Unit 1 – Tools of Algebra

Section 1 – Using Variables

(Refer to Pages 49 - 50, problem numbers 1 - 72 in your textbook for additional practice)

Vocabulary and Examples:

Variable – a letter used to hold the place of a number in a math problem

Ex: $3\underset{\substack{\downarrow \\ \textbf{variable}}}{x} + 4 = 2$

Algebraic Expression – a math problem that only includes the front of the problem (numbers, variables and operations – **NO** "=, <, >," etc)

Ex: 3 more than g → $g + 3$ (notice the back of the problem - the part behind the equal sign - is not there)

Algebraic Equation – a math problem that includes the back of the problem as well as the front of the problem (a complete math sentence containing "=, <, >, etc.)

Ex: 3 more than g is 45 → $g + 3 = 45$ (notice the front of the problem as well as the back of the problem are there)

:Sum" or "Increased By" or "More Than" – all three mean addition

ex: 6 more than $\underbrace{\text{a number}}_{\textbf{since the number is unknown, assign it a variable (letter)}}$ is 12 → $a + 6 = 12$

"is" means "equals"

**when the problem asks for "THE SUM OF, THE PRODUCT OF, THE QUOTIENT OF, OR THE DIFFERENCE OF" put parenthesis around that part of the problem

Ex: **the sum of** 4 and d minus 40 → $(4 + d) - 40$

Product – means multiplication – Remember that in algebra, a raised dot is used for the multiplication symbol (so as not to confuse the multiplication symbol of "x" with the letter (variable) "x")

ex: the product of 6 and a number is 12 → $6 \bullet a = 12$

Quotient – means division

ex: the $\underbrace{\text{quotient of}}_{\textbf{quotient is typically expressed as a fraction}}$ 6 and a number is 12 → $\frac{6}{a} = 12$

Difference – means subtraction

ex: the difference between 6 and a number is 12 → $6 - a = 12$

Less than – means subtraction - REVERSE THE ORDER OF THE NUMBER AND VARIABLE WHEN WRITING A MATH PROBLEM THAT INCLUDES "LESS THAN"

ex: 6 less than a number is 12 → $a – 6 = 12$

Twice – 2 times (2 •)

ex: the sum of 6 and $\underbrace{\text{twice}}_{\textbf{2 times}}$ a number is 12 → $6 + 2 \bullet a = 12$

To write a phrase for a given math problem - use the vocabulary word for the given operation

Ex: $4x - 8 \longrightarrow$ the product of 4 and some number minus 8 **OR**
8 less than the product of 4 and some number

To define a variables and write an equation to model the relationship in a table –

a) assign a variable (letter) for each column in the table
b) determine what was done to the number in the first column to get the number in the second column for each row.

Ex:

number of sales (n)	total earnings (e)
5	$2.00
10	$4 .00
15	$6.00
20	$8.00

let *n* be the "number of sales" and *e* be "total earnings"

To go from 5 to $2.00, multiply by $0.4
To go from 10 to $4.00, multiply by $0.4
To go from 15 to $6.00, multiply by $0.4
To go from 20 to $8.00, multiply by $0.4

THEREFORE: the **VARIABLES** are: "n" and "e"

let *n* be the "number of sales" and *e* be "total earnings in dollars"

the **EQUATION** becomes: $e = 0.4n$

Practice Problems – Unit 1 – Section 1

For problems 1 - 6, write an algebraic expression for each phrase.

1) 45 increased by a

2) n less than 9

3) the product of 4 and r

4) the sum of 8 and h minus 37

5) 8 minus the product of 12 and y

6) the sum of the quotient r and 12 and the quotient of w and 8

For problems 7 - 10, write a phrase for each expression.

7) $5 - g$

8) $8a + 5$

9) $\frac{k}{4}$

10) $6ab$

For problems 11 and 12, define variables and write an equation to model the relationship in each table.

11)

number of workers	# of radios built
1	13
2	26
3	39
4	52

12)

number of tapes	cost
1	$8.50
2	$17 .00
3	$22.50
4	$34.00

Unit 1 – Tools of Algebra

Section 2 – Exponents and Orders of Operations

(Refer to Page 60, problem numbers 1 - 37 in your textbook for additional practice)

Vocabulary and Examples:

Exponent – tells how many times a number, the base, is used as a factor.

Ex: $6^4 \longrightarrow$ exponent

$\downarrow$

base

To solve: $\underbrace{6 \cdot 6 \cdot 6 \cdot 6}_{\text{The base multiplied 4 times}}$

$\cancel{6 \cdot 6} \cdot 6 \cdot 6$

$\downarrow$

$\cancel{36 \cdot 6} \cdot 6$

$\downarrow$

$\cancel{216 \cdot 6}$

$\downarrow$

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Power – consists of the base and the exponent

ex: 6^4 is read as "6 to the fourth power"

Order of Operation – the order that every math problem is to be completed in -

First: complete all **P**arentheses

Second: complete any **E**xponents

Third: complete any **M**ultiplication and **D**ivision (in the order it appears in the problem from left to right)

Fourth: complete any **A**ddition and **S**ubtraction (in the order it appears in the problem from left to right)

(**PEMDAS** – Using "Please Excuse My Dear Aunt Sally "helps to remember order of operations)

ex: $(2^3 + 3)^2 - 10 \cdot 6 \div 2 \longrightarrow (\underbrace{\cancel{2^3}} + 3)^2 - 10 \cdot 6 \div 2 \longrightarrow$

Within the parentheses, there is an exponent, and addition. Follow the order of operation here too. Solve the exponent first, then add.

