Name: ______________________ Due Date: First day of school

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Algebra 2

Summer Assignment 2021

The following packet contains topics and definitions that you will be required to know in order to succeed in Algebra 2 this year. Please look over the following review topics and complete the exercises. These topics will help you begin your study of Algebra 2. They are review topics and will not be covered in length during the start of the school year. ALL problems are expected to be completed. Use a separate paper if you need additional space.

It is recommended that you complete problems every week throughout the summer. There are nearly 100 problems so don't wait until the last minute to start… if you work every day, its only 2-3 problems per day!

Section 1: Simplifying Algebraic Expressions

The difference between an expression and an equation is that an expression does not have an equal sign. Expressions can only be simplified, not solved. Simplifying an expression often involves **combining like terms**. Terms are like if and only if they have the **same variable and power or if they are constants**. Simplifying expressions also refers to substituting values to get a resultant value of the expression.

⌧ *Example*

Simplify the following: $2x+5x^2-7y+4x-y+x^2$

$6x+5x^2-7y-y+x^2$	Combine the terms with only x as the variable.
$6x+6x^2-7y-y$	Combine the terms with only x^2 as the variable.
$6x+6x^2-8y$	Combine the terms with only y as the variable.

Simplify the following expressions by combining like terms.

1.) $3+2y^2-7-5x-4y^3+6x$	2.) x^2+x^2+x+x
3.) $4(3x-2x^3+5)-6x$	4.) $x(2x-3x^4+2y-5xy)$
5.) $x^3(5x^2-3y+2-5x^5y)$	6.) $8a-(7b-4a)-3(4a+2b)$

Evaluate the following expressions by substituting the given values for the variables.

7.) $3a+2b-6a+5b-8b$; $a=-2$ and $b=6$	8.) $3(4c-2d)+d(dc^2+7)$; $c=-2$ and $d=3$

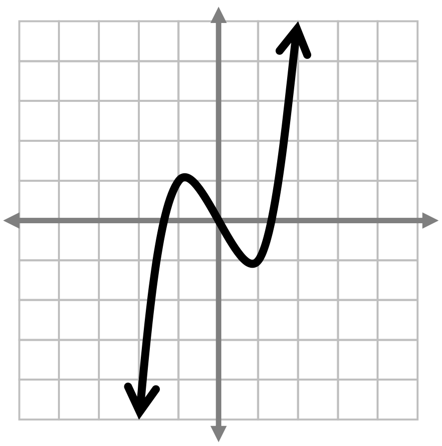
Section 2: Functions

Function: A function is a relation in which each element of the domain is paired with exactly one element of the range.

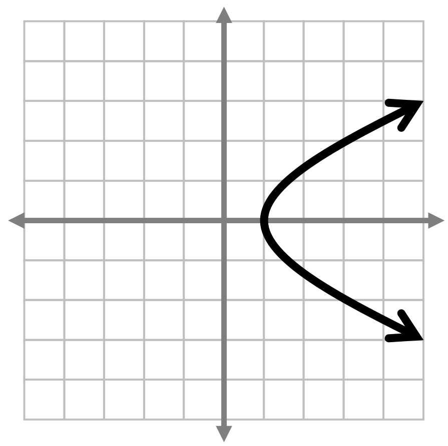
Vertical line test: If you draw a vertical line through any graph and it only crosses the graph once, then the relation is a function.

⌧ *Examples*

$\{(-2,3),(-4,6),(-8,12),(-10,24)\}$ This relation is a function; each input has only one output.



This is a function because a vertical line would only touch one point on the graph no matter where it is placed.



This is not a function because a vertical line would touch two points on the graph if placed behind the left most point.

