

## I. Algebraic Properties

Commutative	$a + b + c = a + c + b$	Reflexive	$a + b = a + b$
Associative	$a + (b + c) = (a + b) + c$	Symmetric	If $a = b + c$ then $b + c = a$
Identity	$a + 0 = a$ or $a \cdot 1 = a$	Transitive	If $a = b$ and $b = c$ then $a = c$
Inverse	$a + (-a) = 0$ or $a \cdot \frac{1}{a} = 1$	Distributive	$a(b + c) = ab + ac$

Name the property illustrated by each equation.

1)  $5(3x + y) = 5(3x + 1y)$

2)  $7n + 2n = (7 + 2)n$

3)  $3(2x)y = (3 \cdot 2)(xy)$

4)  $5x \cdot (4y + 3x) = 5x \cdot (3x + 4y)$

5)  $(6 + -6)y = 0y$

6)  $4n + 0 = 4n$

7)  $\cos(3x + 5) = \cos(3x + 5)$

8)  $\log\left(\frac{1}{4} \cdot 4y\right) = \log y$

## II. Properties of Exponents

PROPERTY		EXAMPLE
Product of Powers	$a^m \cdot a^n = a^{m+n}$	$x^4 \cdot x^2 = x^6$
Power of a Power	$(a^m)^n = a^{m \cdot n}$	$(x^4)^2 = x^8$
Power of a Product	$(ab)^m = a^m b^m$	$(2x)^3 = 8x^3$
Negative Power	$a^{-n} = \frac{1}{a^n}$	$x^{-3} = \frac{1}{x^3}$
Zero Power	$a^0 = 1$	$4^0 = 1$
Quotient of Powers	$\frac{a^m}{a^n} = a^{m-n}$	$\frac{x^{10}}{x^4} = x^6$
Power of Quotient	$\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$	$\left(\frac{x}{y}\right)^3 = \frac{x^3}{y^3}$

Tutorial: <https://tinyurl.com/bdhxvbfx>

Simplify each expression. Answers should be written using positive exponents.

1)  $g^5 \cdot g^{11}$  \_\_\_\_\_

2)  $(b^6)^3$  \_\_\_\_\_

3)  $w^{-7}$  \_\_\_\_\_

4)  $\frac{y^{12}}{y^8}$  \_\_\_\_\_

5)  $(3x^7)(-5x^3)$  \_\_\_\_\_

6)  $(-4a^5b^0c)^2$  \_\_\_\_\_

### III. Order of Operations (PEMDAS)

- **P**arenthesis and other grouping symbols.
- **E**xponential expressions.
- **M**ultiplication & **D**ivision (Left to Right)
- **A**ddition & **S**ubtraction (Left to Right)

Tutorial: <http://bit.ly/2YeWKU3>

Simplify each numerical expression.

1)  $6 + 2 \times 8 - 12 + 9 \div 3$       2)  $25 - (2^3 + 5 \times 2 - 3)$       3)  $5 - 3(20 \div 4) + 6^2(3)$

4)  $\frac{-2 \cdot (-30) + 0.5 \cdot 20}{4^2 - 6}$

5)  $\frac{15 - [8 - (2 + 5)]}{18 - 5^2}$

6)  $\frac{14 - 2|13 - 21|}{-4^2}$

### IV. Evaluating Algebraic Expressions

- **S**ubstitute the given value(s) of the variable(s).
- **U**se order of operations to find the value of the resulting numerical expression.

Tutorial: <http://bit.ly/2Ju5fX9>

Evaluate each expression.

1)  $x\left(\frac{y}{2} + 3z^2\right) - 2x$  if  $x = \frac{1}{2}$ ,  $y = 4$ ,  $z = -2$       2)  $12a - 4a^2 + 7a^3$  if  $a = -3$

3)  $\frac{-b + \sqrt{b^2 - 4ac}}{2a}$  if  $a = 1$ ,  $b = -4$ ,  $c = -21$

4)  $15\left(-\frac{1}{3}\right)^x$  if  $x = 3$

5)  $\frac{3(x+y) - 2(x-y)}{5x+y}$  if  $x = 3$ ,  $y = 4$

## V. Fraction Operations

Tutorials: Adding and Subtracting Fractions: <http://bit.ly/2DWlj0o>

Multiplying Fractions: <http://bit.ly/2vTWopy>

Dividing Fractions: <http://bit.ly/2DVfMac>

Evaluate each of the following.

