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) $6 + 2\times8 - 12 + 9 \div 3$

2) $25 - (2^3 + 5\times2 - 3)$

3) $5 - 3(20 \div 4) + 6^2(3)$

4) $\frac{-2\cdot(-30)+0.5\cdot20}{4^2-6}$

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

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

IV. Evaluating Algebraic Expressions

- **Substitute the given value(s) of the variable(s).**
- **Use 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	Difference of Squares	Trinomial
a) $6x^2 + 21x$	b) $x^2 - 64$	c) $3x^2 + 7x + 2$
$3x(2x + 7)$	$(x - 8)(x + 8)$	$(3x + 1)(x + 2)$

Tutorials: Factoring out GCF's: http://bit.ly/2HaI3f2
Factoring Difference of Perfect Squares: http://bit.ly/2JcHKlW
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) $x^2 - 2x - 63$

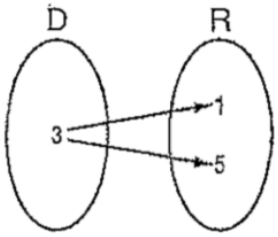
8) $8x^2 - 6x - 9$

9) $x^2 - 121$

IX. Functions

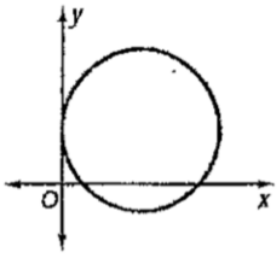
Tutorial: http://bit.ly/2H8tdo6

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

1) 

2)

x	y
1	2
2	4
3	6

3) 

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

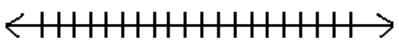
7) $4(x+1) - 1 = 2(x-5) + 2x + 5$ 8) $2[3(x+1) - 2] = 6x + 2$

XI. Solving Inequalities

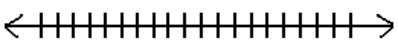
Tutorials: Linear Inequalities: http://bit.ly/2vPI7ui
Compound Inequalities: http://bit.ly/2LuMi9r

Solve and graph each inequality.

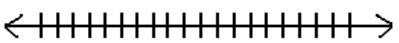
1) $8x - 6 \geq 10$



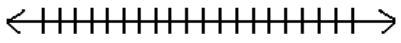
2) $-16 - 8x \geq 0$



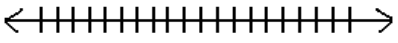
3) $9x - 11 > 6x - 9$



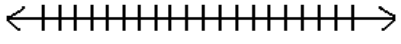
4) $9(2x - 5) - 3 < 7x - 4$



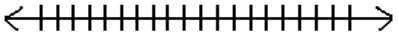
5) $-36 - 2(x + 77) > -4(2x + 52)$



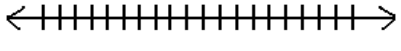
6) $12 < x + 3$ or $-5 \leq 1 - x$



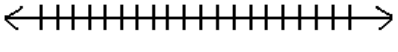
7) $14 < 5 - 3x \leq 53$



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) $y = 2x + 3$

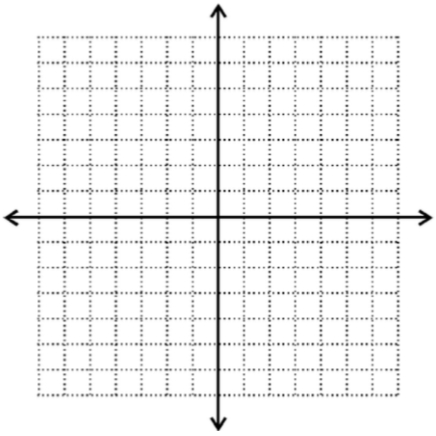
3) $x = 3$

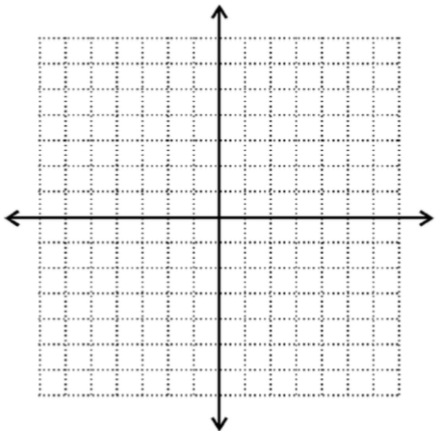
Graph each line.

