

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: <http://bit.ly/2HaPdyI>

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/2vTWopv>

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

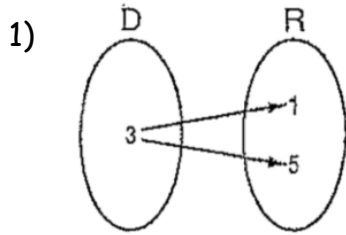
7) $x^2 - 2x - 63$

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

9) $x^2 - 121$

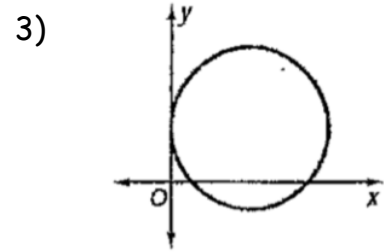
IX. FunctionsTutorial: <http://bit.ly/2H8tdo6>

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 EquationsTutorial: <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>

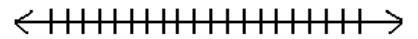
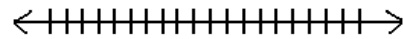
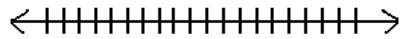
Compound Inequalities: <http://bit.ly/2LuMi9r>

Solve and graph each inequality.

1) $8x - 6 \geq 10$

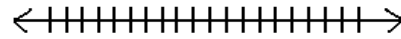
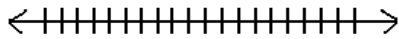
2) $-16 - 8x \geq 0$

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



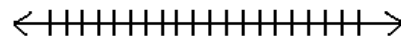
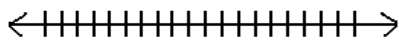
4) $9(2x - 5) - 3 < 7x - 4$

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



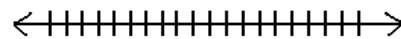
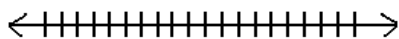
6) $12 < x + 3$ or $-5 \leq 1 - x$

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) $y = 2x + 3$

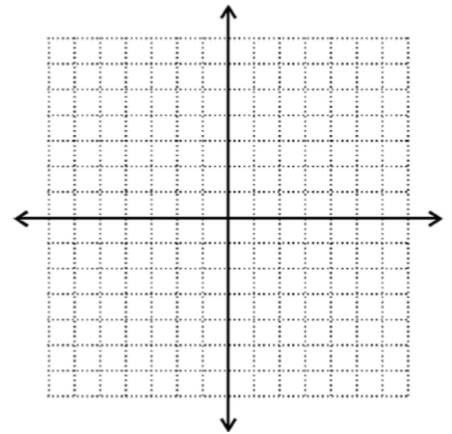
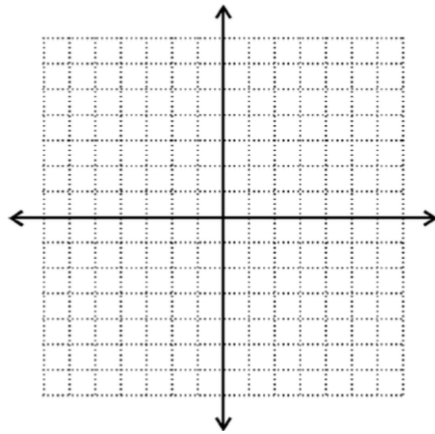
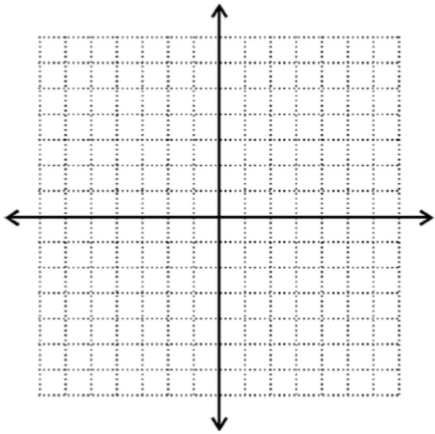
3) $x = 3$

Graph each line.

