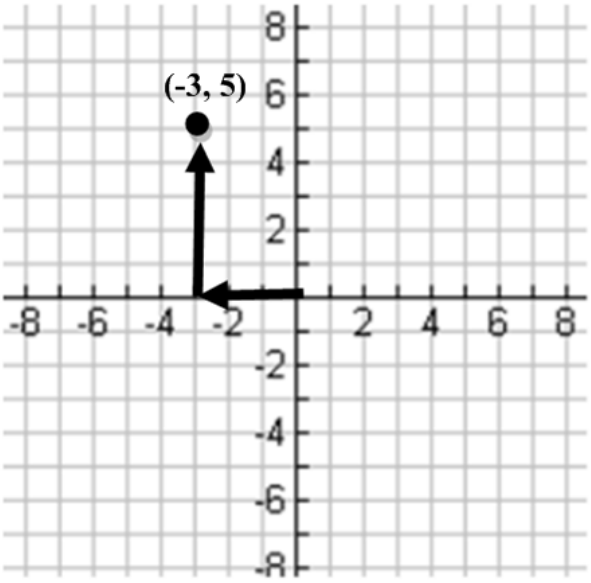
Follow the steps below:

It takes 2 moves to plot a point.

1.) Start at the origin

2.) The x-coordinate comes first and it moves to the right or left. Right for positive numbers and left for negative.
Example: (-3, 5)
For the 1st move, the x-coordinate is -3 so starting at the origin, move 3 places to the left.

3.) The y-coordinate comes last & it moves up or down. Up for positive numbers and down for negative.
Example: (-3, 5)
You have already moved to the left 3 places, and for the 2nd move go up 5.



Measurement Conversion

Length / Distance

12 in = 1 ft	5,280 ft = 1 mi
3 ft = 1 yard	1,750 yds = 1 mi
1 in = 2.54 cm	1 mm = 0.039 in
1 ft = 30.48 cm	1 cm = 0.394 in
1 yd = 0.914 m	1 m = 1.094 yd
1 mi = 1.509 km	1 km = 0.621 mi

Temperature

32° Farenheight = Water Freezing Point (Standard)
212° Farenheight = Water Boiling Point (Standard)
0° Celsius = Water freezing point (Metric)
100° Celcius = Water Boiling Point (Metric)

°F = °C → °F = (°C x 9) ÷ 5 + 32
°C = °F → °C = (°F - 32) x 5 ÷ 9

Capacity (Volume)

3 tsp = 1 tbsp	2 tbsp = 1 fl oz
8 fl oz = 1 c	2 c = 1 pt
2 pt = 1 qt	4 qt = 1 gal
1 fl oz = 29.574 mL	1 mL = 0.034 fl oz
1 pt = 0.473 L	1 L = 2.113 pt
1 qt = 0.946 L	1 L = 1.057 qt
1 gal = 3.785 L	1 L = 0.264 gal

Mass / Weight

16 oz = 1 lb	2000 lb = 1 ton
1 oz = 28.350 g	1 g = 0.035 oz
1 lb = 0.454 kg	1 kg = 2.205 lb
1 ton = 0.907 metric tons	1 metric ton = 1.102 tons

Conversion Rule

Use the equivalent measures and multiply or divide

Example:

To change inches to centimeters:

$5 \times 2.54 = 12.7\ cm$

(5 = number of inches; 2.54 = number of cm in one inch)

To change centimeters to inches:

$23 \div 2.54 = 9.06$

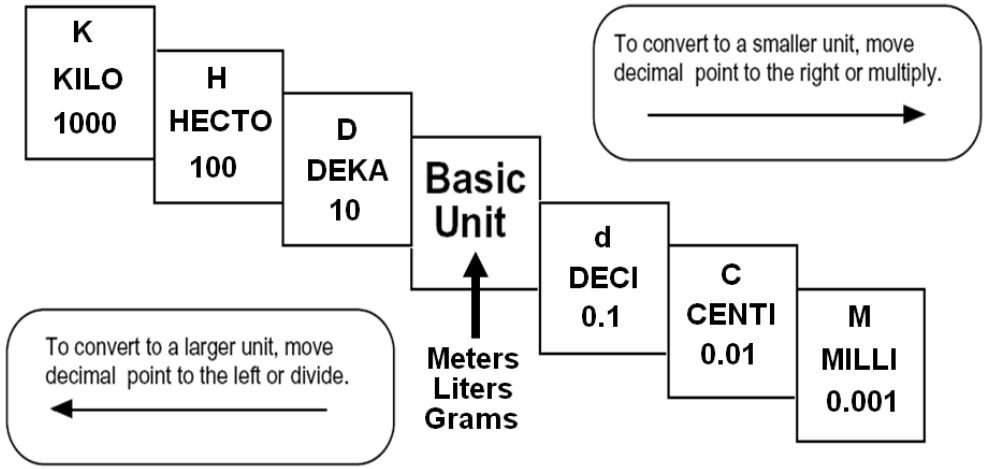
(23 = number of cm; 2.54 = number of cm in one inch)

U.S Customary (Standard)	Metric
in = inch	*mm* = millimeter
ft = foot	*cm* = centimeter
yd = yard	*m* = meter
mi = mile	*km* = kilometer
fl oz = fluid ounce	*mL* = milliliter
pt = pint	*g* = gram
qt = quart	*kg* = kilogram
oz = ounce	
lb = pound	

Abbreviations

Metric Conversion

King Henry Died By Drinking Chocolate Milk
King Henry Doesn't Usually Drink Chocolate Milk



Example

Convert

4 mL = _____ kL

1) Write K H D B D C M

2) 4. ← If there is no decimal point, it is at the end of the number

3) 0 0 0 0 0 4 ← 6 jumps to the left from mL to kL

4) Fill the holes with zero's

5) 4 mL = 0.000004 kL

Compare

200.5 cm _____ 15 m

1) Write: K H D B D C M

2) 200,5 ← Convert centimeters to meters / meters to centimeters

3) 2.005 m < 15 m ← Compare

Order of Operations Cheat Sheet

There is a specific order in which math problems should be worked out. It is called the "order of operations." If you do not work math problems in the correct order, you probably will get the wrong answer. It is like a step-by-step recipe to work out a math problem that will lead you to the correct answer.

1st Parenthesis & Grouping Symbols – 2nd Exponents – 3rd Multiply or Divide – 4th Add or Subtract

Hint: Please guys, excuse my dear Aunt Sallly

			Examples:
P	PG E MD AS **Parenthesis**	**1st** **Do the parenthesis and all other grouping symbols.**	**Parenthesis: (6 + 7)** **Brackets: [(3 + 2) – (2-1)]** **Brackets usually go around a set of parenthesis. Work inside the brackets first until there is nothing left to do.** **Fraction Bars:** $\frac{6\cdot 8}{10+2} = \frac{48}{12} = 4$ **Do everything above the fraction bar, then everything below the Fraction bar, and then divide.**
G	**Grouping symbols such as brackets or a fraction bar.**		
E	**Exponents**	**2nd** **Do all exponents.**	$2^3 = 2\cdot 2\cdot 2 = 8$ $4^2 = 4(4) = 16$
M	**Multiply**	**3rd** **Multiply or divide from LEFT TO RIGHT**	**Sometimes you multiply first, but sometimes you divide first. You decide by going left to right.** **Multiplying comes first:** $6\cdot 2 \div 4$ → $3 \div 4$ → 12 **Dividing comes first:** $18 \div 3\cdot 5$ → $6 \cdot 5$ → 30
D	**Divide**		
A	**Add**	**4th** **Add or subtract from LEFT to RIGHT**	**Sometimes you add first, but sometimes you subtract first. You decide by going left to right.** **Adding comes first:** $4 + 2 - 5$ → $6 - 5$ → 1 **Subtracting comes first:** $7 - 3 + 3$ → $4 + 3$ → 7
S	**Subtract**		

Examples of using the proper order of operations:

Example 1:

$(17 + 3) + 2^3 \div 4 \cdot 2$

$\underline{(17 + 3)} + 2^3 \div 4 \cdot 2$ ← 1st – parenthesis

$20 + \underline{2^3} \div 4 \cdot 2$ ← 2nd – exponents

$20 + \underline{8 \div 4} \cdot 2$ ← 3rd – divide

$20 + \underline{2 \cdot 2}$ ← 4th - multiply

$\underline{20 + 4}$ ← 5th – add

24 ← Answer

Example 2:

$2[6 + (4 - 3)] - 5$

$2[6 + \underline{(4 - 3)}] - 5$ ← 1st – inner parenthesis

$2[\underline{6 + 1}] - 5$ ← 2nd – brackets

$\underline{2[7]} - 5$ ← 3rd – multiply

$\underline{14 - 5}$ ← 4th - subtract

9 ← Answer

Example 3:

$\frac{11+7}{2 \cdot 3} - 3 + 10$

$\frac{11+7}{2 \cdot 3} - 3 + 10$ ← 1st – grouping symbols (above & below fraction bar)

$\frac{18}{6} - 3 + 10$ ← 2nd – divide

$3 - 3 + 10$ ← 3rd – subtract

$0 + 10$ ← 4th – add

0 ← Answer

Example 4:

$3^3 - \frac{7+3}{2} + 2$

$3^3 - \frac{7+3}{2} + 2$ ← 1st – grouping symbols (above & below fraction bar)

$3^3 - \frac{10}{2} + 2$ ← 2nd – divide (finish the grouping symbol)

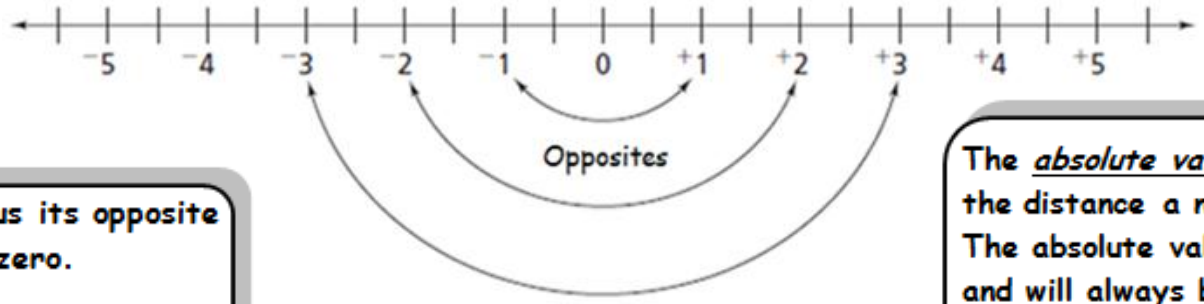
$3^3 - 5 + 2$ ← 3rd – exponent

$27 - 5 + 2$ ← 4th – subtract (because it comes first)

$22 + 2$ ← 5th - add

24 ← Answer

Integers



A number plus its opposite is equal to zero.

5 + (-5) = 0

The *absolute value* of a number is the distance a number is from zero. The absolute value is a distance and will always be positive.

$|4| = 4$ $|-3| = 3$

ADDING INTEGERS

Chip Board	Number Line	Rules
1. Set up chipboard by putting chips on the chip board for the first part of the problem – Remember black chips are positive and red are negative. 2. Add more chips to the chip board from the second part of the problem 3. Calculate the value of the chip board REMEMBER: - Pair up the black and red chips. - One black chip & one red chip equal zero. - Remove each pair from the board - The final value is represented by what is left on the board.	1. Find starting point 2. ADDING mean you'll MOVE to the RIGHT. 3. If you come to a NEGATIVE SIGN in the problem, you must CHANGE DIRECTIONS. Move and see where you land, that is your answer.	1. **Positive + Positive = Positive** • Just add • Answer is positive 2. **Negative + Negative = Negative** • Ignore the signs & just add Answer is negative 3. **Negative + Positive = Neg. or Pos.** **Positive + Negative = Neg. or Pos.** • Ignore signs & subtract • If you have more negatives, the answer is negative • If you have more positives, the answer is positive.