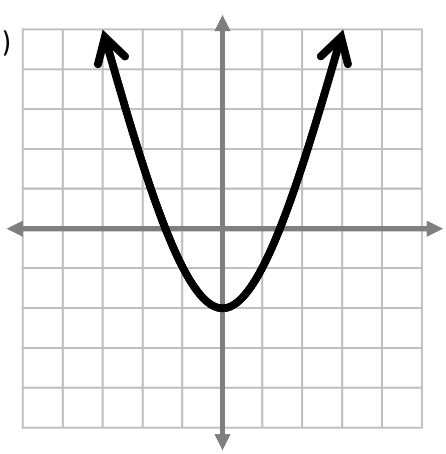
⌧ *Problems*

Identify if the following relations and graphs are functions.

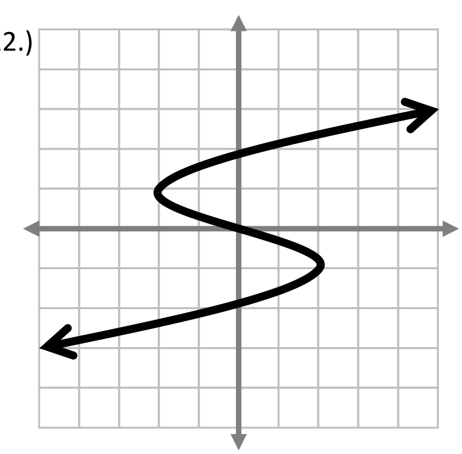
9.) $\{(2,3),(4,8),(6,10),(2,14)\}$

10.) $\{(-1,5),(0,10),(1,15),(2,20)\}$

11.)



12.)



Section 3: Linear Functions

A linear function is a function where the highest power of x is 1. You have seen these functions in many forms. Some of the common forms are:

Slope-intercept Form	**Standard Form**
y = mx + b	**Ax + By = C**

Slope is a key concept to consider when thinking of linear functions. Slope is the "m" in the y = mx + b and is defined to be –A/B for standard form of a line. Here are some definitions of slope.

$$slope = m = \frac{vertical\ change}{horizontal\ change} = \frac{rise}{run} = \frac{y_2 - y_1}{x_2 - x_1}$$

⌦ *Problems*

Find the slope of the line through the following points.

13.) (-2, 5) and (8,-3)

14.) (2, 5) and (2, -7)

15.) (4,-3) and (-2,-3)

Find the slope of the line given the following equations.

16.) y = -2x – 7

17.) y – 3x = -2

18.) x = -4

19.) y = 9

20.) 4x + 2y = -6

21.) 5x – y = -8

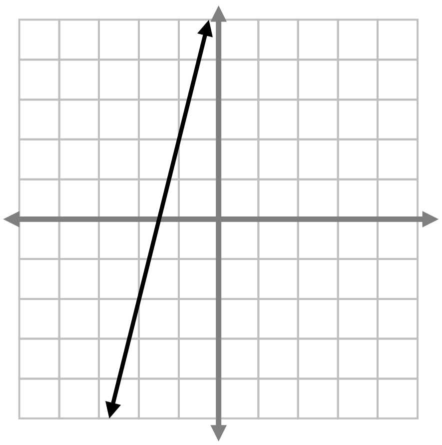
Section 4: Graphing

⌦ *Explanation*

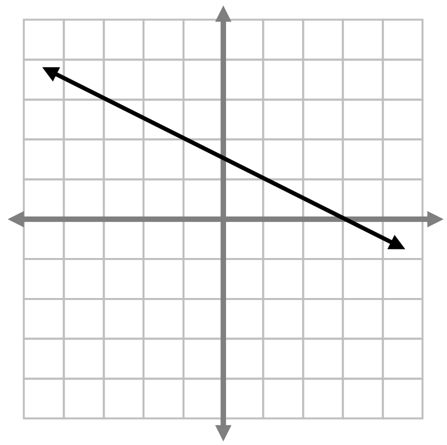
When graphing a line you need at least two points. You'll notice from the previous section that you also need to points to establish the slope of a line. Slope is a number that represents how steep a line is. The bigger the number is for slope, the steeper the line is. Slope can be positive, negative, zero, or undefined. Examples of each are given below.

