Summer Packet for Incoming 7th Grade Algebra Students

Please read the following before completing the packet

First, do not be alarmed at how many pages the packet is

Most of the pages have at least half of the problems complete as examples, in addition to notes for you to follow.

HOWEVER, YOU MUST COMPLETE THE BLANK PROBLEMS ON EACH PAGE.

There is a "Functions and Linear Relations Dictionary" that has all the terms already filled in – PLEASE READ THROUGH THIS! All of these terms are important and WILL BE USED in Algebra.

Have a great summer and looking forward to seeing you in August!

Sincerely,

Mrs. Decker

Name:	Date:
Topic:	Class:

Main Ideas/Questions	Notes/Examples
PARTS OF AN EXPRESSION	

$14x + 9 - 2x + 8 - 5x + 1$

Variable Terms
(Terms WITH a variable)
14x, -2x, -5x

Constant Terms
(Terms WITHOUT a variable)
9, 8, 1

Coefficients
(Number NEXT TO a variable)
14, -2, -5

EXAMPLES

Directions: Identify the variable terms, constant terms, and coefficients.

	Expression	Variable Terms	Constant Terms	Coefficients
1.	$11a + 4a$	11a, 4a	—	11, 4
2.	$3x + 6 + 7x - 4$	3x, 7x	6, -4	3, 7
3.	$-12m - 3 + 4m + 16$	-12m, 4m	-3, 16	-12, 4
4.	$6k - 4 + k - 2$	6k, k	-4, -2	6, 1
5.	$3 + 13 - 5p - 2p$			
6.	$-10r - r - 6r + 11$			
7.	$19 - 5n - 8 + 14$			
8.	$-5 + 13y - 2y + 18$			
9.	$8a - 7b + 1 - 2b + 3a$			
10.	$11x - 4y + 2x + 8$			

Name:	Date:
Topic:	Class:

Main Ideas/Questions	Notes/Examples
Order of Operations	Rules to follow when simplifying an expression that contains multiple operations.

P	Parenthesis + other grouping symbols
E	Exponents + radicals
M/D	Multiplication + Division (left to right)
A/S	Addition + Subtraction (left to right)

Examples

Directions: Evaluate each expression.

1. $7+54\div 3(2)$

$7+18(2)$

$7+36$

$\boxed{43}$

2. $24-4^2\cdot 3+15$

3. $9^2+28\div 4-|-18|$

$9^2+28\div 4-18$

$81+28\div 4-18$

$81+7-18$

$88-18$

$\boxed{70}$

4. $48\div(2^5-29)+6^2$

5. $(9-5)^3-(18-6\cdot 2)$

$(4)^3-(18-12)$

$(4)^3-6$

$64-6$

$\boxed{58}$

6. $7+(53-3^4)\div\sqrt{16}$

Name:	Date:
Topic:	Class:

Main Ideas/Questions	Notes/Examples
Evaluating Expressions	• **What is an algebraic expression?** An expression that contains one or more variables. • **To evaluate:** Substitute the variables with their given values, then follow the order of operations.
Examples	**Directions:** Evaluate each expression using the variable replacements.

1. $7x+4y$ if $x = 5$ and $y = -3$ $\boxed{}$	**2.** $9a^2-2b^2$ if $a = 4$ and $b = 7$ $9(4)^2-2(7)^2$ $9(16)-2(49)$ $144-98$ $\boxed{46}$
3. $4m^2+5m$ if $m = -2$ $\boxed{}$	**4.** $(8c-d)\div cd$ if $c = 2$ and $d = -4$ $(8(2)-(-4))\div(2)(-4)$ $(16+4)\div(2)(-4)$ $20\div(2)(-4)$ $10(-4)$ $\boxed{-40}$
5. $(ab)^2-4b^3+1$ if $a = 3$ and $b = 2$ $=\boxed{}$	**6.** $2\|r\|-3rs$ if $r = -5$ and $s = 4$ $2\|-5\|-3(-5)(4)$ $2(5)-3(-5)(4)$ $10+15(4)$ $10+60 = \boxed{70}$
7. $(w-v)^2+2v-7w$ if $w = -4$, $v = 1$ $=\boxed{55}$	**8.** $\frac{2}{3}x^2-5x+8$ if $x = 6$ $\frac{2}{3}(6)^2-5(6)+8$ $\frac{2}{3}(36)-30+8$ $24-30+8 = \boxed{2}$

Name:	Date:
Topic:	Class:

Main Ideas/Questions	Notes/Examples
DISTRIBUTIVE PROPERTY	**Recall:** The distributive property states that $a(b+c) =$ ab + ac or $a(b-c) =$ ab - ac

GUIDED EXAMPLES

1 $4(x+9)$ $4 \cdot x + 4 \cdot 9$ $4x + 36$	2 $7(k-3)$ $7 \cdot k - 7 \cdot 3$ $7k - 21$
3 $-3(n-8)$ $-3n - 3 \cdot -8$ $-3n + 24$	4 $-2(5x-2)$ $-2 \cdot 5x - 2 \cdot -2$ $-10x + 4$

YOU TRY!