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

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

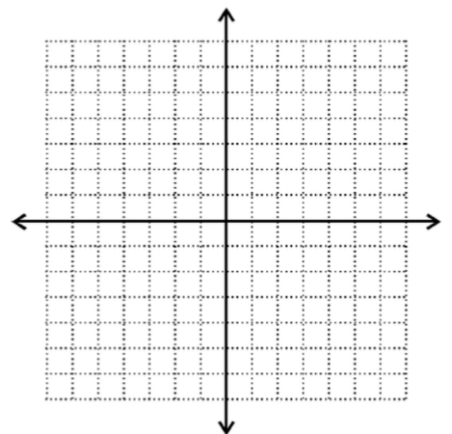
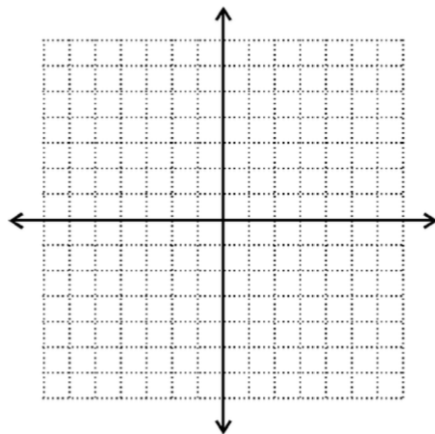
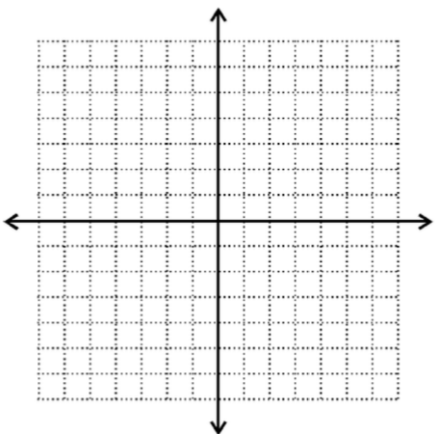
3) $4x - y = -2$



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.

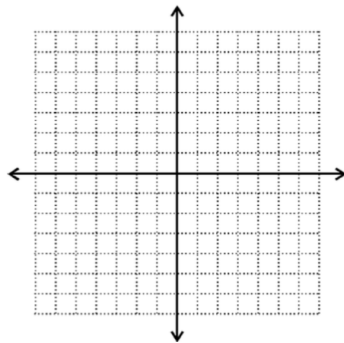
1) $y = 2x + 4$
 $-3x + y = -9$

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

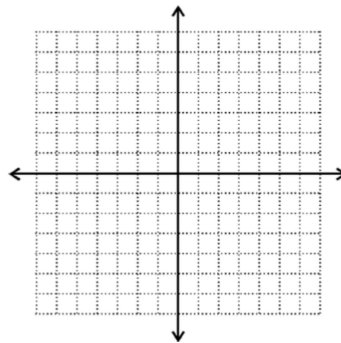
3) $4x - 6y = 20$
 $y = \frac{2}{3}x - \frac{10}{3}$

Solve each system of equations by graphing.

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



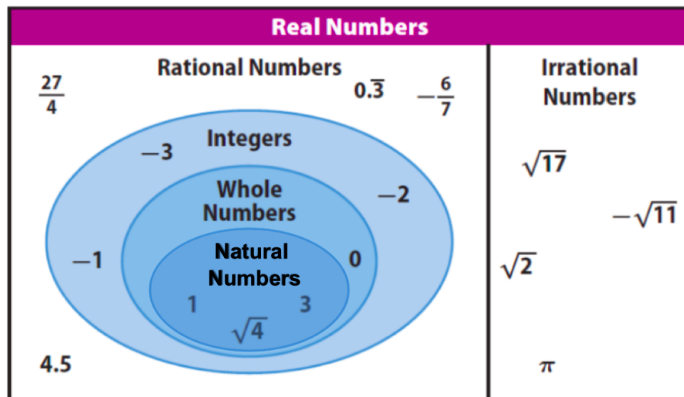
2) $2x + 3y = 18$
 $5x - 3y = 3$



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