Parallel lines relate to slope as well. Parallel lines have the same slope, but different y-intercepts. Perpendicular lines (lines that form right angles) have opposite and reciprocal slopes.

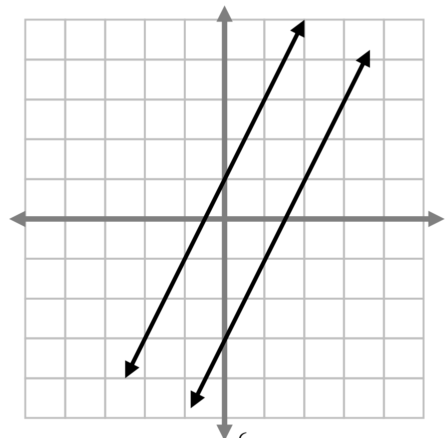
⌦ *Examples*



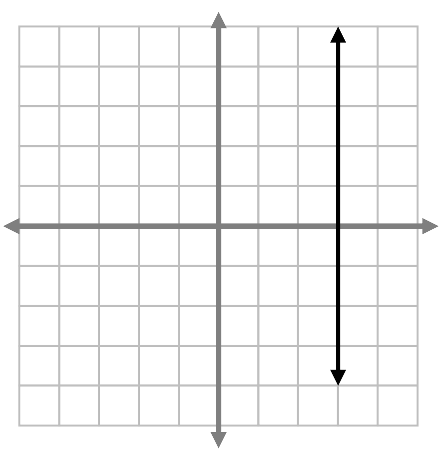
Positive Slope (m = 4)



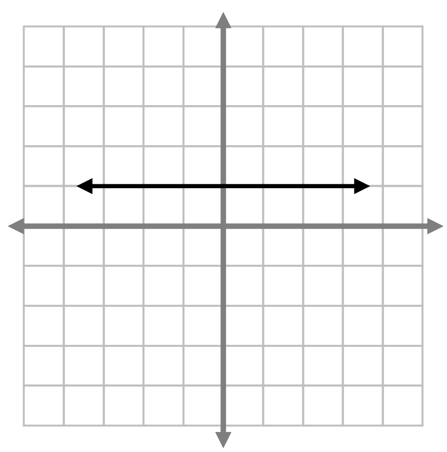
Negative Slope (m = -½)



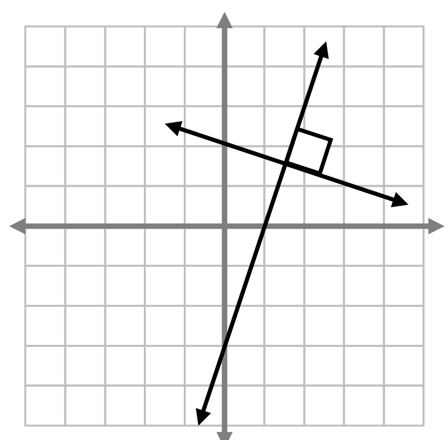
Parallel $\begin{cases} y = 2x+1 \\ y = 2x-3 \end{cases}$



Undefined Slope (x = 3)



Zero Slope (y = 1)



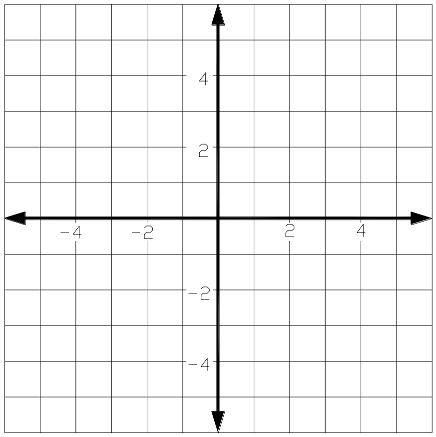
Perpindicular $\begin{cases} y = 3x-3 \\ y = -\frac{1}{3}x+2 \end{cases}$

x – Intercept: Where a function crosses the x – axis.