Directions: Simplify each expression by distributing.

1. $7(x+5)$ $7x+35$	**2.** $5(w-4)$ $5w-20$	**3.** $-5(m-5)$ $-5m+25$
4. $9(2-a)$ $18-9a$	**5.** $2(y+3)$ $2y+6$	**6.** $-2(x+7)$ $-2x-14$
7. $-7(3-5m)$	**8.** $3(2n+8)$	**9.** $-12(c+4)$
10. $-2(4k+5)$	**11.** $-(k-2)$	**12.** $4(1-7p)$
13. $9(2r-7)$	**14.** $-(5k+4)$	**15.** $\frac{4}{9}\left(\frac{3}{8}w+10\right)$

COMBINING LIKE TERMS	You can simplify an algebraic expression by **combining like terms.** This means to combine common variable terms and contant terms. **Example:** Simplify the expression below: $14x+9-2x+8-5x+1=$ $7x+18$

EXAMPLES

Directions: Simplify each expression.

11. $4x+7x$	**12.** $k-6k$ $-5k$
13. $6c+1+11c$	**14.** $7-2y+12$ $-2y+19$
15. $11m-5m-13$	**16.** $-6+8a-16$ $8a-22$
17. $9v+7-3v-v$	**18.** $4-2n-3n-19$ $-5n-15$
19. $-14w+10w-11+2w$	**20.** $-1-6-5r+13r$ $8r-7$
21. $10+4h-8h-1$	**22.** $-7x-12+x-9+6x$ -21
23. $-8x-2y+23x-6y$	**24.** $-a-5b+4b-11b+2-3a$ $-4a-12b+2$
25. $9m-5n+14+m-2n-7$	**26.** $2c+7d-8c-c-5+4d$ $-7c+11d-5$
27. $\frac{11}{4}k-\frac{3}{8}k$	**28.** $\frac{3}{4}-\frac{1}{6}v+\frac{7}{15}v-\frac{1}{2}$ $\frac{3}{4}-\frac{5}{30}v+\frac{14}{30}v-\frac{2}{4}$ $\frac{3}{10}v+\frac{1}{4}$

Name:	Date:
Topic:	Class:

Main Ideas/Questions	Notes/Examples
ONE-STEP EQUATIONS	**Steps to Solve:** ① Locate the variable. ② Determine the operation tied to the variable. ③ Use **inverse operations** on both sides of the equal sign to solve. ④ Check your solution!
INVERSE OPERATIONS	**Inverse operations can be used to solve equations:** ADDITION ⟷ SUBTRACTION MULTIPLICATION ⟷ DIVISION
SET 1: Addition & Subtraction	**Directions:** Solve each equation. Check all solutions.

1. $x+7=-1$ $-7 \quad -7$ $\boxed{x=-8}$	**2.** $m-11=-9$ $+11 \quad +11$ $\boxed{m=2}$
3. $9=14+h$ $-14 \quad -14$ $\boxed{-5=h}$	**4.** $-15+w=14$ $+15 \quad +15$ $\boxed{w=29}$
5. $-21=k-8$ $+8 \quad +8$ $\boxed{-13=k}$	**6.** $-1=-4+v$ $+4 \quad +4$ $\boxed{3=v}$

SET 2: Multiplication & Division

Directions: Solve each equation. Check all solutions.

7. $\frac{4a}{4}=\frac{-24}{4}$ $\boxed{a=-6}$	**8.** $\frac{-56}{-7}=\frac{-7p}{-7}$ $\boxed{8=p}$

	9. $\frac{n}{5} \cdot 5 = 9 \cdot 5$ $\boxed{n=45}$	10. $-8 \cdot 2 = \frac{r}{-8} \cdot -8$ $\boxed{-16=r}$
	11. $\frac{-k}{-1} = \frac{7}{-1}$ $\boxed{k=-7}$	12. $-6 \cdot \frac{x}{-6} = -12 \cdot -6$ $\boxed{x=72}$
SET 3: Mixed Practice	**Directions:** Solve each equation. Check all solutions. 13. $x - 11 = -3$	14. $-10d = 40$
	15. $a + 15 = 2$	16. $24 = -3 + h$
	17. $-4 = \frac{m}{-3}$	18. $9 = -y$
	19. $-47 + w = -10$	20. $\frac{p}{9} = -9$
	21. $-48 = -16a$	22. $k - 9 = -38$
	23. $-20 = \frac{v}{-4}$	24. $6n = 0$

Name:	Date:
Topic:	Class:

Main Ideas/Questions	Notes/Examples	
Rational Equations	**The steps to solve an equation with decimals or fractions are exactly the same!**	
	①	Locate the variable.
	②	Determine the operation tied to the variable.
	③	Use **inverse operations** on both sides of the equal sign to solve.
	④	Check your solution!

Set I: Equations with Decimals

Directions: Solve each equation. Check all solutions.