REMEMBER: this is $2 \cdot 2 \cdot 2$ NOT $2 \cdot 3$

$(\underbrace{\cancel{8 + 3}})^2 - 10 \cdot 6 \div 2$

$\underbrace{\cancel{(11)^2}} - 10 \cdot 6 \div 2$

REMEMBER: this is $11 \cdot 11$ NOT $11 \cdot 2$

$121 - \underbrace{\cancel{10 \cdot 6}} \div 2$

$121 - \underbrace{\cancel{60 \div 2}}$

$\underbrace{\cancel{121 - 30}}$

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Practice Problems – Unit 1 – Section 2

For problems 1 -5, simplify each expression.

1) $8 \bullet 4 + 9^2$

2) $21 + 49 \div 7 + 1$

3) $(10^2 - 4 \bullet 8) \div (8 + 9)$

4) $1^{11} + 3\left[\left(\frac{22}{11} + 8\right) \div 5\right]$

5) $27[5^2 \div (4^2 + 3^2) + 2]$

For problems 6 - 9, evaluate each expression for a = 5, b = 12, and c = 2.

6) $abc + ab$ 7) $2b \div c + 3a$ 8) $b^2 - 4a$ 9) $b[(ac + a) \div a] - b$

For problems 10 – 13, evaluate each expression for m = 3, p = 7, and q = 4.

10) $(mp)^2 - q$ 11) $m(p - q)^2$ 12) $qp^2 + pq^2$ 13) $m(p^2 - q)$

14) The formula for the volume of a sphere with radius *r* is $V = \frac{4\pi r^3}{3}$. Find the volume of a ball that has a radius 8.7 in. Round your answer to the nearest hundredths place. (HINT: Plug in 8.7 for *r* in the formula and use 3.14 for π. Remember to follow order of operation rules!!)

15) In 1883, Jan Matzeliger invented the shoe-lasting machine to attach the upper part of a sole to its sole. Before that, each shoe was assembled and sewn by hand. You can estimate the wages at that time using the formula $w = 0.34\frac{p}{t}$, where *w* is the hourly wage in dollars, *p* is the price of a pair of shoes in dollars, and *t* is the time in minutes to assemble a pair of shoes.

In 1891, a worker who used the shoe-lasting machine could assemble on pair of shoes in two minutes. A pair of shoes cost about $.94. Estimate the worker's hourly wage to the nearest cent. (HINT: Replace *p* with the cost of a pair of shoes in 1891, and *t* with the amount of time it took to assemble a pair of shoes in 1891. Remember to follow the order of operation rules!)

Unit 1 – Tools of Algebra

Section 3 – Exploring Real Numbers

(Refer to Page 6, problem numbers 9 - 22 in your textbook for additional practice)

Vocabulary and Examples:

Natural Number – are the "counting numbers" beginning with 1 to infinity, but NOT including decimals and any fractions that DO NOT reduce to a natural number

Example: 1, 2, 3, 4, ……. Fractions like : $\frac{25}{5}$ (because it reduces to 5, which is a natural number)

Whole Number – are all of the natural numbers and 0

Example: 0, 1, 2, 3, 4, …….

Integers – are all of the whole numbers and their opposites (negative numbers), but NOT including decimals or any fractions that DO NOT reduce to integers

Example: ……….-3, -2, -1,. 0, 1, 2, 3, 4, ……. Fractions like : $\frac{-25}{5}$ (because it reduces to -5, which is a natural number)

Rational Number – any number that can be written as a fraction. This includes all of the natural numbers, whole numbers and integers. The only numbers that CANNOT be rational are those numbers that are decimals that have no pattern and never end (irrational numbers)

Example: (a) 16 = $\frac{16}{1}$ or $\frac{64}{4}$

(b) .145 = $\frac{145}{1000}$

(c) $.\overline{3} = \frac{1}{3}$

(d) $\frac{22}{7}$ = 18.85714286….. This is not rational because the decimal does not end and there is no pattern

Irrational Number – any number that is not rational

Example: $\sqrt{10}$ = 16227766….. This number is irrational because the decimal does not end and there is no pattern

Other examples are: $\sqrt{2}$, 0.102003000400005...

Real Number – every number in our number system. This includes all rational numbers, whole numbers, integers, rational numbers, and irrational numbers

Counterexample – is an example that proves a statement to be false

Example: no fractions are whole numbers – this statement is false. A counterexample that proves that it is false could be $\frac{30}{5}$ = 6 because 6 is a whole number and is also a fraction.