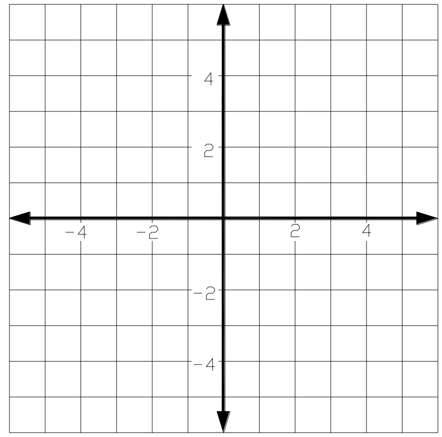
y – Intercept: Where a function crosses the y – axis.

Graph each equation.

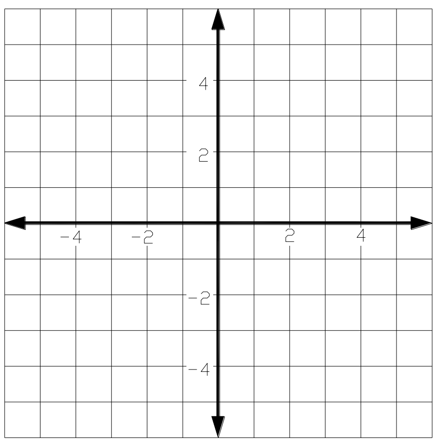
22.) y = 3x – 2



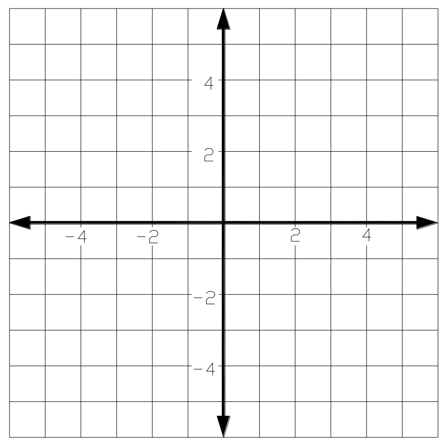
23.) y – 5 = 4x



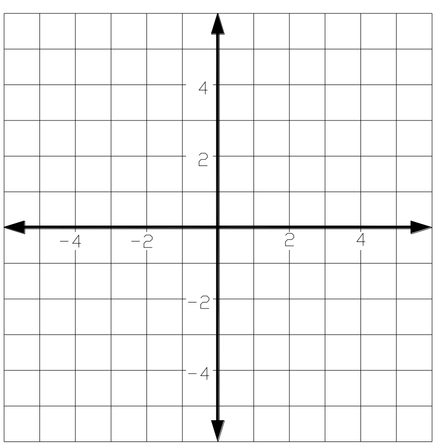
24.) 5x – 4y = 20



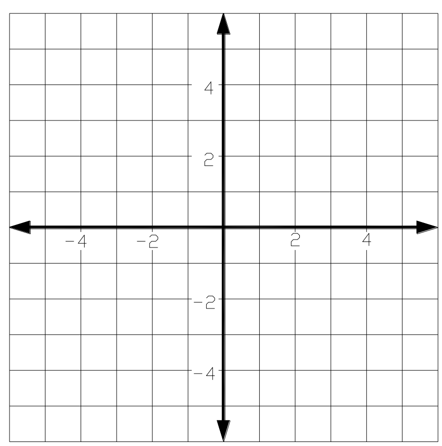
25.) y – 2x = -5



26.) $y + 3 = \frac{-3}{4}x$



27.) $y = \frac{-1}{3}x + 4$



Write the equation of the line given the following. Write the equation in slope-intercept form.