1. $a-17.9=32.4$	**2.** $14.7=15.3+n$ $-15.3\ -15.3$ $\boxed{-0.6=n}$
3. $-4.5p=-60.3$	**4.** $-8.5+k=-27.8$ $+8.5\quad +8.5$ $\boxed{k=-19.3}$
5. $16=\dfrac{y}{0.3}$	**6.** $1.6m=-9.44$ $1.6\quad 1.6$ $\boxed{m=-5.9}$
7. $7.84=2.67+w$	**8.** $\dfrac{c}{-8.4}\cdot -8.4=6.2\cdot -8.4$ $\boxed{c=-52.08}$
9. $-8.01=p-4.49$	**10.** $0.26n=1.95$ $0.26\quad 0.26$ $\boxed{n=7.5}$
11. $-0.75=\dfrac{r}{25.2}$	**12.** $-19.4+x=-32.1$ $+19.4\quad +19.4$ $\boxed{x=-12.7}$

Set 2:
Equations with Fractions

Directions: Solve each equation. Check all solutions.

13. $n+\frac{1}{4}=\frac{5}{6}$

$-\frac{1}{4} \quad -\frac{1}{4}$

$\boxed{n=\frac{7}{12}}$

$\frac{5}{6}-\frac{1}{4}$

$\frac{10}{12}-\frac{3}{12}=\frac{7}{12}$

14. $\frac{11}{18}=x-3\frac{2}{3}$

15. $-\frac{1}{8}+m=-\frac{7}{24}$

$+\frac{1}{8} \quad +\frac{1}{8}$

$\boxed{m=-\frac{1}{6}}$

$-\frac{7}{24}+\frac{1}{8}$

$-\frac{7}{24}+\frac{3}{24}$

$-\frac{4}{24}$

16. $a+8\frac{1}{2}=5\frac{1}{3}$

Recall: To divide by a fraction, multiply by its reciprocal.

17. $\frac{3}{2}\cdot\frac{2}{3}x=48\cdot\frac{3}{2}$

$\boxed{x=72}$

18. $-3\cdot 7=-\frac{1}{3}w\cdot -\frac{3}{1}$

19. $-\frac{5}{4}\cdot 60=-\frac{4}{5}k\cdot -\frac{5}{4}$

$\boxed{-75=k}$

20. $\frac{1}{4}p=-9$

21. $\frac{3}{2}\cdot\frac{2}{3}x=-\frac{4}{9}\cdot\frac{3}{2}$

$x=\frac{-12}{18}$

$\boxed{x=-\frac{2}{3}}$

22. $-1\frac{1}{3}=2r$

23. $7\frac{4}{7}v=-106$

$\frac{7}{53}\cdot\frac{53}{7}v=-106\cdot\frac{7}{53}$

$\boxed{v=-14}$

24. $-2\frac{1}{12}=\frac{3}{4}c$

Name:	Date:
Topic:	Class:

Main Ideas/Questions	Notes/Examples
TWO-STEP EQUATIONS $\boxed{px + q = r}$	**Steps to Solve:**
	① Locate the variable.
	② Undo the addition/subtraction to remove "**q**".
	③ Undo the multiplication/division to remove "**p**".
	④ Check your solution!

EXAMPLES

Directions: Solve each equation. Check all solutions.

1. $9a - 2 = -65$

$+2 \quad +2$

$9a = -63$

$\frac{9a}{9} = \frac{-63}{9}$

$\boxed{a = -7}$

2. $-4x + 7 = 31$

3. $\frac{k}{3} - 11 = -5$

$+11 \quad +11$

$3 \cdot \frac{k}{3} = 6 \cdot 3$

$\boxed{k = 18}$

4. $8 = 23 - 5w$

5. $8m - 11 = -11$

$+11 \quad +11$

$8m = 0$

$\frac{8m}{8} = \frac{0}{8}$

$\boxed{m = 0}$

6. $-6 = 1 + \frac{n}{-4}$

7. $19 - x = 30$

$-19 \quad -19$

$-x = 11$

$\frac{-x}{-1} = \frac{11}{-1}$

$\boxed{x = -11}$

8. $-17 + \frac{r}{2} = -25$

9. $0.4x + 9 = 11$

$-9 \quad -9$

$0.4x = 2$

$\frac{0.4x}{0.4} = \frac{2}{0.4}$

$\boxed{x = 5}$

10. $-18 = -10 - 1.5m$

11. $\frac{v}{-0.8} + 14 = 39$

$-14 \quad -14$

$-0.8 \cdot \frac{v}{-0.8} = 25 \cdot -0.8$

$\boxed{v = -20}$

12. $\frac{2}{3}x - 7 = 5$

13. $-1 = -\frac{5}{8}c + 9$

$-9 \quad -9$

$-\frac{8}{5} \cdot -10 = -\frac{5}{8}c \cdot -\frac{8}{5}$

$\boxed{16 = c}$

14. $\frac{1}{3}m - 16 = -1$

TWO-STEP EQUATIONS:

$$\frac{x+q}{p} = r$$

Steps to Solve:

①	Locate the variable.
②	Undo the multiplication/division to remove "**p**".
③	Undo the addition/subtraction to remove "**q**".
④	Check your solution!