Inequality – the math symbols: $<$ which means "is less than", $>$ which means "is greater than", $\leq$ which means "is less than or equal to", and $\geq$ which means "is greater than or equal to"

Opposites - are the numbers that are the same distance from zero on a number line but lie in opposite directions.

Example: 3 and -3, $-\frac{7}{15}$ and $\frac{7}{15}$

Absolute Value of a Number – is the distance from 0 that a number lies on a number line.

Example: $|3| = 3$ because 3 is 3 units away from zero on a number line
Example: $|-3| = 3$ because -3 is 3 units away from zero on a number line
Example: $|-6 + 5|$ - first solve what is inside the absolute value symbols because the symbols also act as grouping symbols (parenthesis) and order of operation rules require that the parenthesis be done first.

$|-6 + 5| = |-1| \longrightarrow$ Then take the absolute value of -1 which is 1 - the final answer is 1

THEREFORE: it doesn't matter whether the number inside the absolute value symbols is positive or negative, the answer is ALWAYS positive UNLESS there is a negative sign OUTSIDE the absolute value symbols, then the answer becomes negative.

Example: $-|24 - 3 \bullet -2| =$

$-|24 - \cancel{3 \bullet -2}|$

$-|\cancel{24 - (-6)}|$

$-|30| = -30 \longrightarrow$

Remember: there is an understood -1 in front of the absolute value symbols, and therefore the final answer is NEGATIVE

Practice Problems – Unit 1 – Section 3

For problems 1 - 5, name the set(s) of numbers to which each number belongs. The response could be natural number, whole number, integer, rational number, irrational number, and real number.

1) -1 2) $\frac{2}{3}$ 3) 7 4) 0 5) $\sqrt{5}$

For problems 6 -7, tell whether each statement is true or false. If the statement is false, give a counterexample.

6) All integers are rational numbers.

7) All negative numbers are integers.

8) Order the numbers from least to greatest: $\frac{7}{11}$, 0.63, 0.636

For problems 9 -11, find the absolute value.

9) |4| 10) $\left|\frac{-9}{14}\right|$ 11) $-|6.25|$

For problems 12 and 13, use $<$, =, or $>$ to compare.

12) $|-3.121|$ ▨ $|3.12|$ 13) $\left|\frac{-8}{10}\right|$ ▨ $\left|\frac{-16}{20}\right|$

For problems 14 and 15, simplify each expression. (HINT: absolute value symbols are grouping symbols, so do what is inside of them first)

14) |-6 + 4| + |3| 15) 4 + |3 • 4 – 2|

Unit 1 – Tools of Algebra

Section 4 – Adding Real Numbers

(Refer to Page 120, problem numbers 1 - 37 in your textbook for additional practice)

Vocabulary and Examples:

Identity Property of Addition – The sum of zero and any number is always the non-zero number.

Example: 0 + 6 = 6 -6 + 0 = -6

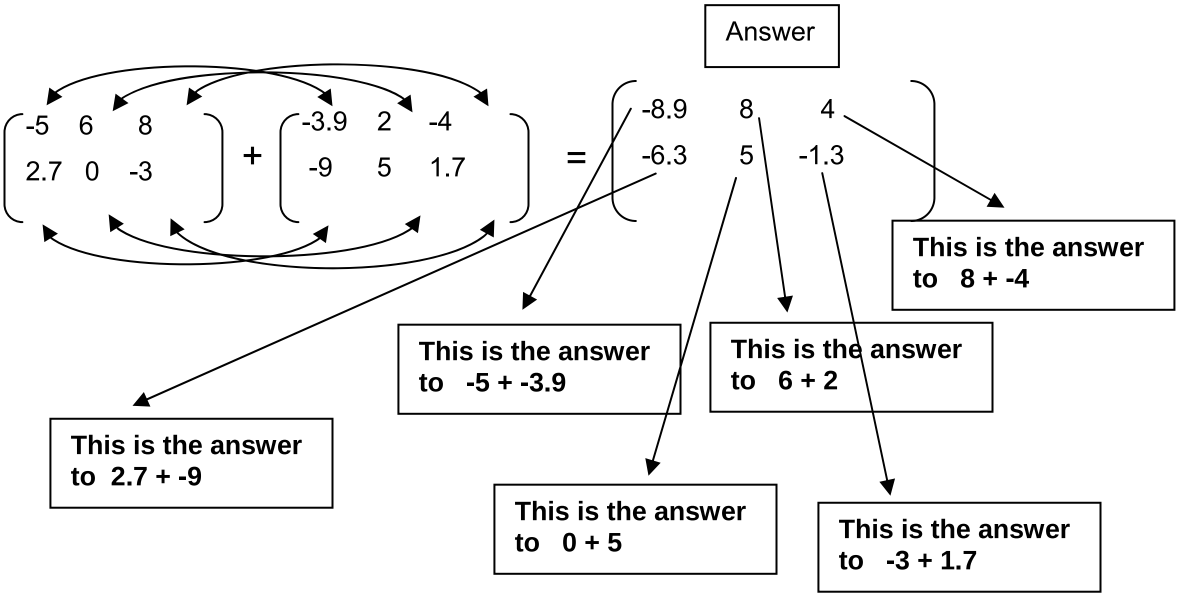
Inverse Property of Addition – The sum of any number and its opposite will always result in zero

Example: -16 + 16 = 0 $\frac{2}{3} + \left(-\frac{2}{3}\right) = 0$

Matrix – a rectangular arrangement of numbers in rows and columns. The size of a matrix is indicated by the number of rows and the number of columns. To add or subtract matrices (plural of matrix), add the two numbers that correspond in each matrix and record the answer in the same position in a new matrix.