28.) slope = $\frac{2}{5}$ through the point (-1, -6)

29.) Through the points (-2, 5) and (6 , 9)

30.) Given f(3) = 7 and f(-1) = -5

31.) Parallel to the line y = 2x + 5 and passing through the point (-1, -5)

<u>Section 5. Systems of Linear Equations</u>

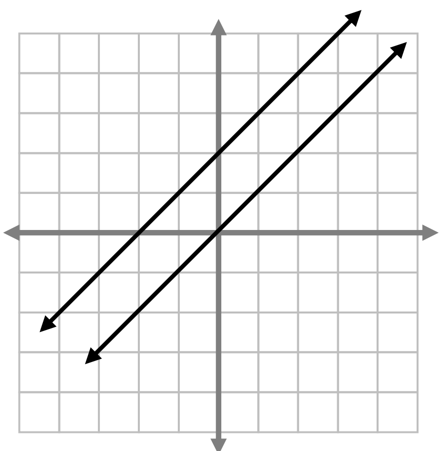
⌧*Explanation*

A system of equations is the combination of two or more equations into a single problem.
When you graph an equation, you graph its points. These points represent solutions. So a graph is all possible solutions to an equation. When you solve a system of equations you are trying to find solutions to all the equations in the system, so you want points that are shared by all the graphs. Below is an illustration of the types of solution you can get when solving a system, and a general explanation for one method for solving systems of equations: Graphing.

⌧ *Examples*

Zero Solutions

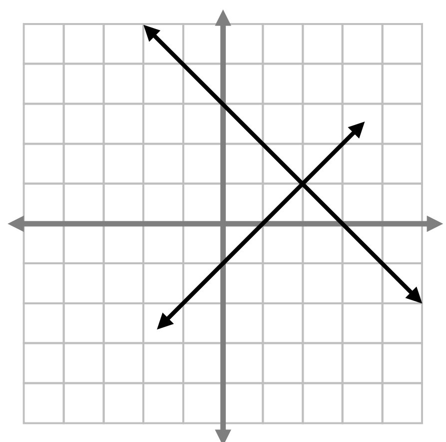
$$\begin{cases} y = x \\ y = x + 2 \end{cases}$$



There are zero solutions to this system because the lines are parallel, and parallel lines do not share any points.

One Solution

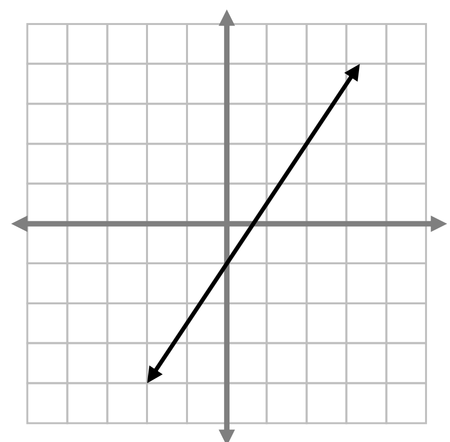
$$\begin{cases} y = x - 1 \\ y = -x + 3 \end{cases}$$



There is one solution to this system because the lines are intersect, and they share exactly one point $(2,1)$.

Infinite Solutions

$$\begin{cases} y = x - 1 \\ 3y = 3x - 3 \end{cases}$$



There are infinitely many solutions to this system because there are actually two lines on this graph. The lines are exactly the same therefore they share all their points!

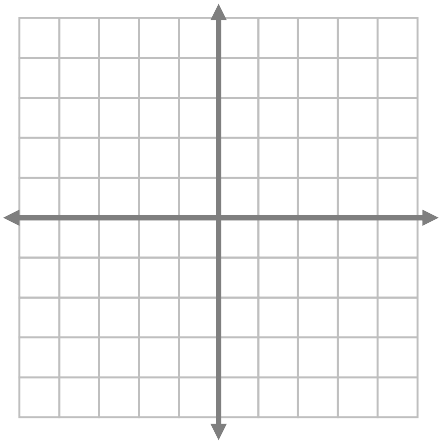
⌦Problems – Solve Systems of Equations by Graphing