EXAMPLES

15. $6 \cdot \frac{x-1}{6} = 2 \cdot 6$

$x - 1 = 12$

$+1 \quad +1$

$\boxed{x = 13}$

16. $9 = \frac{-m+17}{-2}$

17. $16 \cdot -3 = \frac{k-5}{16} \cdot 16$

$-48 = k - 5$

$+5 \quad +5$

$\boxed{-43 = k}$

18. $7 \cdot \frac{p+20}{7} = -4$

Name:	Date:
Topic:	Class:

Main Ideas/Questions	Notes/Examples
Multi-Step Equations (Variables on One Side)	**Steps to Solve:**
	① Distribute (if needed).
	② Combine Like Terms (if needed).
	③ Sovle the remaining equation.
	④ Check your solution!

Examples

Directions: Solve each equation. Check all solutions.

1. $2x-8x+1=49$

$-6x+1=49$

$-1 \quad -1$

$-6x=48$

$\frac{-6x}{-6}=\frac{48}{-6}$

$\boxed{x=-8}$

2. $-19=-5-3a-11$

3. $19=10-5w+9w-7$

$19=3+4w$

$-3 \quad -3$

$16=4w$

$\frac{16}{4}=\frac{4w}{4}$

$\boxed{4=w}$

4. $2k-6-7+3k=-48$

5. $7(x-6)=-14$

$7x-42=-14$

$+42 \quad +42$

$7x=28$

$\frac{7x}{7}=\frac{28}{7}$

$\boxed{x=4}$

6. $16=-2(k+9)$

7. $-52=4(3n-1)$

$-52=12n-4$

$+4 \quad +4$

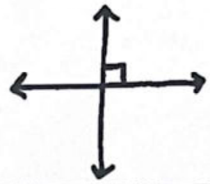
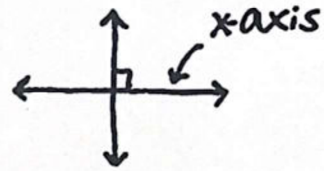
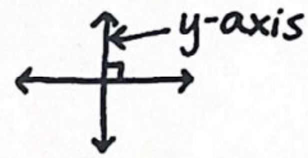
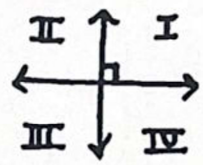
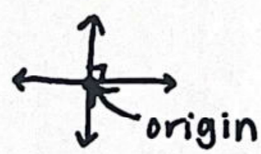
$-48=12n$

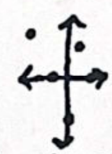
$\frac{-48}{12}=\frac{12n}{12}$

$\boxed{-4=n}$

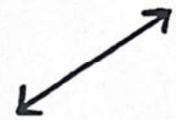
8. $-\frac{1}{2}(12p-42)=-33$

FUNCTIONS & LINEAR RELATIONSHIPS DICTIONARY

GRAPHING BASICS	DEFINITION	EXAMPLE OR VISUAL
COORDINATE PLANE	Formed by the intersection of two number lines, the horizontal axis and the vertical axis.	
X-AXIS	The horizontal axis on the coordinate plane.	 x-axis
Y-AXIS	The vertical axis on the coordinate plane.	 y-axis
QUADRANTS	The four regions into which the x and y-axis separate the coordinate plane.	 II I III IV
ORIGIN	The point at which the x and y-axis intersect on the coordinate plane. (0,0)	 origin
ORDERED PAIR	The set of numbers, or coordinates, written in the form (x, y).	(-1, 5) x y
X-COORDINATE	The x-value of an ordered pair, represents the horizontal placement of the point.	(12, 7) x-coordinate
Y-COORDINATE	The y-value of an ordered pair, represents the vertical placement of the point.	(0, 6) y-coordinate

FUNCTIONS	DEFINITION	EXAMPLE OR VISUAL
RELATION	A set of ordered pairs.	{(5,-1),(-6,2),(4,0)}
DOMAIN	The set of x-values within the ordered pairs of a relation.	{(5,-1),(-6,2),(4,0)} D: {-6,4,5}
RANGE	The set of y-values within the ordered pairs of a relation.	{(5,-1),(-6,2),(4,0)} R: {-1,0,2}
FUNCTION	A relation in which each element of the domain is paired with exactly one element of the range.	{(5,-1),(-6,2),(4,0)} ↑ ↑ ↑ x's do not repeat
INDEPENDENT VARIABLE	The x-value within a function.	y = mx+b ↑ independent
DEPENDENT VARIABLE	The y-value within a function.	y = mx+b ↑ dependent
VERTICAL LINE TEST	If any vertical line passes through the graph of a relation no more than once, then it is a function.	 function  not a function

LINEAR EQUATIONS	DEFINITION	EXAMPLE OR VISUAL
RATE OF CHANGE	A ratio that shows how one variable changes with respect to another.	$7.50/hr 23 mi/gal 31 ft/sec