SUBTRACTING INTEGERS

Rules	Easy Method	Number Line #1	Number Line #2
1. Rewrite the subtraction problem as an addition problem. • **Subtracting a number is the same as adding it's opposite**. **2.** Now just follow the rules for adding integers **Examples**: 7 – 5 = is the same as 7 + (-5) = Subtracting 5 is the same as adding its opposite (-5). Now just add. ********** -6 – (-3) is the same as -6 + 3 = Subtracting -3 is the same as adding its opposite (3). Now just add. ********** -2 – 9 = is the same as -2 + (-9) = Subtracting 9 is the same as adding its opposite (-9). Now just add.	**1.** Cross the line then change the sign. **2.** Then just follow the rules for adding integers. **Examples**: 6 – 2 = Cross the line and change the sign. You get: 6 + $^{-}$2 = Now follow the rule for adding, ********** -8 – (-5) = Cross the line & change the sign. You get: -8 + ($^{+}$5) = Now follow the rule for adding. ********** -4 – 7 = Cross the line and change the sign. You get: -4 + $^{-}$7 = Follow rules; add.	**1.** Find starting point **2.** **SUBTRACTING** mean you'll **MOVE** to the LEFT. **3.** If you come to a **NEGATIVE SIGN** in the problem, you must **CHANGE DIRECTIONS**. **4.** Move and see where you land, that is your answer.	**1.** Subtraction means you are finding a "difference". • "Difference" basically means that you need to find out how far apart the numbers are from each other. **2.** Put both numbers on the number line and see how many far apart they are. **3.** Now you must determine whether you answer is positive or negative. • *A large number minus a smaller number has a positive answer.* • *A small number minus a larger number has a negative answer.* **Large – Small = Positive** **Small – Large = Negative**

Multiplying Integers

- Positive x Positive = Positive
- Negative x Negative = Positive
- Positive x Negative = Negative
- Negative x Positive = Negative

Dividing Integers

- Positive ÷ Positive = Positive
- Negative ÷ Negative = Positive
- Positive ÷ Negative = Negative
- Negative ÷ Positive = Negative

Fraction Operations

Adding & Subtracting Fractions

1. Make sure the denominators are the same.
2. If needed, we have to build each fraction so that the denominators are the same.
3. Then, we add or subtract the numerators.
4. The denominator of your answer will be the same denominator of the built-up fractions.
5. Reduce or simplify the answer, if required.

Examples: To add or subtract fractions with a ***common denominator***, you simply omit Step#1.

1/3 + 1/3 = 2/3

Note: DO NOT add or subtract denominators!

When adding fractions with *different denominators*, we do all the steps.

1/2 + 1/3

3/6 + 2/6 = 5/6

Multiplying Fractions

Here are the Rules for multiplying fractions…

1. You do ***not*** have to worry about a common denominator!
2. If possible, simplify before you multiply.
3. Multiply the numerators.
4. Multiply the denominators.
5. Simplify or reduce the resulting fraction, if possible.

Examples:

$$\frac{2}{3} \times \frac{4}{5} = \frac{8}{15}$$

Remember: You do ***not*** have to worry about a common denominator! Just multiply the numerators & then multiply the denominators!!

Multiplying Mixed Numbers

1. Change the mixed numbers into improper fraction
2. If possible, simplify first.
3. Multiply the numerators.
4. Multiply the denominators.
5. If necessary, rewrite your answer as a mixed number and check to be sure it is in simplest form.

Examples: $1\frac{1}{3} \times 2\frac{3}{4} =$

Change mixed numbers to improper fractions then solve.

$$\frac{4}{3} \times \frac{11}{4} = \frac{44}{12} = \frac{11}{3} = 3\frac{2}{3}$$

Dividing Fractions

A Key Word to Understand

Reciprocal

A ***reciprocal*** of a number is when the numerator and denominator switch places.

If the fraction is a mixed number, change it to an improper fraction first, then write its ***reciprocal***. The product of any number and its reciprocal is always one.

Example:

The ***reciprocal*** of $\frac{3}{4}$ is $\frac{4}{3}$.

The ***reciprocal*** of $\frac{1}{5}$ is $\frac{5}{1}$.

Example of ***reciprocal*** with mixed numbers:

$1\frac{1}{2}$ equals $\frac{3}{2}$ and it's ***reciprocal*** is $\frac{2}{3}$

Steps for Dividing Fractions

1. Rewrite the division problem as a multiplication problem, but multiply by the ***reciprocal*** of the number you were dividing by.
2. Simplify before you multiply.
3. Multiply the numerators.
4. Multiply the denominators.
5. Be sure your answer in its simplified or reduced form. Change improper fraction to whole numbers or mixed numbers.

Example:

$\frac{1}{2} \div \frac{1}{3}$

Rewrite as a multiplication using the ***reciprocal***.

$\frac{1}{2} \times \frac{3}{1}$ Now solve.

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

Hints for Dividing Mixed Numbers

1. Change the mixed numbers into improper fraction
2. Rewrite the division problem as a multiplication problem, but multiply by the ***reciprocal*** of the number you were dividing by.
3. Simplify before you multiply.
4. Multiply the numerators.
5. Multiply the denominators.
6. Be sure your answer in its simplified or reduced form. Change improper fraction to whole numbers or mixed numbers.

Example:

$1\frac{1}{2} \div 2\frac{2}{3}$

Rewrite division problem with improper fractions.

$\frac{3}{2} \div \frac{8}{3}$

Now rewrite as a multiplication using the ***reciprocal***, and solve.

$\frac{3}{2} \times \frac{3}{8} = \frac{9}{16}$

Ladder / Slide Method

Greatest Common Factor or Divisor (GCF/GCD):

Highest number that divides exactly into two or more numbers

Least Common Denominator or Multiple (LCM or LCD):

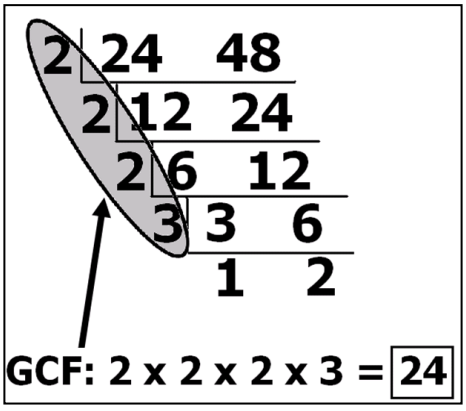
Smallest number that is a multiple of two or more numbers

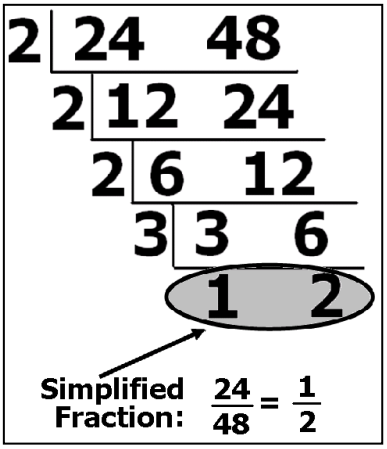
Smallest Number that is a multiple of two or more denominators

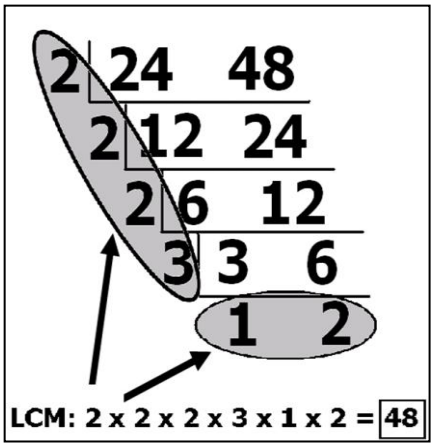
Simplified Fractions:

Reduce a number to make as simple as possible. (Numbers only have a factor of one that is the same)

Step 1:	Write the two numbers in a box
Step 2:	Find a factor that goes into both numbers
Step 3:	Divide both numbers
Step 4:	Continue this process until both numbers only have a factor of 1 that is similar
GCF/GCD	Multiply the left side
LCM/LCD	Multiply the left side and the bottom numbers
Simplified Fractions	Bottom numbers become you simplified fraction







Fractions, Decimals, & Percents

Change a . . .	To a . . .	To a . . .
Fraction	**Decimal**	**Percent**
	Divide the numerator by the denominator. **Example**: ¾ would be 3 ÷ 4 = 0.75	**Change the fraction to a decimal then multiply the decimal by 100.** **Example**: ¾ = 0.75 Then 0.75 x 100 = 75%

Change a . . .	To a . . .	To a . . .
Decimal	**Percent**	**Fraction**
	Multiply the decimal by 100. **Example**: To change 0.382 to a percent just multiply by 100. 0.382 x 100 = 38.2%	**If you can read the decimal properly you can write it as a fraction. Simplify the fraction.** **Example**: 0.875 reads 875 thousandths – as a fraction that would be $\frac{875}{1000}$ - which reads exactly the same. Now simplify your answer and you are finished $\frac{875}{1000} = \frac{7}{8}$.

Change a . . .	To a . . .	To a . . .
Percent	**Decimal**	**Fraction**
	Divide the percent by 100. Example: 75% would be 75 ÷ 100 = 0.75 So 75% = 0.75	**Write the percent as a fraction over 100 then simplify the fraction.** **Example**: 75% would be $\frac{75}{100}$. Simplified $\frac{75}{100} = ¾$

Finding the Percent of a Number

To find the percent of a number – Multiply the number by the percent written as a decimal or a fraction.

Example: 75% of 40 . 75% = 0.75 so this would be 0.75 x 40 = 30 OR since 75% = $\frac{75}{100}$ = ¾ then ¾ x 40 = 30.

Finding the Fraction of a Number

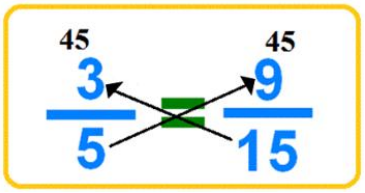
Multiply the number by the fraction or if the fraction can be written as a terminating decimal then you can also multiply by the fraction written as a decimal.

Example: ¾ of 28 would be ¾ x 28 = 21 OR 0.75 x 28 = 21

Cross Products

The Rule of Cross Products states that when you multiply the diagonals of 2 fractions they are equal.

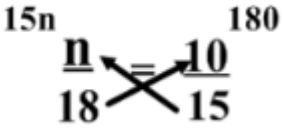
You can see in the example that **15 x 3 = 45** and **5 x 9 = 45**
or we could say **15 x 3 = 5 x 9**



The Rule of Cross Products has truths that are helpful in solving for a missing part of 2 equivalent fractions, ratios or proportions.

EXAMPLE: $\frac{n}{18} = \frac{10}{15}$

Because of the Rule of Cross Product we know that
15n = 18 x 10 or 15n = 180.



This can be solved algebraically but most prefer the quick and easy way below.

QUICK AND EASY SOLUTION

Cross Products
Steps:
1.) Multiply diagonals.
2.) Divide by leftovers.

Example: $\frac{n}{18} = \frac{10}{15}$

1.) 18 x 10 = 180
2.) 180 ÷ 15 = 12
So, n = 12

Ratios Rates & Proportions

Ratio: A comparison between two different amounts.

There are 3 ways to write ratios

8 to 3 **8:3** $\frac{8}{3}$

A ratio is usually a **part-to-part** comparison, but it can be a part to whole comparison.

Example: The score was 15 to 4.
There are two parts being compared - the score of one team being compared to the score of the other team.

Proportion: Two ratios that are equal to each other.

Example:

$$\frac{4 \text{ cats}}{3 \text{ dogs}} = \frac{24 \text{ cats}}{8 \text{ dogs}}$$

Proportions are used when two things are being compared and one of the parts is missing.
Example: Margaret knows that she can serve 7 people with 2 cans of green beans. She will be feeling 84 people at the luncheon. How many cans of green beans will she need to buy?

$$\frac{2 \text{ cans}}{7 \text{ people}} = \frac{N \text{ cans}}{84 \text{ people}}$$

N = 24 cans

Rate: A ratio comparing 2 amounts measured in 2 different units.