Example:

$$\begin{pmatrix} -5 & 6 & 8 \\ 2.7 & 0 & -3 \end{pmatrix} + \begin{pmatrix} -3.9 & 2 & -4 \\ -9 & 5 & 1.7 \end{pmatrix} = \begin{pmatrix} -8.9 & 8 & 4 \\ -6.3 & 5 & -1.3 \end{pmatrix}$$



Answer

This is the answer to 8 + -4

This is the answer to -5 + -3.9

This is the answer to 6 + 2

This is the answer to 2.7 + -9

This is the answer to 0 + 5

This is the answer to -3 + 1.7

This matrix is a '2 by 3' because there are 2 rows and 3 columns. Only matrices with the same dimensions can be added or subtracted together.

Practice Problems – Unit 1 – Section 4

For problems 1 -5, simplify.

1) -8.7 + (-10.3)

2) $\frac{4}{5} + \frac{2}{15}$

3) -7 + (-4)

4) $-4\frac{3}{8}$ +

5) $-\frac{2}{3} + \frac{4}{6}$

6) A diver dives 47 ft. below the surface of the water and then rises 12 ft. Use addition to find the diver's depth.

7) The temperature at 6 A.M. is -6°F. The temperature rises 13 degrees Fahrenheit by noon. Use addition to find the temperature at noon.

8) On two football plays a team gains 8 yds. and then loses 5 yds. Use addition to find the result of the two plays.

For problems 9 and 14, simplify.

9) $\begin{pmatrix} 7 & -8 \\ -12 & 6.2 \end{pmatrix} + \begin{pmatrix} -8 & 9.4 \\ -9 & 17 \end{pmatrix}$

10) $\begin{pmatrix} 1.3 & 26 \\ \frac{1}{8} & -2 \end{pmatrix} - \begin{pmatrix} 0.5 & -4 \\ -\frac{5}{8} & 9 \end{pmatrix}$

11) -13.2 + 7 + (-6.8)

12) -8.02 + |-5.9| + 0.4

13) |-2| + |2/3| + 3

14) -4.3 + 1.2 + (-5.7)

Use the table for problems 15 - 17

15) How many people aged 18 to 34 participate in photography?

16) How many people aged 45 to 64 draw?

17) Which of the activities is most popular?

ages	**drawing**	**pottery**	**weaving**	**photography**	**creative writing**
18-24	9.2	5.0	5.2	6.6	7.6
25-34	7.2	6.8	10.2	7.2	5.2
35-44	6.8	8.2	13.1	8.2	5.4
45-54	4.4	6.1	9.8	6.1	3.4
55-64	1.9	2.1	6.1	2.1	1.0

Unit 1 – Tools of Algebra

Section 5 – Subtracting Real Numbers

(Refer to Page 139, problem numbers 1 - 64 in your textbook for additional practice)

Vocabulary and Examples:

Subtracting Numbers – when subtracting integers (positive and negative numbers), you can change the subtraction problem to addition by adding the opposite.

Example: 3 – 5 means the same as 3 + (-5) = -2
6 – (-6) means the same as 6 + 6 = 12

**REMEMBER: when working an absolute value problem, completely solve the problem within the absolute value symbols, and then make the FINAL answer positive (unless there is a negative sign OUTSIDE of the absolute value symbols, which would result in the FINAL answer being negative)

Example 1: |5 – 11| =

$\downarrow$

|-6| = 6

Example 2: -|12 – (-6)| OR -|12 + 6| =

$\downarrow$

$$\begin{tikzcd} - \arrow[rr, bend right, leftrightarrow] & |18| = & -18 \end{tikzcd}$$

Practice Problems – Unit 1 – Section 5

For problems 1 -5, simplify.

1) $3 - 7$

2) $2 - (-9)$

3) $5.3 - (-8.4)$

4) $-\frac{2}{5} - \frac{7}{10}$

5) $|-3 - (-5)|$

For problems 6 – 8, evaluate each expression for $x = 3$, $y = -4$, and $z = 6$.

6) $-x - y$

7) $2x - z$

8) $-z + y - x$

For problems 9 – 14, evaluate each expression for $a = -2$, $b = 3.5$, and $c = -4$.

9) $-c - b + a$

10) $|a| + |b|$

11) $-|3 + a|$

12) $|a| + |3b|$

13) $|a - c| - |c|$

14) $-4b - |a|$

15) Archaeologists found a 1500-year-old ship at the bottom of the Black Sea. The ship is well preserved because oxygen could not make the ship decay. The ship is at a depth of 1000 ft. below the surface. This is about 350 ft. below the boundary between surface water, which has oxygen, and water below, which does not have oxygen. At what depth is the boundary?