SLOPE	A ratio that compares the vertical to horizontal change between points.	$m = \frac{rise}{run}$
POSITIVE SLOPE	A line that is increasing from left to right.	
NEGATIVE SLOPE	A line that is decreasing from left to right.	
ZERO SLOPE	A horizontal line	
UNDEFINED SLOPE	A vertical line	
SLOPE FORMULA	A formula used to find the slope between 2 points.	$m = \frac{y_2 - y_1}{x_2 - x_1}$
SLOPE-INTERCEPT FORM	The form of a line, used to graph the line.	$y = \underset{\text{slope}}{m}x + \underset{\text{y-intercept}}{b}$
STANDARD FORM	Another form of a line	$Ax + By = C$
VERTICAL LINE	A line with an undefined slope; $x = a$	

HORIZONTAL LINE	A line with zero slope; $y=a$	
LINEAR FUNCTION	A function represented by a line; rate of change is constant	
NONLINEAR FUNCTION	A function that cannot be represented by a line, but often is a curve; rate of change is not constant	

DIRECT VARIATION	DEFINITION	EXAMPLE OR VISUAL
PROPORTIONAL RELATIONSHIP	If the ratios of quantities are equal, then they are proportional.	5 candies = \$.50 7 candies = \$.70
NONPROPORTIONAL RELATIONSHIP	If the ratios of quantities are not equal, then they are not proportional.	12 candies = \$1 30 candies = \$2
CONSTANT OF VARIATION	The ratio between all ordered pairs	$k = \frac{y}{x}$
DIRECT VARIATION	A specific relationship in which there is a constant ratio between all ordered pairs.	$y = k \cdot x$

COORDINATE PLANE

Formed by the intersection of two number lines, the horizontal axis and the vertical axis.

parts of the plane

x-axis
The horizontal axis

y-axis
The vertical axis

ORIGIN:
The point at which the x-axis and y-axis intersect; (0,0).

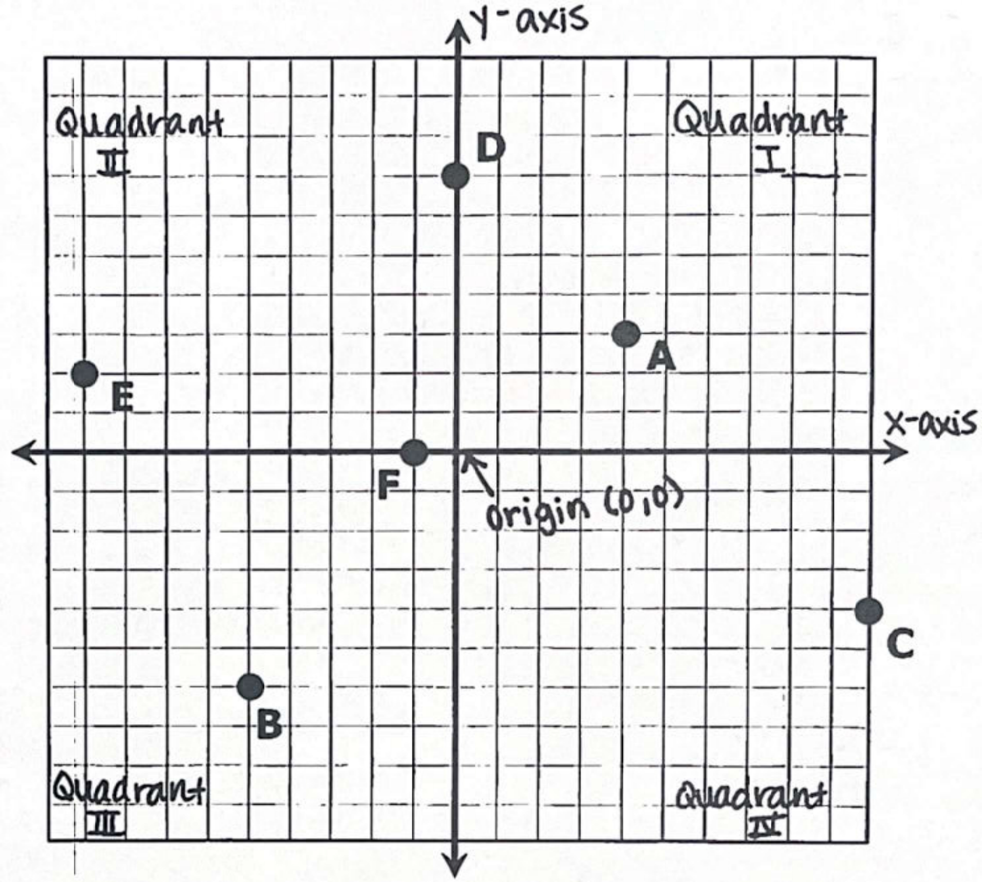
QUADRANTS:
The four regions into which the x and y-axis separate the coordinate plane.

ORDERED PAIR:
A pair of numbers used to locate any point on the plane.

(x, y)

X-coordinate

Y-coordinate



LOCATING POINTS: Identify the ordered pair and quadrant (or axis) for each point.