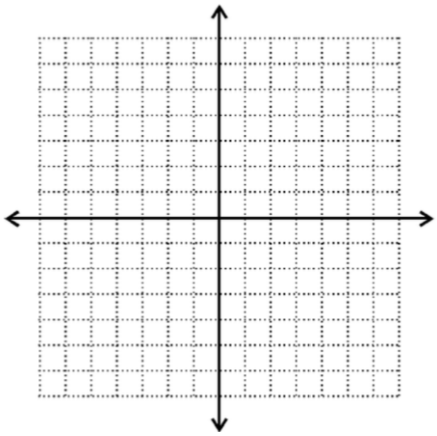
1) $y = \frac{1}{5}x - 5$

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

3) $4x - y = -2$



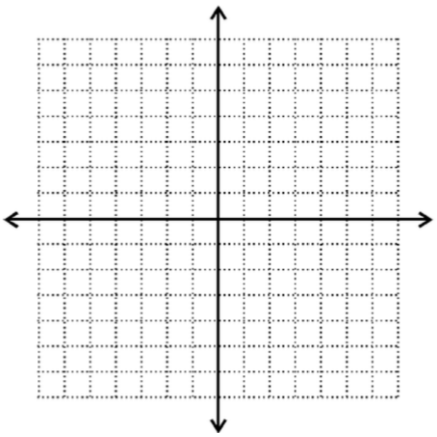


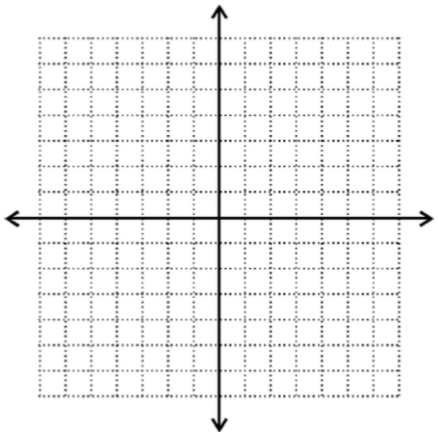


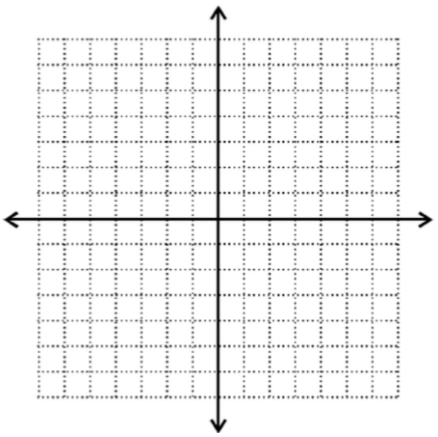
4) $3x - 8y + 24 = 0$

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.

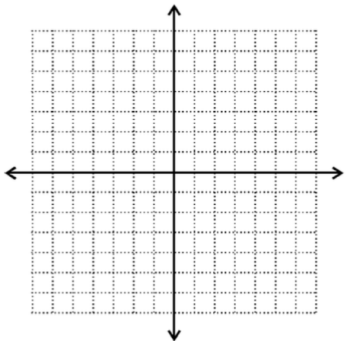
1) $y = 2x + 4$
$-3x + y = -9$

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

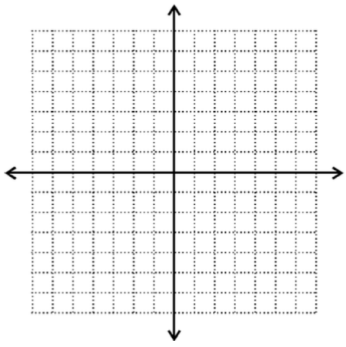
3) $4x - 6y = 20$
$y = \frac{2}{3}x - \frac{10}{3}$

Solve each system of equations by graphing.

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



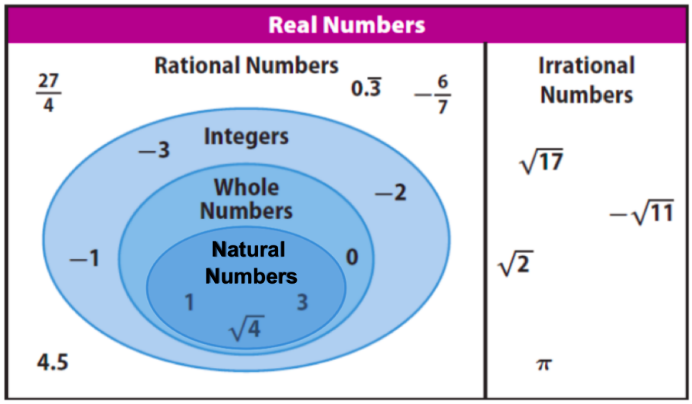
2) $2x + 3y = 18$
$5x - 3y = 3$



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