Unit 1 – Tools of Algebra

Section 6 – Multiplying and Dividing Real Numbers

(Refer to Page 135, problem numbers 1 – 36 and Page 144, problem numbers 1 – 51 in your textbook for additional practice)

Vocabulary and Examples:

Identity Property of Multiplication – multiplying any number by 1 will always results in the non-one number

Example: 6 • 1 = 6 1 • -23 = -23

Multiplication Property of Zero – For every real number *n*, *n* • 0 = 0
(multiplying any number by zero always results in zero)

Example: 1 • 0 = 0 0 • -23 = 0

Multiplication Property of -1 – for every real number *n*, -1 • *n* = -*n*
(multiplying any POSITIVE number by -1 will always result in a negative answer)

Example: -1 • 6 = -6 23 • -1 = -23

Multiplying and Dividing Integers (positive and negative numbers) – any time two numbers that have the SAME sign are multiplied or divided, the answer is always a positive number

Example: 6 • 2 = 12 -6 • -2 = 12

$$\frac{6}{2} = 3 \qquad \frac{-6}{-2} = 3$$

Any time two numbers that have DIFFERENT signs are multiplied or divided, the answer is always a negative number

Example: -6 • 2 = -12 6 • -2 = -10

$$\frac{-6}{2} = -3 \qquad \frac{6}{-2} = -3 \qquad -\frac{6}{2} = -3$$

Inverse Property of Multiplication – For every nonzero number, *a*, there is a multiplicative inverse (reciprocal), $\frac{1}{a}$, such that *a*·1/a = 1 (any number times the multiplicative inverse (reciprocal) – flip that number upside down - will always equal 1)

Example: 6· 1/6 = 1 1/15 ·15 = 1

Practice Problems – Unit 1 – Section 6

For problems 1 -11, simplify.

1) 13(-6)

2) -20(-4)

3) $-(-2)^3$ (HINT: a negative sign with no number attached to it is -1 – the 1 is invisible but really there!)

4) $-5^2(-3)^3$

5) $\frac{6}{-3}$

6) $\frac{3-14}{-2}$

7) -56 ÷ (4 + 3)

8) 2.25 ÷ 3

9) |-6(-9)| ÷ (-2) - HINT: remember to work everything inside the absolute value symbols first, then take the absolute value of the answer!

10) (-2)(5)(-3)

11) 2/3 −4/5

For problems 12 - 14, evaluate each expression for x = -2, y = 3, and z = 3.5

12) (y + 3x) ÷ y

13) (3x + 2y) ÷ (2x + 3y)

14) $8 + 6x \div 4y - \frac{3z}{y}$

15) A toll bridge in Maine in the early 1900's charged 2¢ per person and $6\frac{1}{4}$¢ for a dozen sheep. How much would the toll for 3 people and 4 dozen sheep have been?

Unit 1 – Tools of Algebra

Section 7 – The Distributive Property

(Refer to Page 74, problem numbers 1 - 50 in your textbook for additional practice)

Vocabulary and Examples:

The Distributive Property – allows the number that is OUTSIDE of the parenthesis to be MULTIPLIED by every term INSIDE the parenthesis (usually this property is used when what is inside the parenthesis CANNOT be completed first, even though order of operation rules indicate that parenthesis must be done first – typically, if there is a variable inside the parenthesis, the distributive property MUST be used because letters and numbers CANNOT be added or subtracted since they are not like terms)

Example (a): 6(a + 4)

This problem can be written as: 6 • a and 6 • 4 (remember: there is an understood multiplication symbol between the 6 and the parenthesis)

6 • a = 6a
6 • 4 = 24

THEREFORE, the final answer becomes
6a + 24

Example (b): 4(a - 2)

This problem can be written as: 4 • and 4 • -2

4 • a = 4a
4 • 2 = -8

THEREFORE, the final answer becomes
4a - 8

Example (c): -(a - 8)

This problem can be written as: -1 • a and -1 • -8

There is an understood " -1

-1 • a = -1a
-1 • -8 = 8

THEREFORE, the final answer becomes
-1a + 8

Combining Like Terms - adding or subtracting terms that have the same variable

Ex: $6a^2 – 5ab + 3ab – 12a^2$

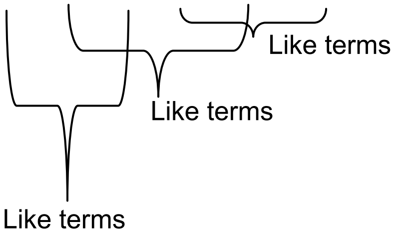
Both $6a^2$ and $(-12a^2)$ are like terms since they both have a^2 attached to the coefficient (the number in front of the variable) - Combine $6a^2 – 12a^2$ and the answer is: **$-6a^2$**

Combine (-5ab) and 3ab since they are like terms because they both have the same variables (ab) attached to the coefficient - Combine (-5ab) and 3ab and the answer is: **-2ab**

The final answer is: $-6a^2 – 2ab$ – once there are no more like terms to combine, the problem is finished