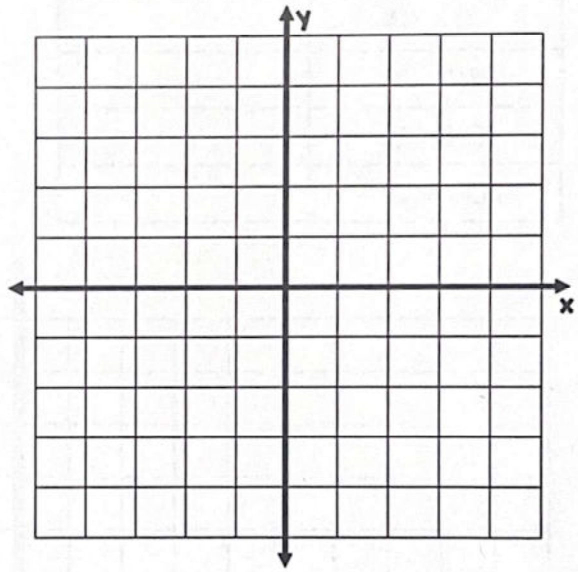
POINT	ORDERED PAIR	QUADRANT
A	(4,3)	I
B	(-5,-6)	III
C	(10,-4)	IV
D	(0,7)	y-axis
E	(-9,2)	II
F	(-1,0)	x-axis

GRAPHING BY MAKING A TABLE

Graph the equations by using substitution to complete a table of values.

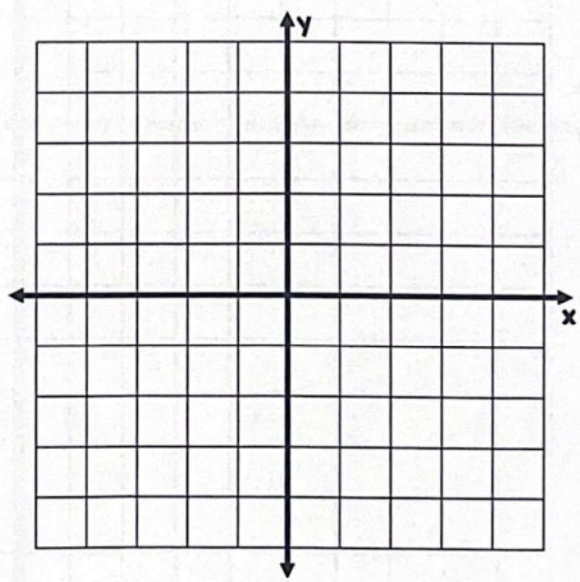
$y = x + 2$

x	y
-2	
-1	
0	
1	
2	



$y = 2x - 1$

x	y
-2	
-1	
0	
1	
2	



Name:	Date:
Topic:	Class:

Main Ideas/Questions	Notes/Examples
Rate of Change	A ratio that shows how one variable changes with respect to another. On a linear graph, this is called the <u>slope</u> of the line!
Slope 	• Slope is written as a <u>ratio</u> of the **vertical change** (<u>rise</u>) to the **horizontal change** (<u>run</u>) between any two points on a line. • This remains <u>constant</u> for any two points on the same line. • Slope is written as a <u>fraction</u> in <u>simplest form</u> (reduced). • Variable for slope: <u>m</u>

Types of Slope

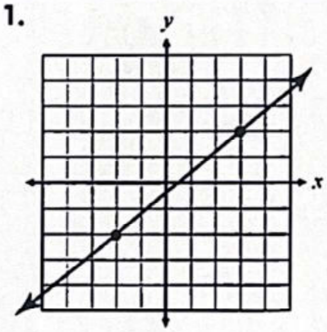
			
Positive	Negative	Zero	Undefined

Finding Slope on a Graph

$m = \frac{\text{rise}}{\text{run}}$

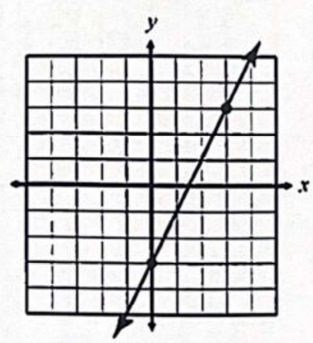
Directions: Find the slope of each line. Write your answer in simplest form!

1.



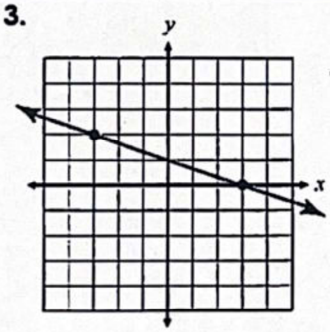
$\boxed{\frac{4}{5}}$

2.



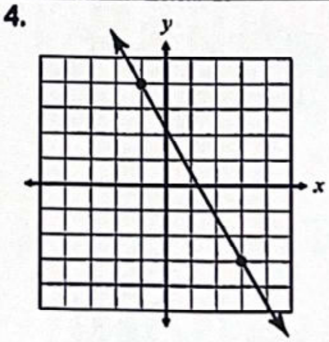
$\frac{6}{3} = \boxed{2}$

3.