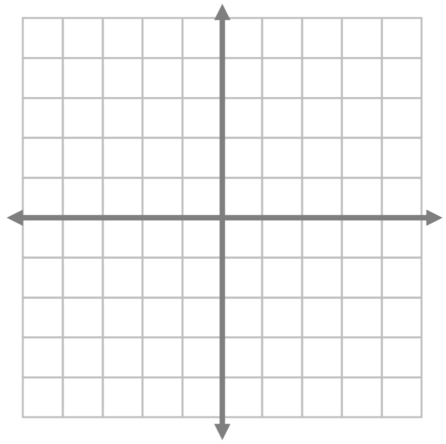
Graph the following systems to find the number of solutions that exist. Find solutions and check in both equations.

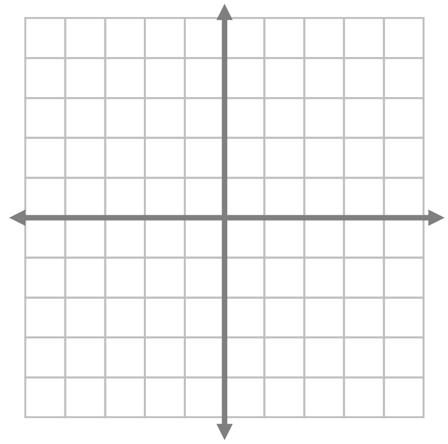
32.) $\begin{cases} y = \frac{2}{3}x + 1 \\ y = \frac{-6}{-9}x + 1 \end{cases}$

33.) $\begin{cases} y = 2x - 1 \\ y = -4x + 5 \end{cases}$

34.) $\begin{cases} y = \frac{4}{2}x + 3 \\ 3y = 6x - 9 \end{cases}$







⌧*Explanation – Solving Systems of Equations using Substitution*

Another method for solving systems of equations is named Substitution. Here your steps to solve are:

1) Isolate a variable in one of the equations.
2) Substitute the expression the isolated variable is equal to, into the other equation.
3) Solve for the only variable left in the other equation.
4) Use the value you found in Step #3 to solve for the remaining variable.

⌧ *Example*

Solve the following: $\begin{cases} 4x+3y=4 \\ 2x-y=7 \end{cases}$

$2x=7+y$	Add y across in the second equation to begin isolating it
$2x-7=y$	Subtract 7 across and y is isolated. Step one is complete.
$4x+3(2x-7)=4$	Substitute the expression y is equal to into the other equation. Step two is done.
$4x+6x-21=4$	Begin to solve for x.
$10x=25$	Continue to solve for x.
$x=2.5$	Now x is isolated and solved for. Step three is complete.
$2(2.5)-7=y$	Substitute the value of x into one of the original equations to solve for y.
$-2=y$	Solve for y, your solution is $(2.5,-2)$, and the graphs cross at that point.

⌧*Problems*

Solve the following systems using the substitution method.

35.) $\begin{cases} y=6x-11 \\ -2x-3y=-7 \end{cases}$

36.) $\begin{cases} 4x-3y=18 \\ y=-2 \end{cases}$

37.) $\begin{cases} -7x-2y=-13 \\ x-2y=11 \end{cases}$

38.) $\begin{cases} -2x+6y=6 \\ -7x+8y=-5 \end{cases}$

⌧*Explanation – Solving Systems of Equations by Elimination*

In this method we use the Addition Property of Equality from Geometry to add one equation to the other, thus allowing a term to be eliminated.

1) Use multiplication to make one term in each equation become the exact opposite of the other.
2) Add respective sides of the equations to eliminate a variable.
3) Solve for the only variable left in the equation.
4) Use the value you found in Step #3 to solve for the remaining variable.

⌧*Example*

Solve the following: $\begin{cases} 4x+3y=4 \\ 2x-y=7 \end{cases}$

$-2(2x-y)=(7)\cdot -2$ Multiply both sides by -2 so that the x terms are exact opposites in the system.