Example: The ratio below is comparing minutes to kilometers. These are two different units of measurement so this ratio is a rate.

$$\frac{23 \text{ minutes}}{5 \text{ km}}$$

Unit Rate: A unit rate is the amount for 1 item

Example:

The car gets 32 miles per gallon of gasoline. This is a unit rate because we are talking about 1 gallon of gasoline

$$\frac{32 \text{ miles}}{1 \text{ gallon}}$$

A proportion can be used to find a unit rate.
Example: A bottle of shampoo cost $3.99 for 13.5 ounces. Find the unit rate.

$$\frac{\$3.99}{13.5 \text{ oz}} = \frac{N \text{ dollars}}{1 \text{ oz}}$$

N = about $0.30 per ounce

Comparing with Fractions, Percents, Ratios, and Proportions

What is being compared?		
Fractions:	***Always*** a **part to whole** comparisons.	Numerator → **part** Denominator → **whole**
Percents:	***Always*** a **part to whole** comparison.	The percent is the part out of 100. **Example**: 53% 53 is the **part** out of 100. The 100 represents the **whole**.
Ratios:	***Usually*** a **part** to **part** comparisons, but ***may be*** **Part to whole** comparisons.	- Most of the time 1 part is being compared to another part - Sometimes 1 part is being compared to the whole - You need to look at what the number represent then think…. Are these separate parts or is one a whole?
Proportions:	***Always*** **comparing 2 equal ratios.**	Used to help find a missing part when things are being compared. Example: $\frac{3 \text{ dogs}}{5 \text{ cats}} = \frac{N \text{ dogs}}{120 \text{ cats}}$ N = 72 dogs

Key Words			
"to"	A ratio usually uses "to". Look for 2 things being compared.	**"altogether"**	"Altogether" usually refers to a whole.
"all"	"All" usually refers to a whole.	**"total"**	"Total" usually refers to a whole.

There are 8 girls and 12 boys in Mrs. Green's 4th hour class.	
Find the ratio of boys to girls.	**Think: A ratio is a part to part comparison.** • Ask yourself: What part are boys? 12 boys • Ask yourself: What part are girls? 8 girls • Now write your ratio with the boys first and then the girl. 12 :8 or 12 to 8 or 12/8
Find the fraction of the students that are girls.	**Think: A fraction is a part to whole comparison.** • Ask yourself: What part are the girls? 8 girls • Ask yourself: What number represents the whole class? 20 students $\frac{8}{20}$ or $\frac{2}{5}$ **of the class are girls.**
Find the percent of students that are girls.	**Think: A percent is a part to whole comparison.** • Ask yourself: What part of the class are girls? 8 boys • Ask yourself: What number represents the whole class? 20 students. **Think: You just found the fraction of the students.** • Change the fraction to a decimal to a percent. $\frac{8}{20}$ **= 0.4 = 40%**

Solving Percent Problems

Finding Percent of a Number -- There are 2 common ways – using a *proportion* or using an *equation*.

Finding the Percent of a Number

Using a Proportion

Things you need to know:

- **Remember**: A percent is a part to whole comparison. The part is the percent and the whole is 100.
- A percent can be written as a fraction out of 100.
- $72\% = \frac{72}{100}$

How it works:

1. Find 25% of 68

2. Write a *part* to whole proportion.

$$\frac{25}{100} = \frac{n}{68}$$

3. Solve the proportion by multiplying diagonals and dividing by left-over. So, $n = 17$.

4. Therefore, 25% of 68 is 17.

5. **Hint**: The "of" in the problem "25% of 68" will *usually* be hooked to the number that represents the whole.

Other examples:

1. 11% of 840 ⟶ $\frac{11}{100} = \frac{n}{840}$ Solve and $n = 92.4$

So 11% of 840 = 92.4

2. 32% of 912 ⟶ $\frac{32}{100} = \frac{n}{912}$ Solve and $n =$ 291.84

So, 32% of 912 is 291.84

Using an Equation

Things you need to know:

- **Remember**: A percent is a part to whole comparison. The part is the percent and the whole is 100.
- A percent can be written as a decimal by dividing the percent by 100.
- 72% = 72 ÷ 100 = 0.72

How it works:

1. Find 25% of 68

2. In math "of" *usually* always means multiply.

3. So 25% of 68 would mean to multiply 25% by 68.

4. First, change 25% to a decimal.

25% = 25 ÷ 100 = 0.25

5. Rewrite the original problem as a multiplication problem, but multiply by the percent written as a decimal.

25% of 68

0.25 x 68 = 17

6. Therefore, 25% of 68 is 17

Other examples:

1. 11% of 840 ⟶ Remember: 11% = 0.11

0.11 x 840 = 92.4

So 11% of 840 = 92.4

2. 32% of 912 ⟶ Remember: 32% = 0.11

0.32 x 912 = 291.84

So, 32% of 912 is 291.84

Other Types of Percent Problems

- So far you have learned to find the percent of a number. You are finding the part when given the whole.
- Sometimes you are given the part asked to find the whole, or you might be given the part and the whole and asked to find the percent.
- It is important that you understand the word used in percent problems.

Hints: a.) "IS" *usually* represents the part.
b.) "OF" *usually* represents the whole
c.) Proportions are the easiest way to solve these problems. ⟶ $\frac{percent}{100} = \frac{is}{of}$

EXAMPLES

1.) 24 is what percent of 32? ⟶ **Fill in your proportion:** $\frac{percent-we\ don't\ know}{100} = \frac{24\ is}{of\ 32}$

So our proportion is $\frac{p}{100} = \frac{24}{32}$ ⟶ Solve: $p = 75$ Answer is 75%

2.) What number is 62% of 50? ⟶ **Fill in your proportion:** $\frac{62}{100} = \frac{is-we\ don't\ know}{of\ 50}$

So our proportion is $\frac{62}{100} = \frac{n}{50}$ ⟶ Solve: $n = 32$ Answer is 32.

3.) 28 is 35% of what number? ⟶ **Fill in your proportion:** $\frac{35}{100} = \frac{28\ is}{of-we\ don't\ know}$

So our proportion is $\frac{35}{100} = \frac{28}{n}$ ⟶ Solve: $n = 80$ Answer is 80

4.) 8 is what percent of 400? ⟶ **Fill in your proportion:** $\frac{percent-we\ don't\ know}{100} = \frac{8\ is}{of\ 400}$

So our proportion is $\frac{p}{100} = \frac{8}{400}$ ⟶ Solve: $p = 2$ Answer is 2%

Substitution & Variable Cheat Sheet

Substitution is used to replace a value for a *variable* in an expression, equation, or formula.

Things you need to know:

- **What is a variable?** A variable is a letter that represents a number in an expression or equation.

  Examples: $5 + n = 2$ ⟶ '*n*' is the variable
  $f - g$ ⟶ '*f*' and "*g*" are variables

- **What does it mean when a number is right next a variable?**
  When a number is right next to a variable it means multiply.

  Example: $3t = 15$ Because the '*t*' is right next to the 3, this means 't' multiplied by 3.

- **What does it mean when 2 variables are right next to each other?**
  When a 2 variables are right next to each other it means multiply.

  Example: *xy* Because the '*x*' and '*y*' are right next to each other it means the value 'x' Is multiplied by the value of '*y*'.

EXAMPLES:

a. Solve the problem if $a + b$ if $a = 3$ and $b = 5$

1st	**Write out the problem** ⟶	$a + b$
2nd	**Show the substitutions**	$3 + 5$
	- Take out the "*a*" and put in a 3.	
	- Take out the "b" and put in a 5.	8
3rd	**Solve the problem**	

---

b. Solve the problem $6n + 4$ if $n = 0$

1st	**Write out the problem** ⟶	$6n + 4$
2nd	**Show the substitutions**	
	- Take out the '*n*' and put in a 0.	$6(0) + 4$
	- Be sure to show some type of multiplication sign between the 6 and the 0.	$0 + 4$
3rd	**Solve the problem**	4

---

c. Solve the problem $10 - tu$ if $t = 2$ and $u = 4$

1st	**Write out the problem** ⟶	$10 - tu$
2nd	**Show the substitutions**	
	- Take out the '*t*' and put in a 2.	$10 - 2(4)$
	- Take out the '*u*' and put in a 4.	
	- Be sure to show some type of multiplication sign between the 2 and the 4.	$10 + 8$
3rd	**Solve the problem**	18

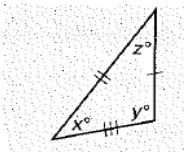
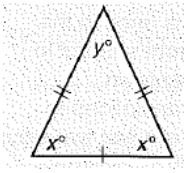
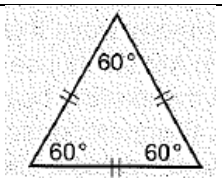
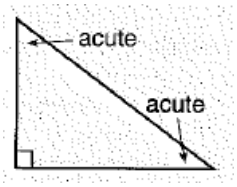
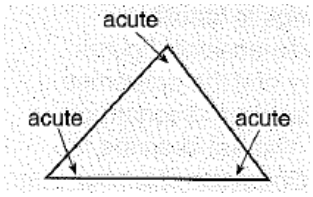
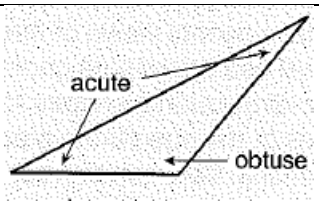
Geometric Figures

Polygons are two-dimensional closed geometric figures formed by line segments.

Two-Dimensional Figures

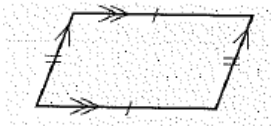
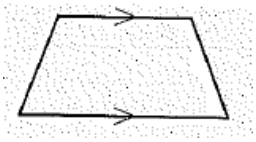
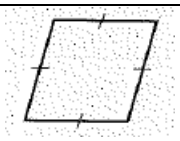
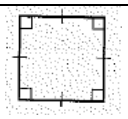
Triangles have 3 sides and 3 angles.

- **The sum of the measure of the inside angles of any triangles is always 180°.**
- **Angle + Angle + Angle = 180°**

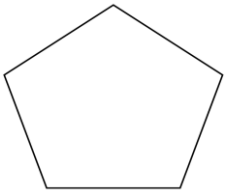
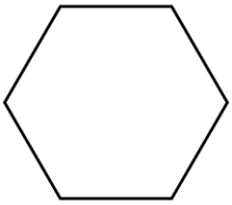
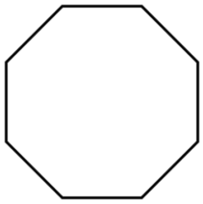
Scalene Triangle	Isosceles Triangle	Equilateral Triangle
		
No congruent sides or congruent angles	At least 2 congruent sides and at least 2 congruent angles	3 congruent sides and 2 congruent angles
Right Triangle	**Acute Triangle**	**Obtuse Triangle**
		
Has a right angle (measure 90º)	All angles measure less than 90º	Has an angle that measures more than 90º

Quadrilaterals have 4 sides and 4 angles.

- **The sum of the measure of the inside angles of any triangles is always 360°.**
- **Angle + Angle + Angle + Angle = 360°**

Quadrilateral	Parallelogram	Trapezoid
		
Any closed figure with 4 sides	Opposite sides are congruent and parallesl	Exacly 1 pair of parallel sides
Rectangle	**Rhombus**	**Square**
		
A parallelogram with 4 right angles	A parallelogram with 4 congruent sides	A parallelogram with 4 right angles and 4 congruent sides. (A rhombus with 4 right angles) (A rectangle with 4 equal sides.)