$\frac{-2}{6} = \boxed{\frac{-1}{3}}$

4.



$\boxed{\frac{-7}{4}}$

Name:	Date:
Topic:	Class:

Main Ideas/Questions	Notes/Examples
Slope Formula	Used to find the slope between any two points (x_1, y_1) and (x_2, y_2)
	Formula: $m = \dfrac{y_2 - y_1}{x_2 - x_1}$
	Always remember to simplify your answer!
Examples	**Directions:** Find the slope of the line between each pair of points.

1. (-13, 8) and (3, 12) $m = \dfrac{12-8}{3-(-13)} = \dfrac{4}{16} = \boxed{\dfrac{1}{4}}$	**2.** (19, -12) and (5, 16)
3. (-15, 9) and (-10, 3) $m = \dfrac{3-9}{-10-(-15)} = \boxed{\dfrac{-6}{5}}$	**4.** (-1, 8) and (8, -4) $= \boxed{}$
5. (7, 3) and (6, -2) $m = \dfrac{-2-3}{6-7} = \dfrac{-5}{-1} = \boxed{5}$	**6.** (12, 7) and (5, 9) $= \boxed{}$
7. (-7, -4) and (2, -7) $m = \dfrac{-7-(-4)}{2-(-7)} = \dfrac{-3}{9} = \boxed{-\dfrac{1}{3}}$	**8.** (-4, 4) and (-9, 6)
9. (4, -13) and (8, -8) $m = \dfrac{-8-(-13)}{8-4} = \boxed{\dfrac{5}{4}}$	**10.** (-7, -5) and (5, -17) $= \boxed{}$

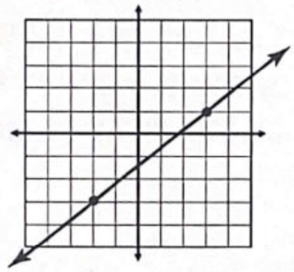
Slope

Date:

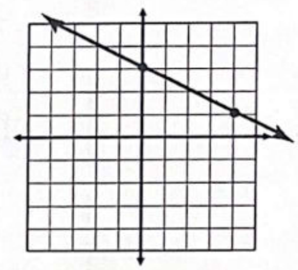
1. How do you find slope given a graph?

Find the slope between the following points:

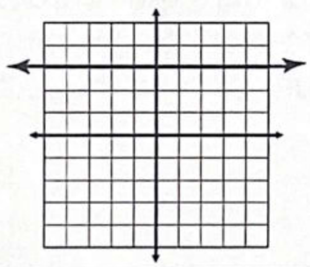
2.



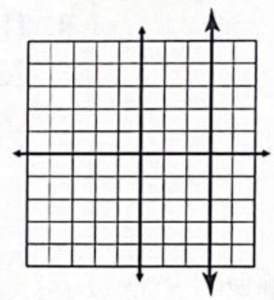
3.



4.



5.



Slope Formula

Date:

1. What is the slope formula?

Find the slope between the following points:

2. (6, -5) and (2, 3)

3. (-2, 4) and (-8, -1)

4. (7, 3) and (7, -6)

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

EXPONENT RULES

Graphic Organizer

ZERO EXPONENT

$$x^0 = 1$$

Examples:

- $12^0 = 1$
- $5x^0 = 5 \cdot 1 = 5$
- $(-2)^3 n^0 = -8 \cdot 1 = -8$

NEGATIVE EXPONENTS

$$x^{-a} = \frac{1}{x^a}$$

Examples:

- $3^{-2} = \frac{1}{3^2} = \frac{1}{9}$
- $a^{-7} = \frac{1}{a^7}$
- $p^4 q^{-1} = \frac{p^4}{q}$

ADDING & SUBTRACTING MONOMIALS

▶ COMBINE LIKE TERMS! ◀

(DO NOT CHANGE common variables and exponents.)

Examples:

- $10x + 3x = 13x$
- $7k - 2k^2 + 6k^2 = 4k^2 + 7k$
- $-5m^2n - 4m^2n = -9m^2n$

PRODUCT RULE

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

Examples:

- $9^5 \cdot 9^7 = 9^{12}$
- $a^7 \cdot a^{-1} \cdot b^3 \cdot b^{-5} = a^6 b^{-2} = \frac{a^6}{b^2}$
- $-2x^3y^7 \cdot 9x^4y = -18x^7y^8$

QUOTIENT RULE

$$\frac{x^a}{x^b} = x^{a-b}$$

Examples:

- $\frac{(-2)^{20}}{(-2)^5} = (-2)^{15}$
- $\frac{x^{12}}{x^3} = x^9$
- $\frac{r^2s^2}{r^2s^3} = \frac{1}{s}$
- $\frac{28m^5}{4m^3} = 7m^2$

POWER RULE

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

Examples:

- $(7^2)^9 = 7^{18}$
- $(w^4)^3 = w^{12}$
- $(-4r^3s^7)^2$ $16r^6s^{14}$

PERFECT SQUARE NUMBERS

should memorize $\boxed{1-13}$ by mid year.