1)  $\frac{2}{5} + \frac{2}{3}$

2)  $\frac{3}{4} - \frac{1}{6}$

3)  $5 \cdot \frac{7}{3}$

4)  $\frac{10}{9} \div \frac{55}{3}$

5)  $\left(\frac{23}{8} - \frac{1}{2}\right) \div \left(\frac{1}{2}\right)^2$

6)  $\frac{5}{7} \cdot \left[\left(\frac{1}{3}\right)^2 - \frac{3}{4}\right]$

## VI. Simplifying Radicals

An expression under a radical sign is in simplest radical form when:

- 1) there is no integer under the radical sign with a perfect square factor,
- 2) there are no fractions under the radical sign,
- 3) there are no radicals in the denominator

Tutorial: <http://bit.ly/2YfsM25>

Express the following in simplest radical form.

1)  $\sqrt{50}$

2)  $\sqrt{192}$

3)  $\sqrt{169}$

4)  $\sqrt{\frac{13}{49}}$

## VII. Operations With Polynomials

Tutorials: Polynomials (adding & subtracting): <http://bit.ly/2H7XQLs>

Polynomials (multiplying): <http://bit.ly/2J9YmLp>

Perform the indicated operations and simplify.

1)  $(7x^2 + 4x - 3) - (-5x^2 - 3x + 2)$

2)  $(7x - 3)(3x + 7)$

3)  $(5x - 6)^2$

4)  $(n^2 + 5n + 3) + (2n^2 + 8n + 8)$

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

6)  $-2x(5x + 11)$

## VIII. Factoring Polynomials

- Always factor out *GCF* first
- Look for difference of squares
- Factor trinomials using Algebra 1 techniques

Examples:

Factoring out the *GCF*

a)  $6x^2 + 21x$   
 $3x(2x + 7)$

Difference of Squares

b)  $x^2 - 64$   
 $(x - 8)(x + 8)$

Trinomial

c)  $3x^2 + 7x + 2$   
 $(3x + 1)(x + 2)$

Tutorials: Factoring out GCF's: <http://bit.ly/2HaI3f2>

Factoring Difference of Perfect Squares: <http://bit.ly/2JcHKIW>

Factoring trinomials: <http://bit.ly/2Haqk6h>

Factor Completely.

1)  $16y^2 + 8y$

2)  $18x^2 - 12x$

3)  $6m^2 - 32m + 10$

4)  $6y^2 - 13y - 5$

5)  $20x^2 + 31x - 7$

6)  $12x^2 + 23x + 10$

7)  $x^2 - 2x - 63$

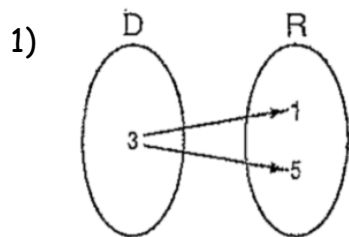
8)  $8x^2 - 6x - 9$

9)  $x^2 - 121$

## IX. Functions

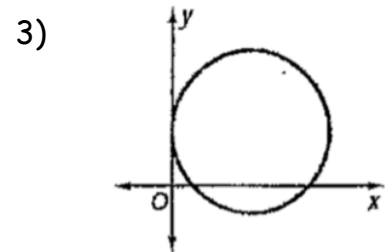
Tutorial: <http://bit.ly/2H8tdo6>

Determine whether each relation is a function. Write yes or no.



2) 

x	y
1	2
2	4
3	6



State the domain and range of each relation. Then, determine if each relation is a function.

1)  $\{(2, -3), (2, 4), (2, -1)\}$

2)  $\{(2, 6), (6, 2)\}$

3)  $\{(-3, 4), (-2, 4), (-1, -1), (3, -1)\}$

Find each value if  $f(x) = 2x - 1$  and  $g(x) = 2 - x^2$ .

1)  $f(0)$

2)  $g(4)$

3)  $f(b + 1)$

4)  $g(a - 4)$

## X. Solving Linear Equations

Tutorial: <http://bit.ly/2YiCe52>

Solve each equation.

1)  $2[x + 3(x - 1)] = 18$

2)  $6(y + 2) - 4 = 10$

3)  $2x^2 = 50$

4)  $5 + 2(k + 4) = 5(k - 3) + 10$

5)  $6 + 2w(w - 3) = 2w^2$

6)  $\frac{2}{3}x - 18 = \frac{x}{6}$

7)  $4(x + 1) - 1 = 2(x - 5) + 2x + 5$

8)  $2[3(x + 1) - 2] = 6x + 2$

## XI. Solving Inequalities

Tutorials: Linear Inequalities: <http://bit.ly/2vPI7ui>

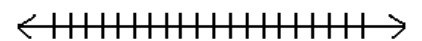
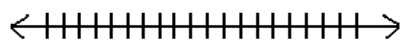
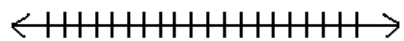
Compound Inequalities: <http://bit.ly/2LuMi9r>

Solve and graph each inequality.