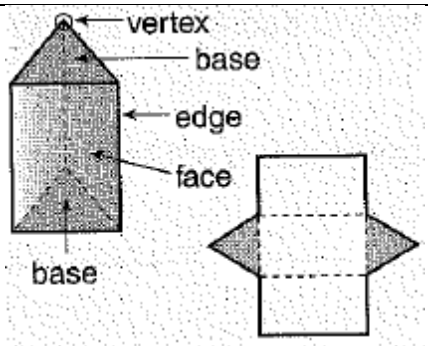
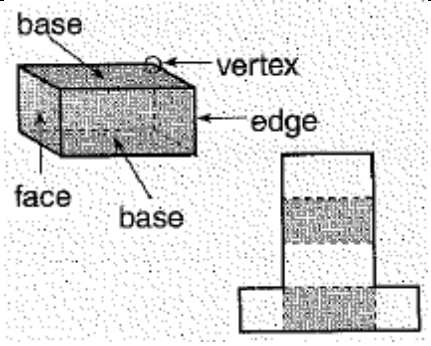
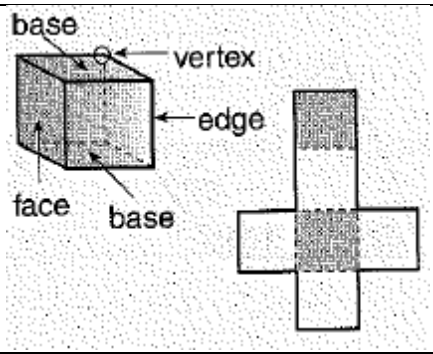
Other Common Two-Dimensional Figures

Pentagon	Hexagon	Octagon
		
A polygon with 5 sides and 5 angles	A polygon with 6 sides and 6 angles	A polygon with 8 sides and 8 angles

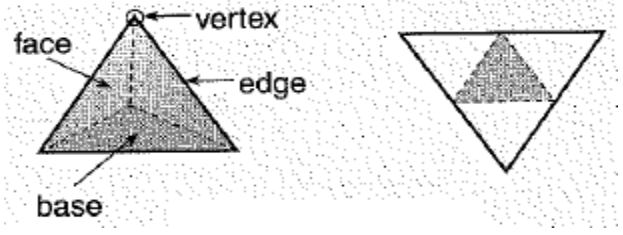
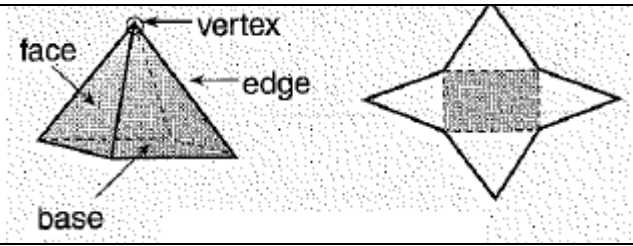
Three Dimensional Figures

A 3-dimensional figure has length, width, and height. The surfaces may be flat or curved. A 3-dimensional figure with flat surfaces is called a *polyhedron*.

Prisms

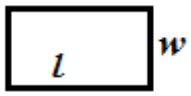
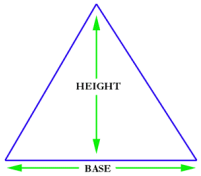
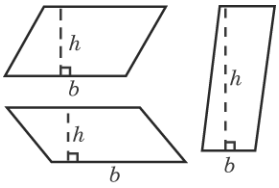
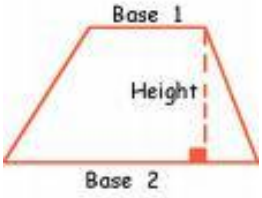
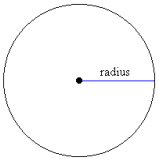
Triangular Prisms:	Rectangular Prisms:	Cubes:
- 5 faces (2 bases) - 9 edges - 6 vertices	- 6 faces (2 bases) - 12 edges - 8 vertices	- 6 faces (2 bases) - 12 edges - 8 vertices
		

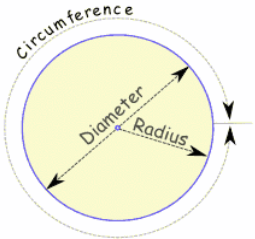
Pyramids

Triangular Pyramid:	Rectangular Prisms:
- 4 faces (1 base – it's a triangle) - 6 edges - 4 vertices	- 5 faces (1 base – it's a rectangle) - 8 edges - 5 vertices
	

AREA (Covering) - The number of square units it takes to cover a figure or an object.

PERIMETER (Distance Around)- The sum of the sides of straight sided figures.

Shape	Example	Area Equation/Formula	Perimeter Equation/Formula
Rectangle		$A = l\,w$	$P = S_1 + S_2 + S_3 + S_4$ $(P = 2l + 2w)$
Triangle		$A = \frac{bh}{2}$ **OR** $A = \frac{1}{2}\,bh$	$P = S_1 + S_2 + S_3$
Parallelogram		$A = bh$	$P = S_1 + S_2 + S_3 + S_4$
Trapezoid		$A = \frac{1}{2}\,h(b + b)$ **or** $A = \frac{h(b + b)}{2}$	$P = S_1 + S_2 + S_3 + S_4$
Circle		$A = \pi\,r^2$	***Circumference*** $C = \pi d$ or $C = 2\pi r$

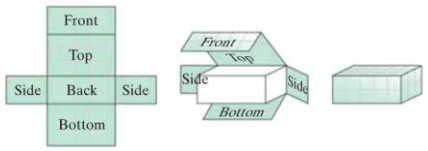
The Circle		
	**Circumference**	The distance around a circle.
	Radius	The distance between the center of the circle and any point on the circle
	Diameter	The distance across the circle through the center
	Pi	$\pi \approx 3.14$ or $\frac{22}{7}$

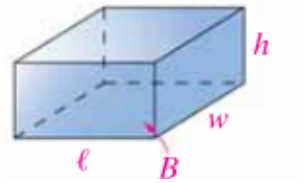
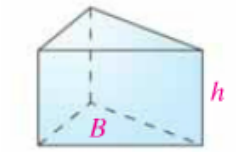
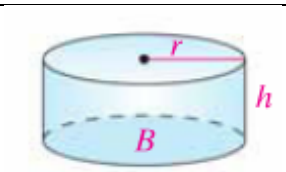
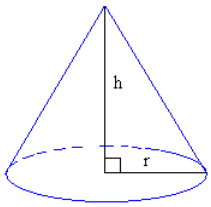
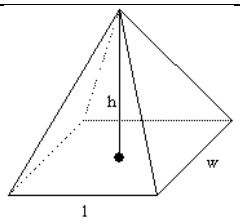
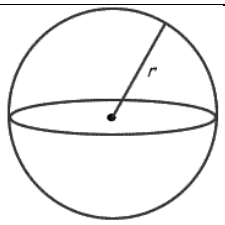
Key					
	b = base	h = height	l = length	w = width	d = diameter
	r = radius	A = Area	$\pi \approx 3.14$ or $\frac{22}{7}$	C = Circumference	

Surface Area - Covering

Total area of a three-dimensional object (Sum)

** Find the area of every side and add them together**



Shape	Example	Equation/Formula
Rectangular Prism		$SA = 2(lw + wh + hl)$
Triangular Prism		$SA = bh + (S_1 + S_2 + S_3)H$
Cylinder		$SA = 2\pi r^2 + 2\pi rh$
Cone		$SA = \pi r^2 + \pi rl$
Rectangular Pyramid		$SA = s^2 + 2sl$
Sphere		$SA = 4\pi r^2$

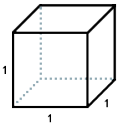
Key

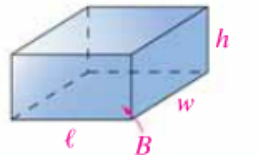
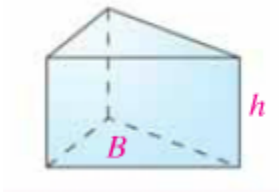
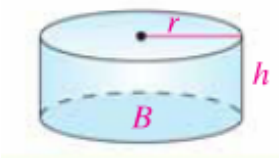
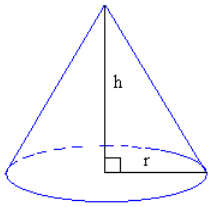
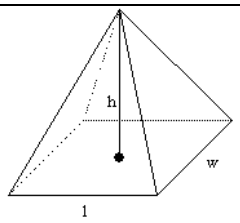
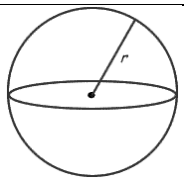
b = base	h = height	r = radius	A = Area	C = Circumference
V = Volume	B = area of base	$\pi \approx 3.14$ or $\frac{22}{7}$		SA = Surface Area

Volume - Filling

The number of cubic units needed to fill the space *inside* the figure

Cubic Unit: A cube with edges of one unit long.



Shape	Example	Equation/Formula
Rectangular Prism		**V = *lwh*** Volume = length x width x height
Triangular Prism		**V = Bh** Volume = area of the triangle x height ★ $\mathbf{V = \frac{bh}{2} \times h}$
Cylinder		**V = Bh** Volume = area of base x height ★ $\mathbf{V = \pi r^2 \cdot h}$
Cone		$V = \frac{1}{3}Bh$ Volume = ⅓ x Area of Base x Height ★ $\mathbf{V = \frac{1}{3} \pi r^2 \cdot h}$
Rectangular Pyramid		$V = \frac{1}{3}Bh$ Volume = ⅓ x Area of Base x Height ★ $\mathbf{V = \frac{1}{3} l \cdot w \cdot h}$
Sphere		$\mathbf{V = \frac{4}{3} \pi r^3}$ Volume = 4/3 x Pi x radius cubed

Key

b = base *h* = height *r* = radius *A* = Area

C = Circumference *V* = Volume *B* = area of base $\pi \approx 3.14$ or $\frac{22}{7}$

Congruent and Similar Figures

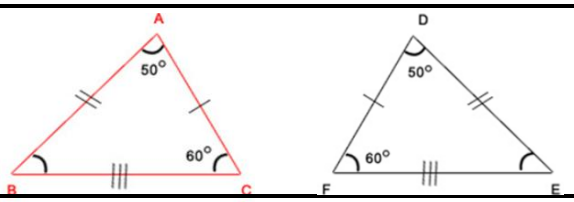
Understanding Congruent Figures

The symbol for congruent ≅

Congruent Figures Must Have
-Same Shape -Same Angles -Same Size -Same Side Lengths

EXAMPLE: Triangles ABC ≅ DEF

Therefore, they have the….
- **Same Shape** - **Same Angles**
- **Same Size** - **Same Side Lengths**



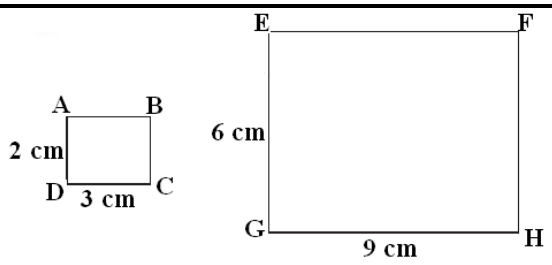
Understanding Similar Figures

The symbol for similar ~

Similar Figures Must Have
-Same Shape -Same Angles -A Scale Factor* -Same Side-to-Side Ratios**

EXAMPLE: Rectangles ABCD ~ EFGH

Therefore, they have the….
- **Same Shape**
- **Same Angles**
- **A *Scale Factor****
- **Same Side-to-Side Ratios****

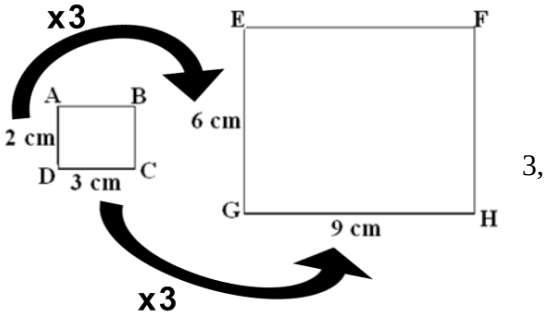


*So, what does *Scale Factor* mean?

The ***Scale Factor*** is the magic number that all of the side lengths of one figure are multiplied by to get all of the side lengths of new figure.

Because all of the side lengths of the smaller figure are all multiplied by 3, the scale factor is 3 or SF = 3.

In similar figures the sides that are in the same position are called corresponding sides. We call the angles that are the same in similar figures, corresponding angles.



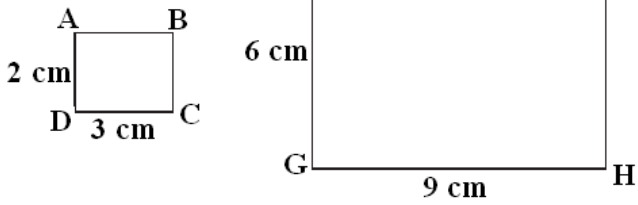
**Then what are *Side-to-Side Ratios*?

In Rectangle ABCD, if you compare the ratio of *the long side to the short side*, it should be equal to the ratio of Rectangle EFGH's long side to its short side.