Complete the perfect squares chart. Fill in as many as you can $\boxed{\text{without a calculator.}}$

$1^2 =$	$1 \cdot 1 = 1$	$16^2 =$	
$2^2 =$	$2 \cdot 2 = 4$	$17^2 =$	
$3^2 =$	9	$18^2 =$	
$4^2 =$	16	$19^2 =$	
$5^2 =$		$20^2 =$	
$6^2 =$		$21^2 =$	
$7^2 =$		$22^2 =$	
$8^2 =$		$23^2 =$	
$9^2 =$		$24^2 =$	
$10^2 =$		$25^2 =$	
$11^2 =$		$30^2 =$	
$12^2 =$		$40^2 =$	
$13^2 =$		$50^2 =$	
$14^2 =$		$60^2 =$	
$15^2 =$		$70^2 =$	

1–13 - w/out calculator ⇒ Need to memorize by mid-year

14–70 – use a calculator

Name:	Date:
Topic:	Class:

Main Ideas/Questions	Notes/Examples
Exponents	In the case of repeated multiplication with the same number, we can rewrite the expression using **exponents.** For example: $4 \cdot 4 \cdot 4 =$ 4^3 **Parts of an exponential expression:** $\boxed{\text{base}} \rightarrow x^n \leftarrow \boxed{\text{exponent}}$ Read as: X to the n^{th} power
Examples	**Directions:** Write each expression using exponents, then evaluate (if possible).

	Expanded Notation	Exponential Expression	Value
1.	$11 \cdot 11$	11^2	121
2.	$2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2$	2^7	128
3.	$(-5) \cdot (-5) \cdot (-5) \cdot (-5)$	$(-5)^4$	625
4.	$\left(\frac{1}{4}\right) \cdot \left(\frac{1}{4}\right) \cdot \left(\frac{1}{4}\right)$		
5.	$7 \cdot 7 \cdot 4 \cdot 4 \cdot 4$		
6.	$8 \cdot (-2) \cdot (-2) \cdot 8 \cdot (-2) \cdot 8 \cdot 8$		
7.	$\left(\frac{2}{3}\right) \cdot 9 \cdot \left(\frac{2}{3}\right) \cdot 9$	$\left(\frac{2}{3}\right)^2 \cdot 9^2$	36
8.	$a \cdot a \cdot a \cdot a \cdot a \cdot a \cdot a \cdot a \cdot a$	a^9	—
9.	$xy \cdot xy \cdot xy \cdot xy \cdot xy$	$(xy)^5$	—
10.	$r \cdot s \cdot s \cdot s \cdot t \cdot s \cdot t \cdot t \cdot s \cdot r$		—
11.	$k \cdot 9 \cdot k \cdot k \cdot 9 \cdot k \cdot k \cdot k \cdot 9$	$9^3 \cdot k^6$ -	$729k^6$
12.	$(-7) \cdot m \cdot m \cdot n \cdot m \cdot (-7) \cdot n$		
13.	$(p-2) \cdot (p-2) \cdot (p-2)$		—
14.	$(a+b) \cdot 6 \cdot 6 \cdot (a+b) \cdot 6$	$6^3(a+b)^2$	$216(a+b)^2$

Zero Exponent	Any number, except 0, raised to the zero power is defined as 1. $1^0 = 1$ $2^0 = 1$ $3^0 = 1$ $4^0 = 1$ $x^0 = 1$ $(x \neq 0)$
Negative Exponent	**Negative Exponent Rule:** $\boxed{x^{-n} = \frac{1}{x^n}}$ (if $x \neq 0$)
Examples	**Directions:** Write each expression using positive exponents, then evaluate (if possible).

15. 5^{-2} $\frac{1}{5^2} = \boxed{\frac{1}{25}}$	**16.** 8^{-2}
17. 9^{-1} $\frac{1}{9^1} = \boxed{\frac{1}{9}}$	**18.** 4^{-4}
19. 10^{-3} $\frac{1}{10^3} = \boxed{\frac{1}{1000}}$	**20.** 2^{-7}
21. $4^{-3} \cdot 7^{-1}$ $\frac{1}{4^3} \cdot \frac{1}{7^1} = \frac{1}{64} \cdot \frac{1}{7} = \boxed{\frac{1}{448}}$	**22.** $5^{-4} \cdot 3^{-2}$ =
23. $3^4 \cdot 9^{-2}$ $3^4 \cdot \frac{1}{9^2} = 81 \cdot \frac{1}{81} = \boxed{1}$	**24.** $8^{-3} \cdot 10^2 \cdot 4^0$
25. x^{-9} $\boxed{\frac{1}{x^9}}$	**26.** a^{-4}
27. $r^{-6}s^0t^{11}$ $\frac{1}{r^6} \cdot 1 \cdot t^{11} = \boxed{\frac{t^{11}}{r^6}}$	**28.** $3^{-3}m^{-4}n^5$

Summary: ____