REMEMBER: what makes terms alike is that the variables are 100% identical or there are no variables attached, only the coefficient exists

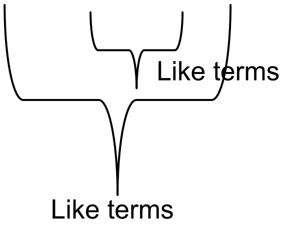
Example: $-6d - 4a + 3d - 6 - 12a + 20$



Combine $-6d$ and $+ 3d = -3d$
Combine $-4a$ and $-12a = -16a$
Combine -6 and $+ 20 = + 14$

FINAL ANSWER:
$-3d - 16a + 14$

Example: $8m^2 - 5mz + 4mz - m^2 + 4$



Combine $8m^2$ and $-m^2 = 7m^2$
Combine $-mz$ and $+4mz = +3mz$

Notice "+4" does not have another like term to combine with, so it just gets tacked on to the end of the answer

FINAL ANSWER:
$7m^2 + 3mz + 4$

<u>To write and expression for a phrase</u> – any time the word "quantity" appears in an expression, use parenthesis around the phrase

Example: write an expression for "3 times the quantity x minus 5"

$3(x - 5)$

Practice Problems – Unit 1 – Section 7

For problems 1 -12, simplify.

1) $7(r - 4)$

2) $-2(n - 6)$

3) $(5b - 4)\frac{1}{5}$

4) $-(x + 3)$

5) $(4 - a)(-1)$

6) $-(2 - 7x)$

7) $4g - 7g$

8) $w + 23w$

9) $13q - 30q$

10) $-(8.4 + 300g - 512h)$

11) $9 - 4f + 6y - 3f + 10$

12) $1.4b - 3b^2 + 4c - 2b^2 + c$

For problems 13 – 15, write an expression for each phrase.

13) 3 times the quantity m minus 7

14) -4 times the quantity 4 plus w

15) the product of -11 and the quantity m minus 8

16) Suppose you buy 4 cans of tomatoes at $1.02 each, 3 cans of tuna for $.99 each, and 3 boxes of pasta at $.52 each. Find the total cost.

Unit 1 – Tools of Algebra

Section 8 – Properties of Real Numbers

(Refer to Page 68 - 69, problem numbers 1 - 24 in your textbook for additional practice)

Vocabulary and Examples:

Commutative Property of Addition – reversing the order of any numbers in an addition problem does not affect the answer

Example: $8 + 4 = 4 + 8$

Commutative Property of Multiplication – reversing the order of any numbers in a multiplication problem does not affect the answer

Example: $8 \bullet 4 = 4 \bullet 8$

Associative Property of Addition – moving the parenthesis from around any numbers in an addition problem and putting them around different numbers does not affect the answer

Example: $(8 + 4) + 6 = 8 + (4 + 6)$

Associative Property of Multiplication – moving the parenthesis from around any numbers in a multiplication problem and putting them around different numbers does not affect the answer

Example: $(8 \bullet 4) \bullet 6 = 8 \bullet (4 \bullet 6)$

Identity Property of Addition – adding 0 to any number will always results in the nonzero number

Example: $6 + 0 = 6$

Identity Property of Multiplication – multiplying any number by 1 will always results in the non-one number

Example: $6 \bullet 1 = 6$ $1 \bullet -23 = -23$

Inverse Property of Addition – Adding the positive and negative of the same number will always result in 0

Example: $6 + (-6) = 0$

Inverse Property of Multiplication – For every nonzero number, *a*, there is a multiplicative inverse (reciprocal), $\frac{1}{a}$, such that $a \cdot 1/2 = 1$ (any number times the multiplicative inverse (reciprocal) – flip that number upside down - will always equal 1

Example: $6 \cdot 1/6 = 1$ $1/15 \cdot 15 = 1$

The Distributive Property – allows the term OUTSIDE of the parenthesis to be MULTIPLIED by every term INSIDE of the parenthesis (usually this property is used when what is inside the parenthesis CANNOT be done first, even though order of operation rules require parenthesis to be done first. The distributive property solves that problem)

Multiplication Property of Zero – For every real number n, $n \bullet 0 = 0$
(multiplying any number by zero always results in zero for the answer)

Example: $1 \bullet 0 = 0$ $0 \bullet -23 = 0$

Multiplication Property of -1 – for every real number n, $-1 \bullet n = -n$
(multiplying any POSITIVE number by -1 will always result in a negative answer)

Example: $-1 \bullet 6 = -6$ $23 \bullet -1 = -23$

Practice Problems– Unit 1 – Section 8

For problems 1 -9, name the property that each equation illustrates.

1) $-\frac{6}{7} + 0 = -\frac{6}{7}$

2) 8 + 43 = 43 + 8

3) $1 \bullet \frac{21}{23} = \frac{21}{23}$

4) (-7 + 4) + 1 = -7 + (4 + 1)

5) -0.3 + 0.3 = 0

6) 9(7.3) = 7.3(9)

7) 5(12 – 4) = 5(12) – 5(4)

8) 8(9 • 11) = (8 • 9) • 11

9) $-\frac{1}{2} \bullet (-2) = 1$

For problems 10 – 15, tell whether the expression in each pair is equivalent.