Rectangle ABCD: $\frac{long}{short}$ $\frac{3}{2} = 1.5$

Rectangle EFGH: $\frac{long}{short}$ $\frac{9}{6} = 1.5$

Therefore, these rectangles have the same side-to-side ratios.



Corresponding Sides and *Corresponding Angles*

In congruent and similar figures the sides that are in the same position in both figures are called ***corresponding sides***. The angles that are the same in both congruent figures and similar figures are called ***corresponding angles***.

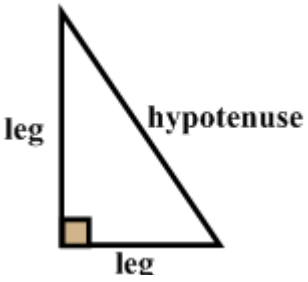
EXAMPLES:

In the rectangles above the short sides in rectangle ABCD corresponds with the short sides in EFGH.
In the triangles above, angle A corresponds with angle D because they are both 50º.

Pythagorean Theorem

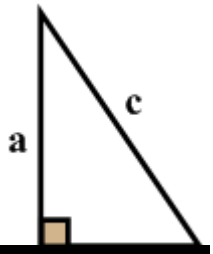
Pythagoras was a Greek philosopher and mathematician, born in Samos in the sixth century B.C. He and his followers tried to explain everything with numbers. One of Pythagoras's most popular ideas is known as The Pythagorean Theorem.

Things you need to know:



1. **Right triangles have 2 legs and a *hypotenuse*.**
   - The legs are the short side.
   - The ***hypotenuse*** is the long side that is opposite the right angle.

2. **What is the Pythagorean Theorem**
   - The Pythagorean Theorem says that the sum of the legs squares of a RIGHT triangle equal the square of the hypotenuse.

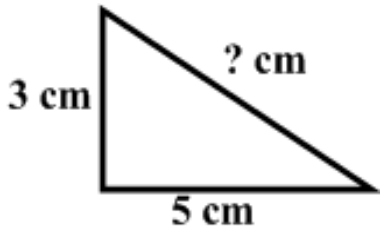


$$a^2 + b^2 = c^2.$$

3. **You can find the missing parts of a right triangle.**

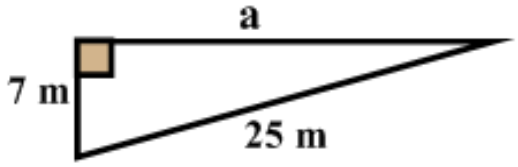
Examples

A. Find the hypotenuse.



$a^2 + b^2 = c^2$	1. Write formula.
$3^2 + 5^2 = c^2$	2. Show substitutions.
$9 + 25 = c^2$	3. Solve.
$36 = c^2$	
$\sqrt{36} = \sqrt{c^2}$	4. Find the square root of c^2.
$c = 6$ cm	5. The hypotenuse equals 6 cm.

B. Find the missing side.



$a^2 + b^2 = c^2$	1. Write formula.
$a^2 + 7^2 = 25^2$	2. Look closely & then show substitutions.
$a^2 + 49 = 625$	3. Solve.
$-49 \quad -49$	4. Subtract 49 from each side.
$a^2 = 576$	
$\sqrt{a^2} = \sqrt{576}$	5. Find the square root of a^2.
$a = 24$ m	6. The missing side is 24 m.

Solving Equations with Hands-On-Algebra

Solving equations is all based on maintaining balance. A scale is used to represent that balance.

Example 1

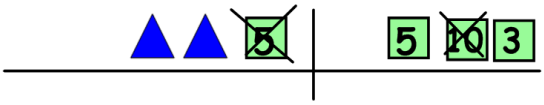
1. Set up your balance scale.

4x + 5 = 2x + 13

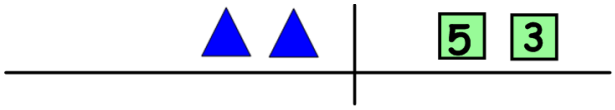
2. There are pawns on both sides so to maintain balance, remove 2 pawns from each side.

3. Now you are left with 2x + 5 = 13.

4. There are cubes on both side. Now remove 5 from the cubes on each side.



5. You are now left with **2x = 8**



6. If 2 pawns equals 8, then each pawn must equal 4. So, **x = 4** (Hint: 8÷2)

7. Finally check your answer if **x = 4**.

4x + 5 = 2x + 13

Substitute: 4(4) + 5 = 2(4) + 13

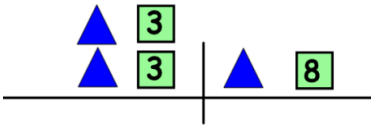
Solve: 16 + 5 = 8 + 13

21 = 21 It checks.

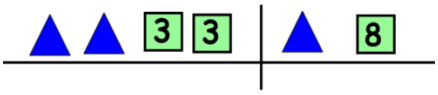
Example 2

1. Set up your balance scale. Hint: The 2 outside the parenthesis means you must do the inside of the parenthesis twice.

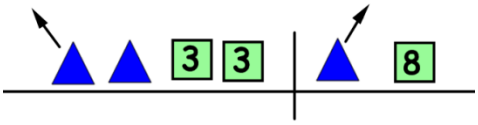
2(x +3) = x + 8



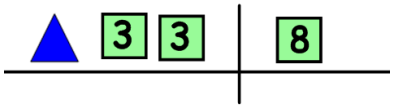
2. When you lay it all out it looks like this.



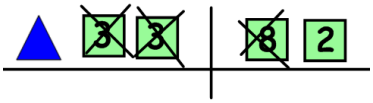
3. There are pawns on both sides so to maintain balance, remove 1 pawn from each side.



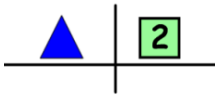
4. Now you are left with **x + 3 = 8**



5. There are cubes on both sides. Now remove 6 from the cubes on each side.



6. Because you have all your pawns on one side and all of your cubes on the other you are finished. You are now left with **x = 2**.



7. Finally check your answer if **x = 2**.

2(x +3) = x + 8

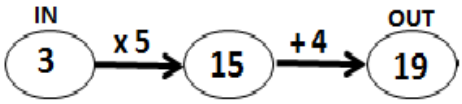
Substitute: 2(2 + 3) = 2 + 8

Solve: 2(5) = 10

10 = 10 It checks.

Understanding Flow Charts

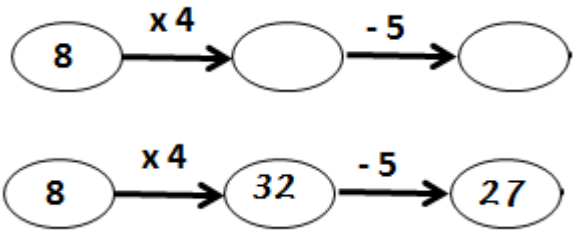
A ***flow chart*** is a visual diagram that shows each step in evaluating an algebraic expression or equation.



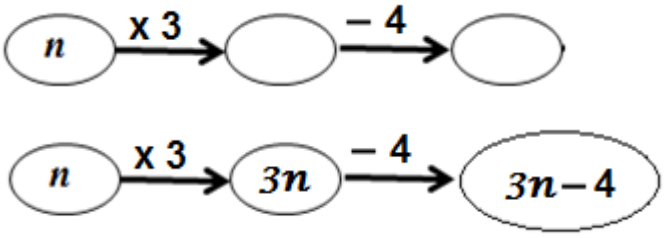
EXAMPLES:

I. Just follow the rules and arrows.

a.



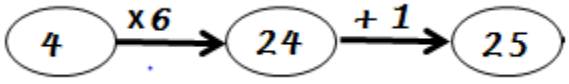
b.



II. Flow charts can be created from expressions. **HINT: ORDER OF OPERATIONS IS VERY IMPORTANT. Start with the variable. What do you do first? Next? Notice the difference in these two flow charts.** ***AGAIN, ORDER OF OPERATIONS IS VERY IMPORTANT!!***

a. **$6n + 1$**

Solve if $n = 4$.



Your answer is the same when using *substitution* with the original expression:

Solve if n = 4 → **$6n + 1$**
6(4) + 1
25

b. **$6(n + 1)$**

Solve if $n = 4$.

Your answer is the same when using *substitution* with the original expression:

Solve if n = 4 → **$6n + 1$**
6(4 + 1)
6(5)
30

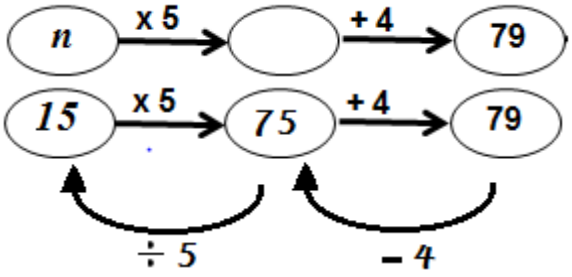
III. Flow charts can be used to solve equations.

1. Create a flow chart for the equation. Since 79 is what comes "OUT" put it in the last oval.

2. Work backwards.
- Start at the "OUT", the 79.
- Undo adding 4 by subtracting 4 from 79.
- Finally, undo multiplying by 5 by dividing 75 by 5.
- So $n = 15$

3. Substitute your answer in the original equation to check your answer.

$5n + 4 = 79$



$n = 15$ → **$5n + 4 = 79$**
5(15) + 4 = 79
75 + 4 = 79
79 = 79 It checks.

Solving Equations Mathematically

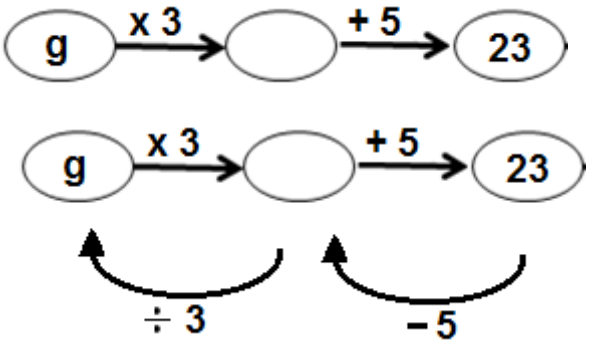
A few hints to solve equations mathematically:

- Remember the importance of keeping the equation "balanced" like with Hands-On-Algebra.
- Think of "undoing" like with the flow charts.
  "**UNDO**" *adding* by *subtracting.* "**UNDO**" *subtracting* by *adding*.
  "**UNDO**" *multiplying* or *dividing.* "**UNDO**" *dividing* by *multiply.*

Examples:

1) **5 + 3g = 23**

5 + 3g = 23



Think about the flow chart

What would you "Undo" first?

- Undo adding 5 by subtracting 5. Remember to keep thing balanced by subtracting 5 from both sides.

5 + 3g = 23
-5 -5
3g = 18

What do you "Undo" next?

- Undo multiplying by 3 by dividing by 3. Keep things balanced by dividing both sides by 3.

$\frac{3g}{3} = \frac{18}{3}$ So, g = 6

2) 2w – 4 = 8
+4 +4 Add 4 to both sides
2w = 12

$\frac{2w}{2} = \frac{12}{2}$ Divide both sides by 2

w = 6

3) $\frac{n}{5} + 3 = 1$
-3 -3 Subtract 3 from both sides.

$\frac{n}{5} = -2$

$5(\frac{n}{5}) = (-2)5$ Multiply both sides by 5
n = -10

4) 22 + 3n = 6n + 4
-4 -4 Take 4 from each side.
18 + 3n = 6n
-3n -3n Take 3n's from each side.
18 = 3n

$\frac{18}{3} = \frac{3n}{3}$ Divide both sides by 3.

6 = n

5) 6 - 5p = p + 30
-6 - 6 Take 6 from each side.
-5p = p + 24
-p = - p Take 1p from each side.
-6p = 24

$\frac{-6p}{-6} = \frac{24}{-6}$ Divide both sides by -6.

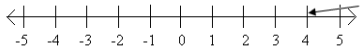
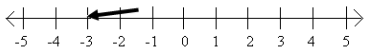
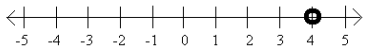
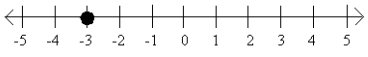
p = -4

Remember to substitute and check your answers!!