1)  $8x - 6 \geq 10$

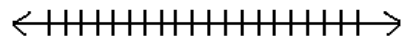
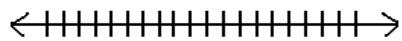
2)  $-16 - 8x \geq 0$

3)  $9x - 11 > 6x - 9$



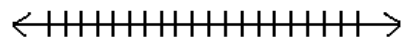
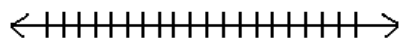
4)  $9(2x - 5) - 3 < 7x - 4$

5)  $-36 - 2(x + 77) > -4(2x + 52)$



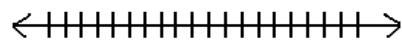
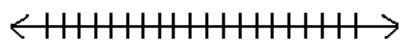
6)  $12 < x + 3$  or  $-5 \leq 1 - x$

7)  $14 < 5 - 3x \leq 53$



8)  $3x - 13 < -4$  or  $7 - 2x \leq 5$

9)  $52 < 4 - 3x < 13$



## XII. Linear Equations in Two Variables

- Slope Formula:  $\text{slope} = m = \frac{y_2 - y_1}{x_2 - x_1}$
- Graph by putting equations in  $y = mx + b$  form or by finding intercepts.
- For an x-intercept, substitute 0 for y. For a y-intercept, substitute 0 for x.
- Parallel lines have the same slope.
- Perpendicular lines have negative reciprocal slopes.

Tutorials: Graphing Lines: <http://bit.ly/2VejbH4>

Writing linear equations from two points: <http://bit.ly/2H7WG2y>

Writing linear equations with parallel or perpendicular lines: <http://bit.ly/2PXmKk0>

Find the slope of each line.

1) Through  $(3, -4)$  and  $(-4, 6)$

2) Through  $(-4, -6)$  and  $(-4, -8)$

3)  $6x - 10y = -1$

4)  $x = -2$

5)  $y = 1$

Write an equation, in slope-intercept form using the given information.

1)  $(5, 4)$   $m = -\frac{2}{3}$

2)  $(-2, 4)$   $m = -3$

3)  $(-6, -3)$   $(-2, -5)$

4) Parallel to  $2x - 3y = 6$  and passing through  $(-2, 5)$

5) Perpendicular to  $y = -2x + 6$  and passing through  $(-4, 2)$

Find the x and y intercepts of each line.

1)  $10x - 4y = -20$

2)  $y = 2x + 3$

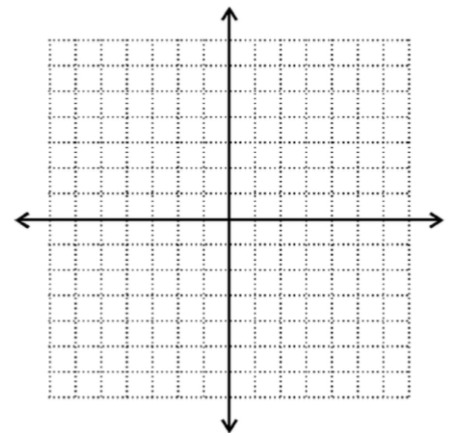
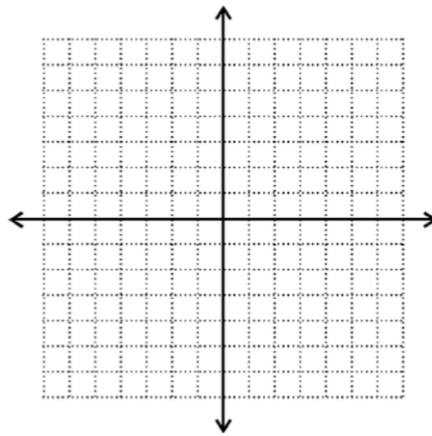
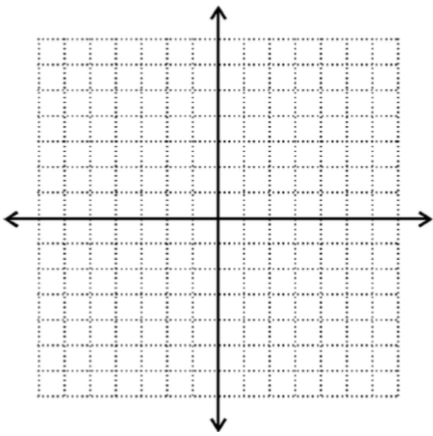
3)  $x = 3$

Graph each line.