10) 6m + 1 and 1 • 6 + m

11) 9y and 9 + y

12) -(5 – 9) and 9 – 5

13) 6a – 4 and 2[(2 + 1)a -2]

14) vwx • yz and v • w • zxy

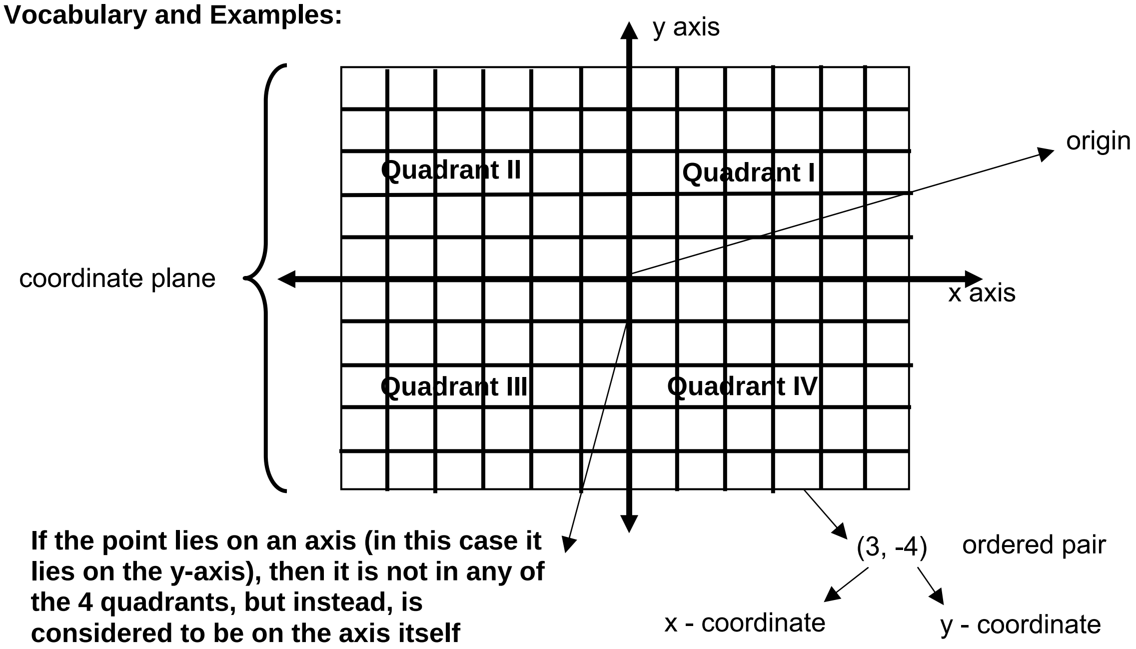
15) 3(5 + a) and 15 + a

Unit 1 – Tools of Algebra

Section 9 – Graphing Data on the Coordinate Plan

(Refer to Page 620, problem numbers 1 - 18 in your textbook for additional practice)

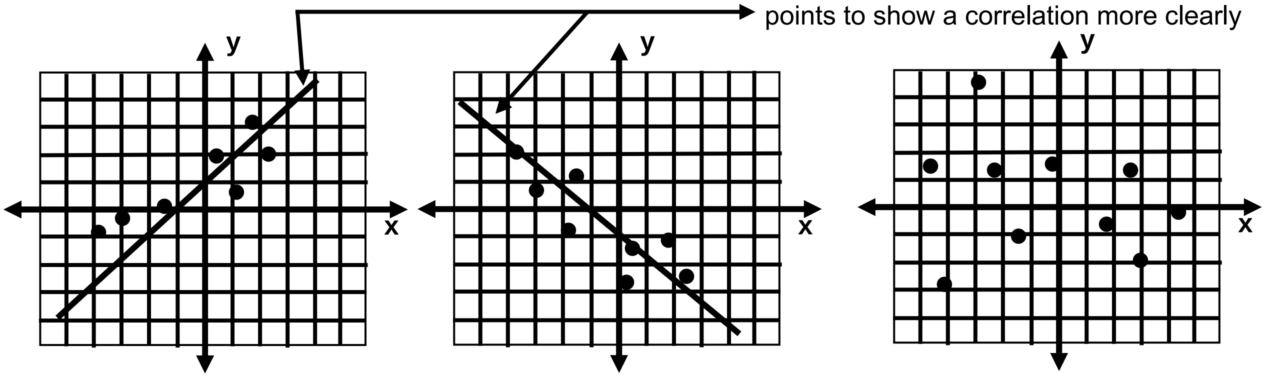
Vocabulary and Examples:



If the point lies on an axis (in this case it lies on the y-axis), then it is not in any of the 4 quadrants, but instead, is considered to be on the axis itself

REMEMBER: when graphing an ordered pair, first move left or right along the x-axis, then move up or down on the y-axis, and then put a dot to represent the point (ordered pair)

Scatter Plot – a graph that has points that are scattered through the graph. Points on a scatter plot CANNOT be connected to create a straight line.