Inequalities

Inequality	Two values that are not equal (less than, greater than)		
$<$	**Greater than**	$>$	**Less than**
$\leq$	**Greater than or equal to**	$\geq$	**Less than or equal to**
$\neq$	**Not equal**		

Graphing Inequalities

$x < 4$	$y \geq -3$	
		1. Locate the value for the variable
		2. Mark the point with one of the following a. Closed Circle ***if symbol is*** $\geq$ ***or*** $\leq$ b. Open Circle ***if symbol is*** $<$ ***or*** $>$
		3. Determine which direction you will draw the arrow a. Left → If variable is smaller than the value b. Right → If variable is larger than the value

Solving Inequalities by Adding & Subtracting

Addition & Subtraction Properties of Inequality: You can add or subtract the number to each side of an inequality and the problem stays balanced.

$$\begin{array}{r} n + 3 \leq -4 \\ -3 \quad -3 \\ \hline n \leq -7 \end{array}$$

- Undo adding by subtracting

$$\begin{array}{r} n - 14 > 10 \\ +14 \quad +14 \\ \hline n > 24 \end{array}$$

- Undo subtraction by adding

Solving Inequalities by Multiplying & Dividing

Multiplication & Division Properties of Inequality: You can multiply and divide each side of the inequality by the same number, ***BUT*** you must be careful about the directions of the inequality sign.

- **IF you multiply or divide by a positive number the sign stays exactly how it was.**
- **IF you multiply or divide by a negative number, the sign flips the opposite way.**

$$\begin{array}{r} \frac{n}{2} - 1 \leq 7 \\ +1 \quad +1 \\ \hline \frac{n}{2} \leq 8 \end{array}$$

1) Add 1 to each side.

2) Multiply both sides by 2.

Since you are multiplying each side by a positive number, the sign stays the same.

$$2\left(\frac{n}{2}\right) \geq (8)2$$

$$n \geq 16$$

$$\begin{array}{r} -3n + 4 > 16 \\ -4 \quad -4 \\ \hline -3n > 12 \end{array}$$

1) Subtract 4 from each side.

2) Divide both sides by -3.

Since you are dividing each side by a negative number you must switch the sign from $>$ ***to*** $<$.

$$\frac{-3n}{-3} < \frac{12}{-3}$$

$$n < -4$$

Correctly Answering a Question:

R **Restate the question**	*You need to restate the question so that the person reading your answer knows what the question was asked.*
A **Answer all parts of the question.**	*Many questions have multiple parts, be sure to read, and re-read and answer all parts of the question*
C **Cite Evidence**	*How do you know that this is the correct answer. Many times this can be shown in your work.*
E **Explain**	*Explain the process you used to get the correct answer.*

Word Problem Cheat Sheet

If you see these words in a word problem then use…

Addition (Sum)

- Add
- Altogether
- And
- Both
- How many
- How much
- More than
- In all
- Increased by
- Plus
- Sum
- Together
- Total

Subtraction (Difference)

- Are not
- Change
- Decreased by
- How many did not have
- Less than
- Have left
- Left over
- How many more
- How much more
- Difference
- Fewer

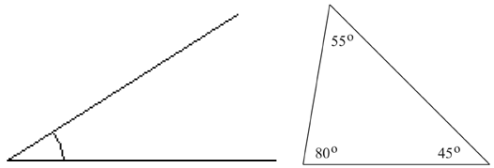
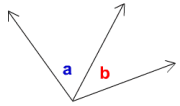
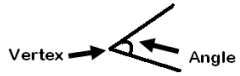
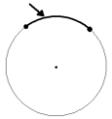
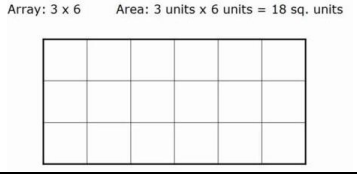
Multiplication (Product)

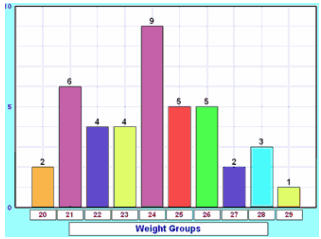
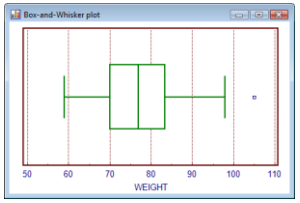
- By (dimensions)
- Double (times two)
- Triple (times three)
- Each group
- Group
- Multiplied by
- Of
- Product of
- Times
- Twice (times two)

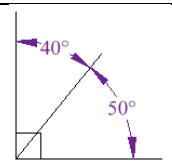
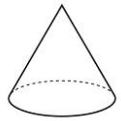
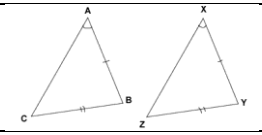
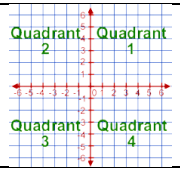
Division (Quotient)

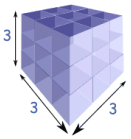
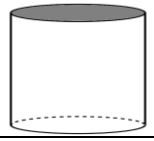
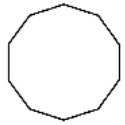
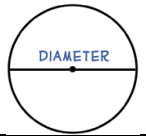
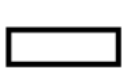
- Each group has
- Half (divide by 2)
- How many in each
- Share something equal
- Fractions – divide by denominator
- Parts
- Quotient of
- Separated
- Split
- Divided by

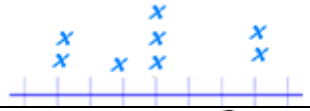
Vocabulary Cheat Sheet

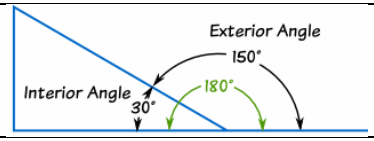
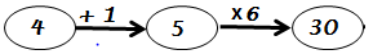
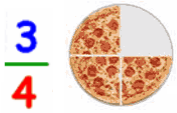
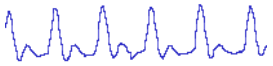
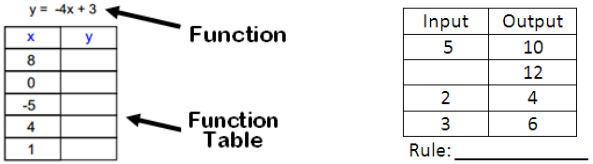
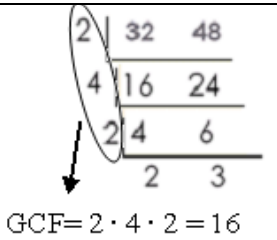
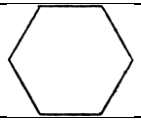
Term	Definition	Example
Absolute Value	Distance from zero – always positive Read – The absolute value of a # is #.	$\|5\| = 5$ 
Acute (Angle)	Angle less than 90˚	
Addend	Numbers being added together	**Addend** + **Addend** = Sum **5** + **4** = 9
Adjacent (angles)	Angles having common sides and common vertex (center point)	
Algebraic	A problem, table, equation that involves a variable	**4m + 7 = 24**
Analyze	Look at data and interpret the results	
Angle	The amount of turn between two straight lines. Meet at a vertex	
Approximation	*See Estimation*	*See Estimation*
Arc	Part of the circumference of a circle	
Area	Covers (square units) *For specific formulas: See Formula Cheat Sheet*	

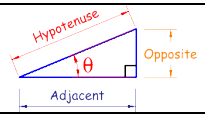
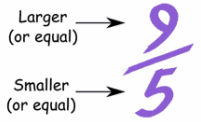
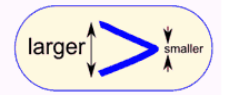
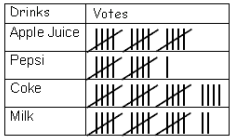
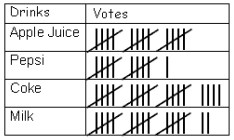
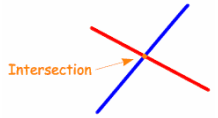
Ascending	Going up from smallest to largest	
Assess	Evaluate or estimate if something may be true or false given conditions	$5 + 3 = 8$?? → True
Associative Property of Addition & Multiplication	Grouping symbols can be moved without the answer changing	$(4 \times 3) \times 2 = 4 \times (3 \times 2)$ $(4 + 3) + 2 = 4 + (3 + 2)$
Average	See mean	
Bar Graph	Graph using rectangular bars	
Box-and-Whisker	Shows outliers and medians Divides data into 4 parts	
Bivariate	Two variable equation	$y = 4x + 3$
Calculate	Solve by applying the four operations	
Centi-	$\frac{1}{100}$	
Circumference	Distance around a circle	

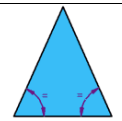
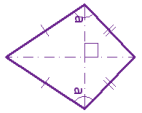
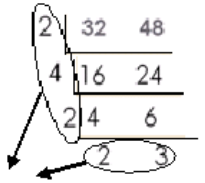
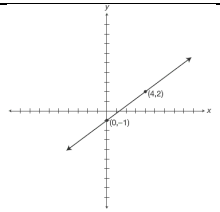
Coefficient	A number used to multiply a variable	$4y - 7 = 5$ Coefficient
Commutative Property of Addition & Multiplication	Multiply or add in any order without changing the answer	$3 \times 6 = 6 \times 3$ $5 + 2 = 2 + 5$
Complimentary Angles	Two angles that add up to 90˚	
Composite Numbers	Numbers that has more than two factors	**Example: 4, 6, 8, 9, 12**
Compute	To solve	
Cone	A 3-dimensional object that has a circular base and it comes to a point	
Congruent	Same measures (angles, length, shape, or size) $\cong$	
Consecutive	Numbers that follow each other in order without gaps	**20, 21, 22, 23…**
Convert	To change from one measurement to a different measurement	**6 mm = _____ km**
Coordinate Graph	Graph that contains an x-axis and y-axis that intersect	
Criterion (Criteria)	Standards or rules that make something true or false	**If a closed figure has 5 straight sides it is a pentagon.**

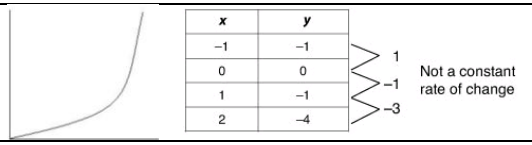
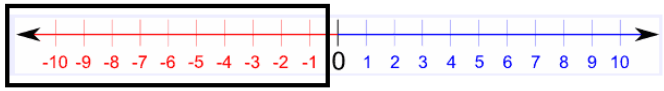
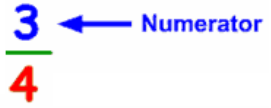
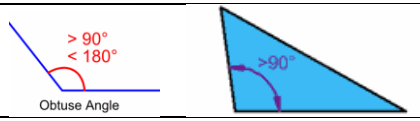
Cube Root	*The number* multiplied by itself 3 times that gives the perfect cube (See Perfect Cube) $\sqrt[3]{}$ $\sqrt[3]{0}=0$ $\sqrt[3]{64}=4$ $\sqrt[3]{512}=8$ $\sqrt[3]{1}=1$ $\sqrt[3]{125}=5$ $\sqrt[3]{729}=9$ $\sqrt[3]{8}=2$ $\sqrt[3]{216}=6$ $\sqrt[3]{1000}=10$ $\sqrt[3]{27}=3$ $\sqrt[3]{343}=7$	$\sqrt[3]{125}=5$ **5 x 5 x 5= 125** 
Cylinder	A 3-dimensional (3-D) shape that has two congruent and parallel round faces	
Deca-	Prefix for tens - 10	Decade – 10 years Decagone – 10 sided figure 
Deci -	Prefix for Tenths - 0.1	**0.1**
Decimal	Any number including whole numbers and numbers with a decimal point.	**9 or 17.5**
Denominator	Bottom number in a fraction	$\frac{3}{4}$ ← Denominator
Descending	Ordering from biggest to smallest	
Diameter	Distance across a circle going through the center	
Difference	Answer to a subtraction problem	Minuend – Subtrahend = **Difference** 8 – 5 = **3**
Dilation	Polygon grows or shrinks but keeps exactly the same shape (Similar Figure – must have a scale factor)	 **SF = 2.5**