1)  $y = \frac{1}{5}x - 5$

2)  $y = -\frac{3}{2}x + 5$

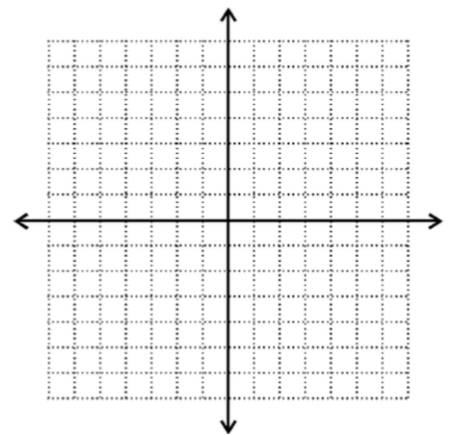
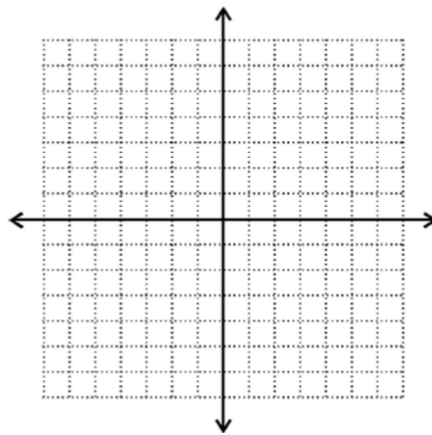
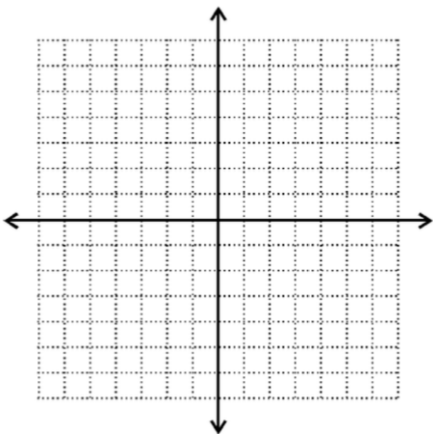
3)  $4x - y = -2$



4)  $3x - 8y + 24 = 0$

5)  $y = -3x$

6)  $3y = 12$





### XIII. Solving Systems of Equations

Tutorials: Solving Systems using Substitution: <http://bit.ly/2JsQmnR>

Solving Systems using Elimination: <http://bit.ly/2LvJEaf>

Solve each system of equations by either the substitution method or elimination method. Write your answer as an ordered pair.

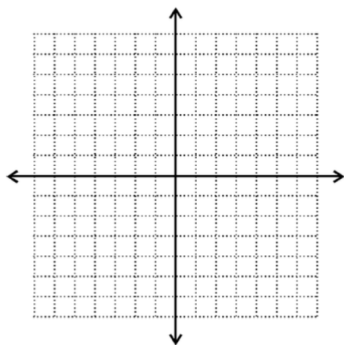
1)  $y = 2x + 4$   
 $-3x + y = -9$

2)  $3x + 7y = -1$   
 $6x + 7y = 0$

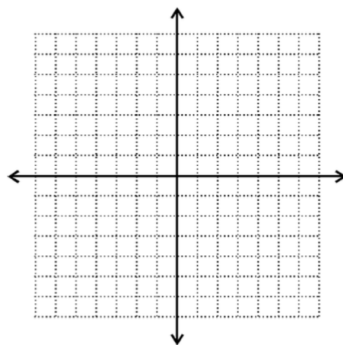
3)  $4x - 6y = 20$   
 $y = \frac{2}{3}x - \frac{10}{3}$

Solve each system of equations by graphing.

1)  $2x + 3y = 6$   
 $-x + 3y = -12$



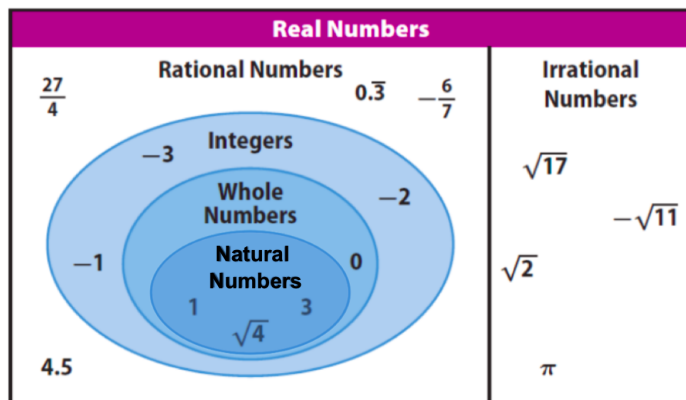
2)  $2x + 3y = 18$   
 $5x - 3y = 3$



3) Is (11, 3) a solution to the system below?

$x - 2y = 5$   
 $3x - 5y = 8$

### XIV. Sets of Numbers



Name all sets of numbers to which each number belongs.

1) 6425

2)  $\sqrt{7}$

3)  $-\frac{2\pi}{3}$

4) 0

5)  $-\sqrt{16}$

6) -31.8