Trend line – drawing a line through the data points to show a correlation more clearly

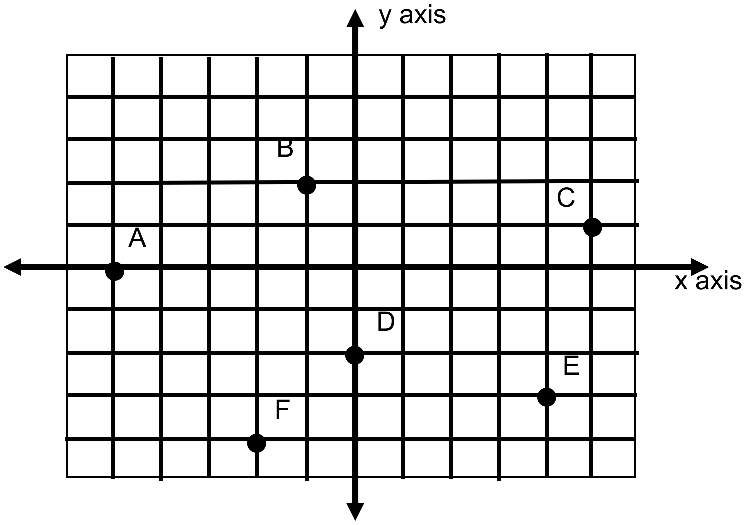
Positive correlation –
In general, both sets of data (along the x- and y-axis, increase together – notice all of the points are clustered in an upward direction

Negative correlation –
In general, one set of data decreases (the y-axis data) as the other set of data increases (the x-axis data) – notice all of the points are clustered in a downward direction

No correlation –
None of the data is related – notice the points are not clustered at all, but instead are scattered all over the coordinate plane

Practice Problems – Unit 1 – Section 9

For problems 1 -6, name the coordinates of each point on the graph below.



1) A

2) B

3) C

4) D

5) E

6) F

For problems 7 – 10, graph the points on the same coordinate plane.

7) (3, 0)

8) (-1, 4)

9) (-2, -3)

10) (3, -3)

For problems 11 – 14, in which quadrant or on which axis would the point lie?

11) (-10, 4)

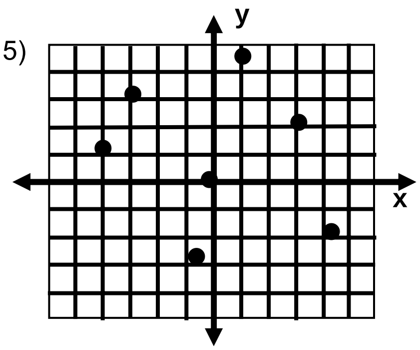
12) (-11, 0)

13) (8, -13)

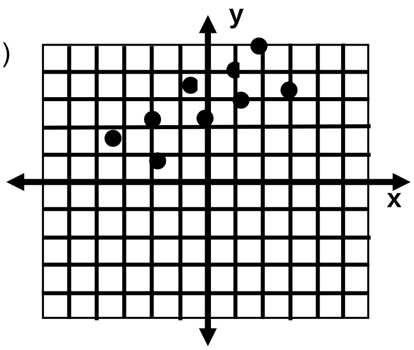
14) (0, 25)

For problems 15 – 17, describe the correlation represented in each scatter plot below.

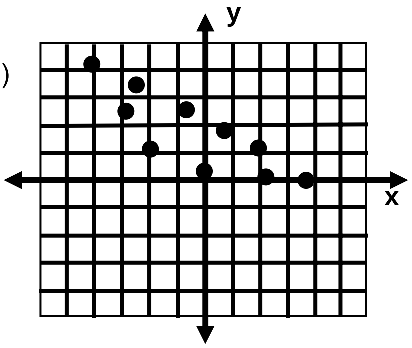
15)



16)



17)



Ex 5: Graph $4 \geq m$ notice that the variable is not first, so flipping the entire problem so that the variable is first will make it so that the rule of "as long as the variable is first, the inequality will point in the direction that the arrow should go on the graph" is true.

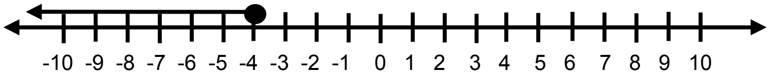
$m \leq 4$ notice that the inequality also flips directions.

In this example, it is a closed circle and the arrow should point to the left

Ex 6: write an inequality for each graph

First, pick any variable. Then, notice the direction of the arrow and whether the circle is closed (colored in) open (not colored in). Last, name the number

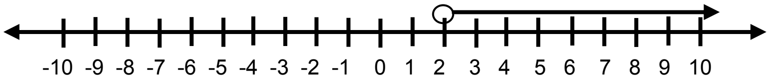
a)



variable - "a"
arrow is pointing left and closed circle – means "less than or equal to"
number - "-4"

THEREFORE: $a \leq -4$

b)



variable - "c"
arrow is pointing right and open circle – means "greater than"
number - "2"

THEREFORE: $c > 2$