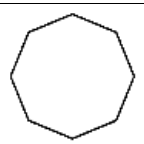
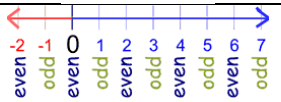
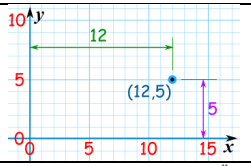
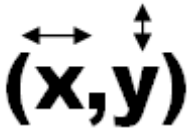
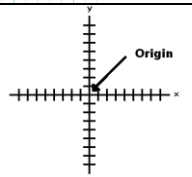
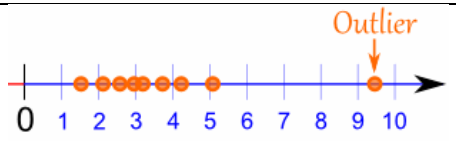
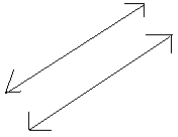
Distribution (Data)	Data and how often (frequency) it occurs	
Distributive Property	The number on the outside of the parentheses is distributed (multiplied) to the numbers on the inside of the parentheses	**Example: $3(2+4)$** **$= 3\cdot 2 + 3\cdot 4$**
Dividend	Number being divided	**Dividend** ÷ Divisor = Quotient **24** ÷ 8 = 3
Divisor	Number dividing	Dividend ÷ **Divisor** = Quotient 24 ÷ **8** = 3
Equation	Problem with an equal sign	$1 + 1 = 2$
Equivalent	Equal	$=$
Estimate (Estimation)	Approximate answer (Around the same number)	$3.4 \approx 3$
Evaluate	Solve the problem!!!!!!	$6-(5-3)+10$ $=6-2+10$ $=4+10$ $=14$
Even	Numbers ending in 0, 2, 4, 6, and 8	Example: 2, 12, 14, 102
Event	A single incident (occurrence)	
Exponent	Shows how many times you multiply a number	exponent (or index, or power), base $8^2 = 8 \cdot 8$
Expression	Problem without an equal sign	**$4 \cdot 5$**

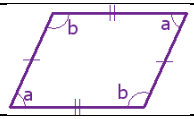
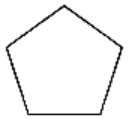
Exterior Angle	Angle measurements outside of a polygon when the lines are extended outside the shape.	
Factor	Number being multiplied	**Factor** x **Factor** = Product **6** x **5** = 30
Flow Chart	Visual diagram that shows each step in evaluating an algebraic expression or equation	
Formula	Recipe for solving a specific type of problem	**Example: $A = l \cdot w$**
Fraction	Part of a whole	
Frequency	How often something occurs (usually in a specific time period	
Function Every input will provide an output.	A relationship between inputs and outputs of a specific rule.	
Greater Than	Bigger	>
Greatest Common Factor (Divisor) (GCF/GCD)	Highest number that divides exactly into two or more numbers	
Hexagon	6 sided figure	
Horizontal	Runs from left to right	

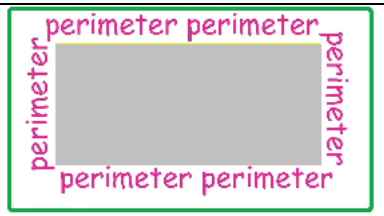
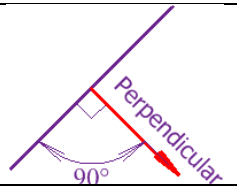
Hypotenuse	The side of a right triangle that is opposite the right angle	
Identify property of Addition	Adding zero to any number keeps the number the same	5 + 0 = 5
Identity Property of Multiplication	Multiplying by 1 to any number keeps the number the same	1 x 10 = 10
Improper Fraction	Fraction that has a larger number in the numerator than in the denominator	
Inequality	Two values that are not equal (less than, greater than)	
Inference (Infer)	Using data and information to come to a conclusion.	 **You can infer that Coke is the favorite drink**
Infinite	Goes on forever with no end. Not finite	
Integer	All counting numbers, including zero and it's opposites	Example: -1, 0, -5, 7, 250 
Interpret	Describing the meaning behind the data.	 **Of the 62 votes, 11 people like Pepsi.**
Intersect	When lines, shapes, or data overlap or cross over each other. (Lines intersect or meet at 1 point.)	
Inverse	Opposite operation	Multiplication → Divide Division → Multiply Addition → Subtract Subtraction → Add

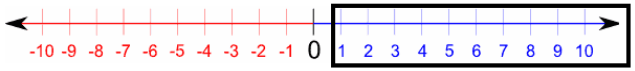
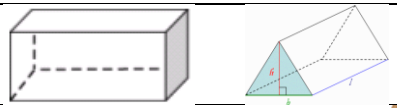
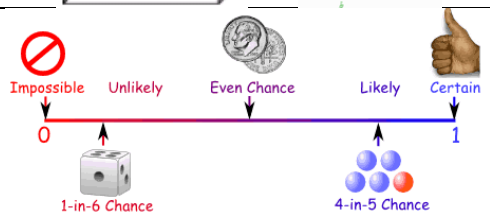
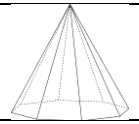
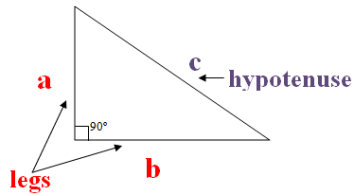
Irrational Number	A decimal that cannot be written as a fraction – It goes on forever *without* repeating.	$\pi \approx 3.14159\ldots$
Isosceles Triangle	Triangle with two equal sides and two equal angles	
Kite	Quadrilateral with two pairs of congruent sides adjacent to each other	
Least Common Multiple (Denominator) (LCM/LCD)	Smallest number that is a multiple of two or more numbers Smallest Number that is a multiple of two or more denominators	 LCM/LCD = 2 · 4 · 2 · 2 · 3 = 96
Less Than	Smaller	<
Linear	Makes a line	 A constant rate of change (–2) and can be written as a linear function **y = mx + b**
Lowest Terms	See Simplify	$\frac{4}{8} = \frac{1}{2}$
Mean	Average (add all numbers together and divide by how many items there are in a set of data)	Example: $\frac{5 + 5 + 8 + 12}{4}$
Median	Middle number in a set of data when the numbers are put in order from least to greatest. **If there are two middle numbers must find the mean of the two numbers**	1, 2, 5, (12), 18, 23, 30

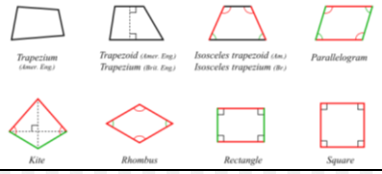
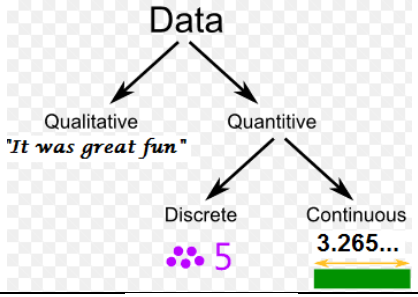
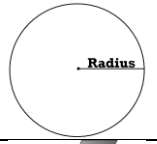
Milli-	$\frac{1}{1000}$	
Mixed Number	Fraction with a whole number and a proper fraction	
Mode	Number that occurs the most often in a set of data	 3, 3, 5, **6, 6, 6**, 9, 9 → The mode = **6**
Multiple	Result of multiplying by a whole number	**Multiples of 3: 3, 6, 9, 12…**
Non-Linear	Not a straight line	
Non-Terminating Decimal	A decimal that *does not* end, and may or may not repeat	**4.2596391142869281…**
Negative	Number less than zero	
Not Equal	Values are not the same amount	≠
Numerator	Top number in a fraction	
Obtuse (Angle)	Angle greater than 90˚ but less than 180˚	

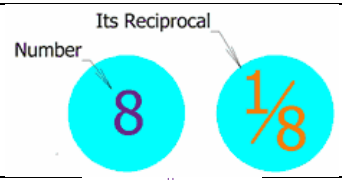
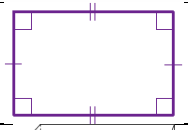
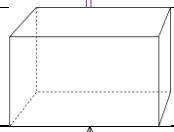
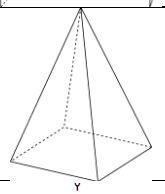
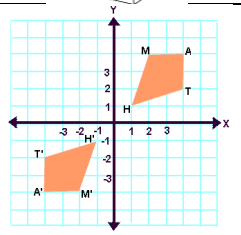
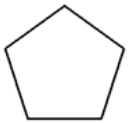
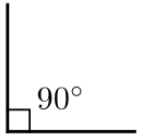
Octagon	8-sided figure	
Odd	Numbers ending in 1, 3, 5, 7 and 9	
Operation	Add, Subtract, Multiply, Divide	+ – x ÷
Opposite	Same distance from zero but in the other direction	Negative → Opposite = Positive Positve → Opposite = Negative
Order of Operations	The rules of which calculations come first in an expression or equation (The order we solve a problem) **Please Guys Excuse My Dear Aunt Sally**	
Ordered Pairs	Two numbers written in parentheses showing the x and y coordinates	 
Origin	Where the x-axis and y-axis intersect Point = (0,0) Always start at the origin when plotting points	
Outlier	Value that "lies" *out*side the other set of data **Either much larger or smaller than the rest of the data	
Parallel	Lines that are always the same distance apart and never touch	

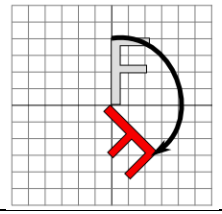
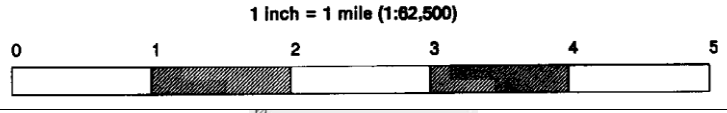
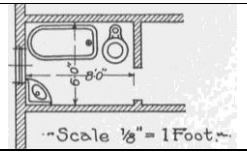
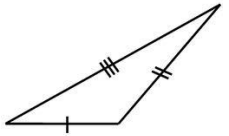
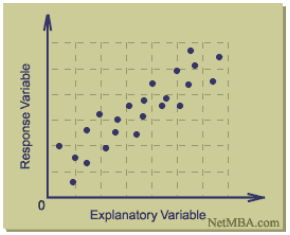
Parallelogram	Quadrilateral that have opposite sides parallel and equal in length. Opposite angles are also equal	
Pentagon	Five-sided polygon	
Per	= 1	Miles **PER** Hour 
Percent	Part out of 100	**/100** **100%**
Percent Decrease	The amount the price of an item went down from the original	**1. Determine the decreased amount** • **$5 to $4 = $1 decrease** **2. Divide by the old value** • **$1/$5 = 0.2** **3. Convert to a percentage** • **0.2 x 100 = 20% decrease**
Percent Error	The approximate error in data	$\frac{\lvert\text{Approximate Value - Exact Value}\rvert}{\lvert\text{Exact Value}\rvert} \times 100\%$
Percent Increase	The amount the price of an item went up from the original	**1. Determine the increased amount** • **$5 to $6 = $1 increase** **2. Divide by the old value** • **$1/$5 = 0.2** **3. Convert to a percentage** • **0.2 x 100 = 20% increase**