$\underline{-4x+2y}=\underline{-14}$ Simplify and step 1 is done.

$(-4x+2y)+4x+3y=4+(-14)$ Add the left sides and right sides of the equations respectively.

$5y=-10$ Simplify and the x terms are eliminated. Step 2 is done.

$y=-2$ Solve for y. Step 3 is done.

$2x-(-2)=7$ Substitute the value of y into one of the original equations to solve for x.

$x=2.5$ Solve for x, your solution is $(2.5,-2)$, and the graphs cross at that point.

⌧*Problems*

Solve the following systems using the elimination method.

39.) $\begin{cases} -4x-2y=-12 \\ 4x+8y=-24 \end{cases}$

40.) $\begin{cases} x-y=11 \\ 2x+y=19 \end{cases}$

41.) $\begin{cases} -4x+9y=9 \\ x-3y=-6 \end{cases}$

42). $\begin{cases} -7x+y=-19 \\ -2x+3y=-19 \end{cases}$

Section 6: Distributive Property and Multiplying Binomials

⌧ *Explanation*

Distributing is the act of taking one or more terms, and multiplying them by another grouping of one or more terms. Some teachers call this FOIL, but that expression is very limited and does not always work. Keep in mind that distributing is very simple already; it means multiply everything in one group, by everything in another group.

⌧ *Examples*

Distribute and simplify the following

$-(x-5)$	Here, a negative is outside the quantity. That is the same as -1.
$-x+5$	Multiply the -1 by both terms inside and remove the parenthesis.

$(x+3)(x-2)$	Here there are two terms in each binomial.
$(x+3)(x-2)$	Take the first term in the first binomial and multiply it by both terms in the second.
x^2-2x	←The results are listed on this line.
$(x+3)(x-2)$	Take the second term in the first binomial and multiply it by both terms in the second.
$x^2-2x+3x-6$	←The results are listed on this line.
x^2+x-6	Combine any like terms and you are done.

⌧ *Problems*

Distribute the following expressions, and combine any like terms that result.

43.) $5(x-3)$

44.) $6x(-x+12y)$

45.) $(x+1)(x-6)$

46.) $(4x^2-2)(x+1)$

47.) $(3x+2)(y-9)$

48.) $(x+1)(x^2+3x+2)$

Section 7: Solving Equations

Solve each equation and check your answer.

49.) 3x + 4 = -2

50.) 3a – 2 = 5a + 7

51.) 4(3h – 5) = -15

52.) 3(4 – 3t) = -2

53.) 5 – 2(3t + 4) = -1

54.) 2(3x – 4) = -3(x – 8)

55.) $\frac{2}{3}s - 5 = 4$

56.) $\frac{1}{3}(2x - 1) = \frac{3}{4}(x + 2)$

57.) $\frac{1}{2}(3x + 5) = -3$

Solve each formula by isolating the indicated variable.

58.) A = bh, solve for h

(Hint: Get "h" by itself)

59.) $V = \pi r^2 \mathrm{h}$; solve for h

(Hint: Get "h" by itself)

60.) $s = \frac{1}{2}gt^2$; solve for g

(Hint: Get "g" by itself)

Section 8: Fractions

To multiply fractions:

- Multiply the numerators of the fractions
- Multiply the denominators of the fractions
- Place the product of the numerators over the product of the denominators
- Simplify the fraction

Example: $\frac{3}{4} \times \frac{5}{6} = \frac{15}{24} = \frac{5}{4}$

To divide fractions:

- Invert (i.e. turn over) the denominator fraction and multiply the fractions as above

Example: $\frac{2}{9} \div \frac{3}{12} = \frac{2}{9} \times \frac{12}{3} = \frac{24}{27} = \frac{8}{9}$

To add or subtract:

- Find a common denominator, if needed
- Then add or subtract the numerators
- The denominator stays the same

Example: $\frac{3}{4} + \frac{5}{6} = \frac{9}{12} + \frac{10}{12} = \frac{19}{12}$

Perform the following operations. Show all work, simplify all fractions.

61.) $12 \text{ x } \frac{3}{4}$

62.) $\frac{1}{5} \text{ x } \frac{30}{4}$

63.) $\frac{2}{7} \text{ x } \frac{21}{30}$

64.) $\frac{20}{3} \div 4$

65.) $\frac{1}{10} \div \frac{3}{5}$

66.) $\frac{2}{5} \div \frac{8}{10}$

67.) $\frac{3}{5} + \frac{4}{5}$

68.) $\frac{1}{2} + \frac{2}{3}$

69.) $\frac{2}{3} - \frac{3}{7}$

Section 9. Properties of Exponents

⌧ *Examples*

Product Property

$a^x \cdot a^y = a^{x+y}$

Example: $5^3 \cdot 5^9 \rightarrow 5^{12}$

Quotient Property

$\dfrac{a^x}{a^y} = a^{x-y}$

Example: $\dfrac{10^8}{10^{12}} \rightarrow 10^{-4}$

Power to a Power Property

$\left(a^x\right)^y = a^{x \cdot y}$

Example: $\left(6^4\right)^5 \rightarrow 6^{20}$

Product to a Power Property

$(ab)^x = a^x b^x$

Example: $\left(19xy^2\right)^3 \rightarrow 19^3 x^3 y^6$

Zero Exponent Property

$a^0 = 1$ except $a \neq 0$

Example: $7^0 \rightarrow 1$

Negative Exponent Property

$a^{-n} = \dfrac{1}{a^n}$

Example: $4^{-3} \rightarrow \dfrac{1}{4^3}$ also $\dfrac{5}{x^{-2}} \rightarrow 5x^2$

⌧ *Problems*

Simplify the following expressions by combining all similar bases, and removing any negative or zero exponents. You may leave constants to a power as they are.

70.) $2x^2y^4 \cdot 7xy^3$

71.) $\dfrac{4x^2y^3}{2xy^8}$

72.) $\left(\dfrac{82x^2y^7z}{12y^5z^9}\right)^0$

73.) $\dfrac{9x^{-2}y}{3z^{-4}}$

74.) $\left(7x^2y^3\right)^4$

75.) $\dfrac{3a^2b^3 \cdot 4ac^4}{12a^{-2}bc^3}$

76.) $15^{-4}(15^8)$

77.) $a^7(a^8)(a)$

78.) $(3m^4n^6)(2mn)^0(2m^2n)$

79.) $\dfrac{-28a^6b^{-3}c^5}{7a^{11}b^{-5}c^5}$

80.) $(-1x^5y^6)^{10}$

81.) $(5m^3n)(-2mn^3)$

Section 10: Simplifying Radicals

Perfect Squares:

X	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
X^2	1	4	9	16	25	36	49	64	81	100	121	144	169	196	225

$\sqrt{25}$ *is read "the square root of* 25"

$\sqrt{25} = 5$ *because* $5^2 = 25$

Examples:

$\sqrt{36}$

6

$\sqrt{27}$

$\sqrt{9} * \sqrt{3}$

$3\sqrt{3}$

$\sqrt{50}$

$\sqrt{25} * \sqrt{2}$

$5\sqrt{2}$

$\sqrt{x^2}$

$\sqrt{x * x}$

x

Simplify the following Radicals. Express all answers in simplest radical form (no decimals).

82.) $\sqrt{40}$

83.) $\sqrt{16x^2}$

84.) $\sqrt{50}$

85.) $\sqrt{18}$

86.) $\sqrt{125}$

87.) $\sqrt{180}$

88.) $\sqrt{72}$

89.) $\sqrt{32y^2}$

90.) $\sqrt{400y^2}$

91.) $\sqrt{98}$

Thank you for taking the time to complete this assignment. Have a great summer!!!