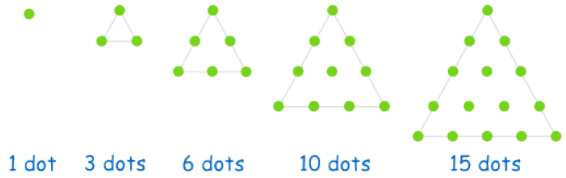
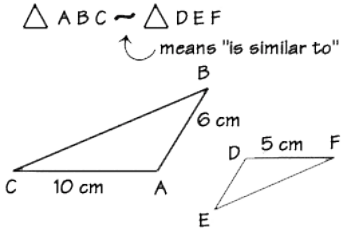
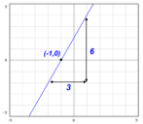
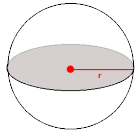
Perfect Cube	A whole number created by multiplying it by itself three times - cubing (n^3) a whole number (Perfect cubes: 1, 8, 27, 64))	**$1^3 = 1$** **$2^3 = 8$** **$3^3 = 27$** **$4^3 = 64$** **$5^3 = 125$** **$6^3 = 216$** **$7^3 = 343$** **$8^3 = 512$** **$9^3 = 729$** **$10^3 = 1000$** **$11^3 = 1331$** **$12^3 = 1728$** **$13^3 = 2197$** **$14^3 = 2744$** **$15^3 = 3375$**
Perfect Square	A whole number created by multiplying it by itself - squaring (n^2) a whole number (Perfect squares: 1, 4, 9, 16)	$1^2 = 1$ $2^2 = 4$ $3^2 = 9$ $4^2 = 16$ $5^2 = 25$ $6^2 = 36$ $7^2 = 49$ $8^2 = 64$ $9^2 = 81$ $10^2 = 100$ $11^2 = 121$ $12^2 = 144$ $13^2 = 169$ $14^2 = 196$ $15^2 = 225$ $16^2 = 256$ $17^2 = 289$ $18^2 = 324$ $19^2 = 361$ $20^2 = 400$ $21^2 = 441$ $22^2 = 484$ $23^2 = 529$ $24^2 = 576$ $25^2 = 625$ $26^2 = 676$ $27^2 = 729$ $28^2 = 784$ $29^2 = 841$ $30^2 = 900$
Perimeter	Distance around an object	
Perpendicular	Lines that form a right angle	
Pi	**3.14** or $\frac{22}{7}$	π
Polygon	• Multi-Sided closed figure • Must Contain all straight sides	
Population	Whole group from which a sample is taken	

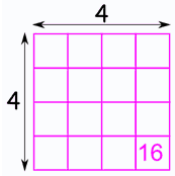
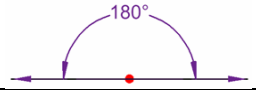
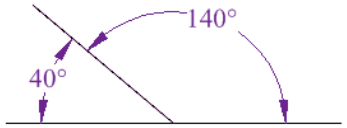
Positive	Numbers to the right of zero on the number line	
Predict	Based on data make an estimation of something that might happen in the future or will be a consequence of the current data	
Prime	A number that can be divided evenly by only one and itself	Example: 2, 3, 5, 7, 11, 13, 17…
Prism	A solid figure that has two faces that are congruent (the same or equal)	
Probability	The chance something will happen (the likelihood of an event taking place	
Product	Answer to a multiplication problem	Factor x Factor = **Product** 5 x 4 = **20**
Proportion	Two ratios set equal to each other	$\frac{33}{12} = \frac{11}{4}$
Pyramid	A solid object where: • Base is a polygon • Sides are triangles which meet at the top (Apex)	
Pythagorean Theorem	Right Angle Triangle – The long side (hypotenuse) squared equals the sum of the squares of the other two sides	$a^2 + b^2 = c^2$ 

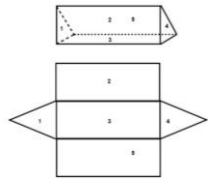
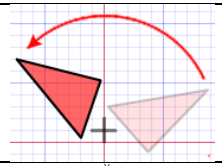
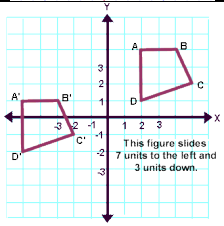
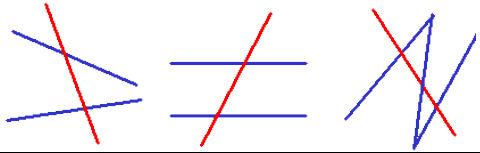
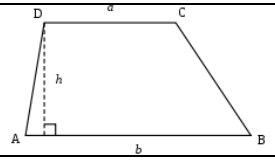
Quadrilateral	Four sided figure	
Qualitative	Information (Data) that describes something	
Quantitative	Information (Data) that can be **counted** or **measured**	
Quantity	How much there is of something	
Quotient	Answer to a division problem	Dividend ÷ Divisor = **Quotient** 45 ÷ 9 = **5**
Radius	Distance from the center to the edge of a circle	
Random Sample	A selection that is chosen randomly (by chance – no prediction)	
Range	The difference between the lowest and highest value	5, 12, 13, 15, 24 Range = 24 – 5 = **19**
Rate	Ratio that compares two different quantities using different units	Miles per hour $ per gallon
Ratio	A comparison of two quantities by division Written in 3 different ways	Miles **:** Hour Miles **to** Hour Miles **/** Hour

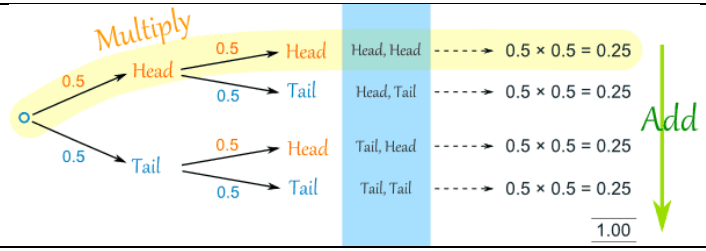
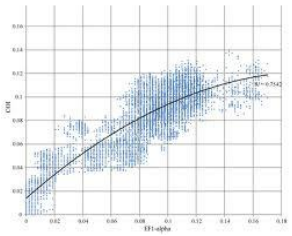
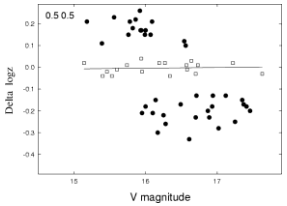
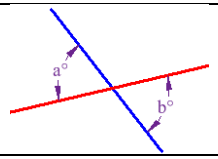
Rational Number	Number that can be made by dividing one integer by another	Example: 0.5, 1.73, -15.23, 5/3
Reciprocal	Number you multiply another number to get one (1)	
Rectangle	4 sided figure with right angles and two sets of equal sides	
Rectangular Prism	Solid object that has six (6) sides that are all rectangles	
Rectangular Pyramid	A solid object where: • Base is a rectangle or square • Sides are triangles which meet at the top (Apex)	
Reflection	An image or shape as it would be seen in a mirror (reflects over an area)	
Regular Polygon	All sides and angles are equal	
Repeating Decimal	A fraction that when written as a decimal repeats in a pattern that goes on forever	Example: 1/3 = 0.3333333… $0.\overline{3}$
Right (Angle)	Angle that is exactly 90˚	

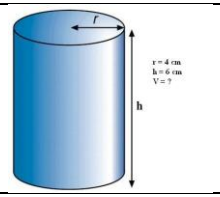
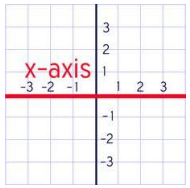
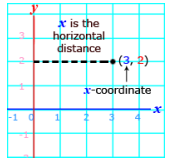
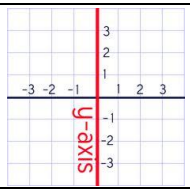
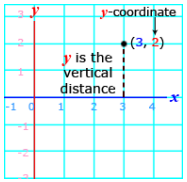
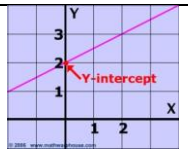
Right Prism	A prism that has the bases that line up one on top of the other. (Lateral faces are rectangles) Prisms that can be stacked straight up on top of each other	
Rotation	A circular movement	
Round	**(0 – 4)** Four or Less → Let it rest **(5 – 9)** 5 or More → Raise the Score	**45.23 → 45**
Scale	The ratio of the length of a model to the real thing	
Scale Drawing	A drawing that shows a real object with accurate sizes but they have been reduced or enlarged using a scale	
Scale Factor	The magic number that all of the side lengths of one figure are multiplied by to get all of the side lengths of new figure	
Scalene Triangle	Triangle with all three sides having different lengths	
Scatter Plot	A graph of plotted points that shows the relationship between two sets of data *Positive Correlation*: Up to the right *Negative Correlation*: Down to the right *No Correlation*: Random dots throughout	

Sequence	List of numbers or objects in special order	
Similar	A shape is similar if: • Same Shape • Same Angles • Same Side to Side Ratios • Scale Factor $\sim$	
Simplify	Reduce a number to make as simple as possible. (No other number other than 1 can go into both numbers.	$\frac{4}{8} = \frac{1}{2}$
Slope	How steep a straight line is $m = \frac{y_2 - y_1}{x_2 - x_1}$	 $y = \underline{m}x + b$
Solution	Answer to a problem	$4 + 3 = \underline{7}$
Sphere	Circular 3-D shape – Like a ball	
Square	4-sided polygon that has all four sides of equal length and equal 90˚ angles	

Square Root	*The number* that is multiplied by itself that gives you the perfect square. (See Perfect Square) $\sqrt{}$ Square Root | Square Root | Square Root | Square Root $\sqrt{1}=1$ | $\sqrt{81}=9$ | $\sqrt{289}=17$ | $\sqrt{625}=25$ $\sqrt{4}=2$ | $\sqrt{100}=10$ | $\sqrt{324}=18$ | $\sqrt{676}=26$ $\sqrt{9}=3$ | $\sqrt{121}=11$ | $\sqrt{361}=19$ | $\sqrt{729}=27$ $\sqrt{16}=4$ | $\sqrt{144}=12$ | $\sqrt{400}=20$ | $\sqrt{784}=28$ $\sqrt{25}=5$ | $\sqrt{169}=13$ | $\sqrt{441}=21$ | $\sqrt{841}=29$ $\sqrt{36}=6$ | $\sqrt{196}=14$ | $\sqrt{484}=22$ | $\sqrt{900}=30$ $\sqrt{49}=7$ | $\sqrt{225}=15$ | $\sqrt{529}=23$ $\sqrt{64}=8$ | $\sqrt{256}=16$ | $\sqrt{576}=24$	$\sqrt{36} = 6$ $6 \times 6 = 36$ 
Stem and Leaf	A plot where ach data value is split into a "leaf" (usually the last digit) and a "stem" (the other digit)	Example: 32 = 3 (stem) and 2 (leaf) Number of Sit-Ups Stem | Leaves The tens digits are called the *stems.* 3 | 4 6 8 8 4 | 0 3 6 7 7 5 | 0 0 1 2 The ones digits are called the *leaves.* Key: 3 | 6 = 36
Straight (Angle)	Line - 180˚	
Substitution	Replacing a variable with a number	x = 4 3 + 2 - x 3 + 2 - 4
Sum	Answer to addition problem	Addend + Addend = **Sum** 4 + 3 = **7**
Supplementary	Two angles that add up to 180 degrees	

Surface Area	Total area of a three-dimensional object *See cheat sheet for formulas*	
Table	Numbers or quantities arranged in rows and columns	"What sport do you play?" Sport / People Soccer 106 Tennis 45 Gymnastics 54 Swimming 82 Track 68
Tax	Percentage of the cost of an item added to the total cost	
Terminating Decimal	Decimal number that has digits that stop	**0.5**
Transformation	Moving a shape in a different position, but it will *not* change shape, size, area, angles or lengths. (See Rotation & Reflection)	
Translation	Moving a shape, without rotating or flipping it (Sliding)	
Transversal	A line that crosses at least two other lines	
Trapezoid	Four sided figure with one pair of parallel sides	

Tree Diagram	A diagram to help you determine the probability of an event • Multiply along branches • Add along columns	
Unique	Leading to only one result	4 + 5 = 9
Unit	One – single item	 One Ounce
Unit Rate	Amount ***per*** item (One Item)	
Variable	A letter that represents a number in an equation or expression	**$5 + x = 15$** ***x* is the variable**
Variability	How close or far apart a set of data is	 
Vertical	Runs up and down	
Vertical Angles	Vertical angles are angles that are opposite each other when two lines cross • Vertical angles are always congruent	

Volume	The amount of space a 3-dimensional object takes up. ****Filling**** *See Cheat Sheet for Formulas*	
X-axis	Line graph that runs horizontally	
X-Coordinate	Horizontal value in a coordinate pair	
Y-axis	Line graph that runs vertically	
Y-Coordinate	Vertical value in a coordinate pair	
Y-Intercept	The point in which the line crosses the y-axis	 $y = mx + \underline{\mathbf{b}}$