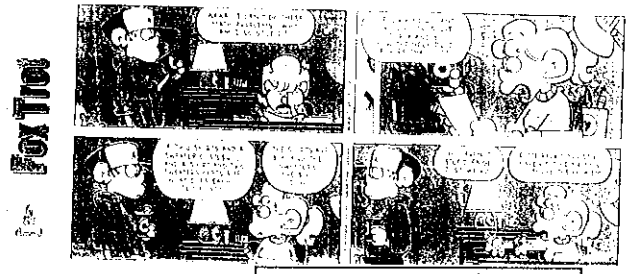
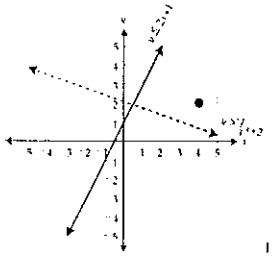
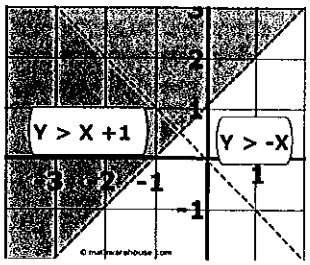
Math I, Fall 2016 Name_____

UNIT 3: Systems of Equations and Inequalities		HOMEWORK
10/26 Wednesday	Parallel and Perpendicular Lines Review Linear Equations	
10/27 Thursday	Solving Systems of Equations by Graphing	
10/28 Friday	Solving Systems by Substitution	
10/31 Monday	Solving Systems by Elimination	
11/1 Tuesday	Applications	
11/2 Wednesday	Solving Systems of Inequalities	
11/3 Thursday	Solving Systems of Inequalities Review	
11/4 Friday	**Unit 3 Test**	
Monday		







Solve using the substitution method.

$\begin{cases} x+y=10 & A \quad (1) \\ 2x+y=15 & B \quad (2) \end{cases}$

A $x+y=10$ (3)

$y=10-x$ (4)

B $2x+y=15$ (5)

$2x+(10-x)=15$ (6)

$x+10=15$ (7)

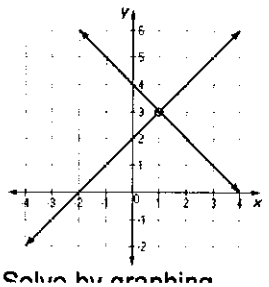
$x=5$ (8)

A $x+y=10$ (9)

$5+y=10$ (10)

$y=5$ (11)

$(5,5)$ (12)



Solve by graphing

$3x-4y=-5$

$-10x+4y=12$ +

$-7x+0=7$

$-7x=7$

$x=-1$

Solve by elimination

$x=-1$

$3x-4y=-5$

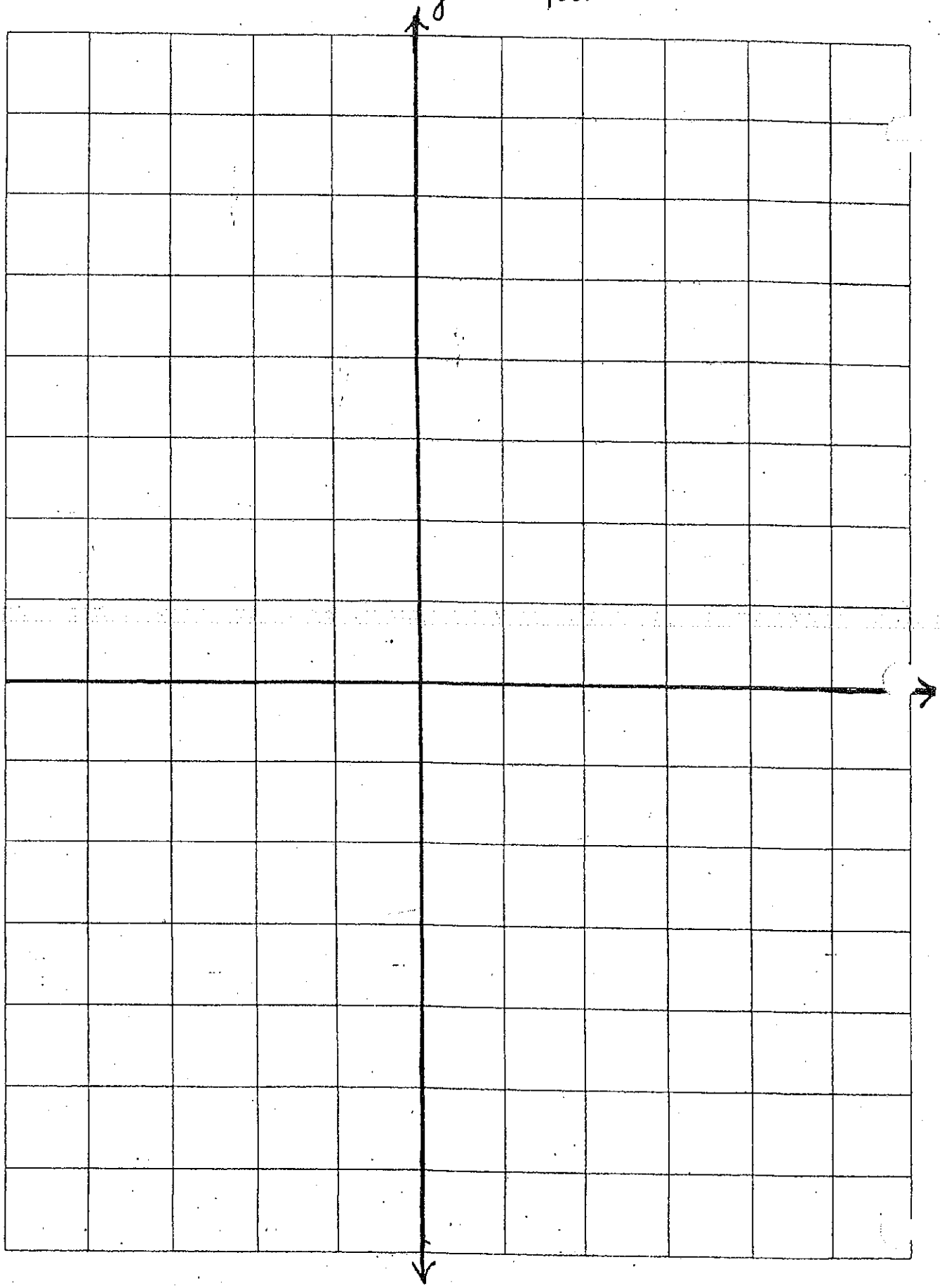
$3(-1)-4y=-5$

$-3-4y=-5$

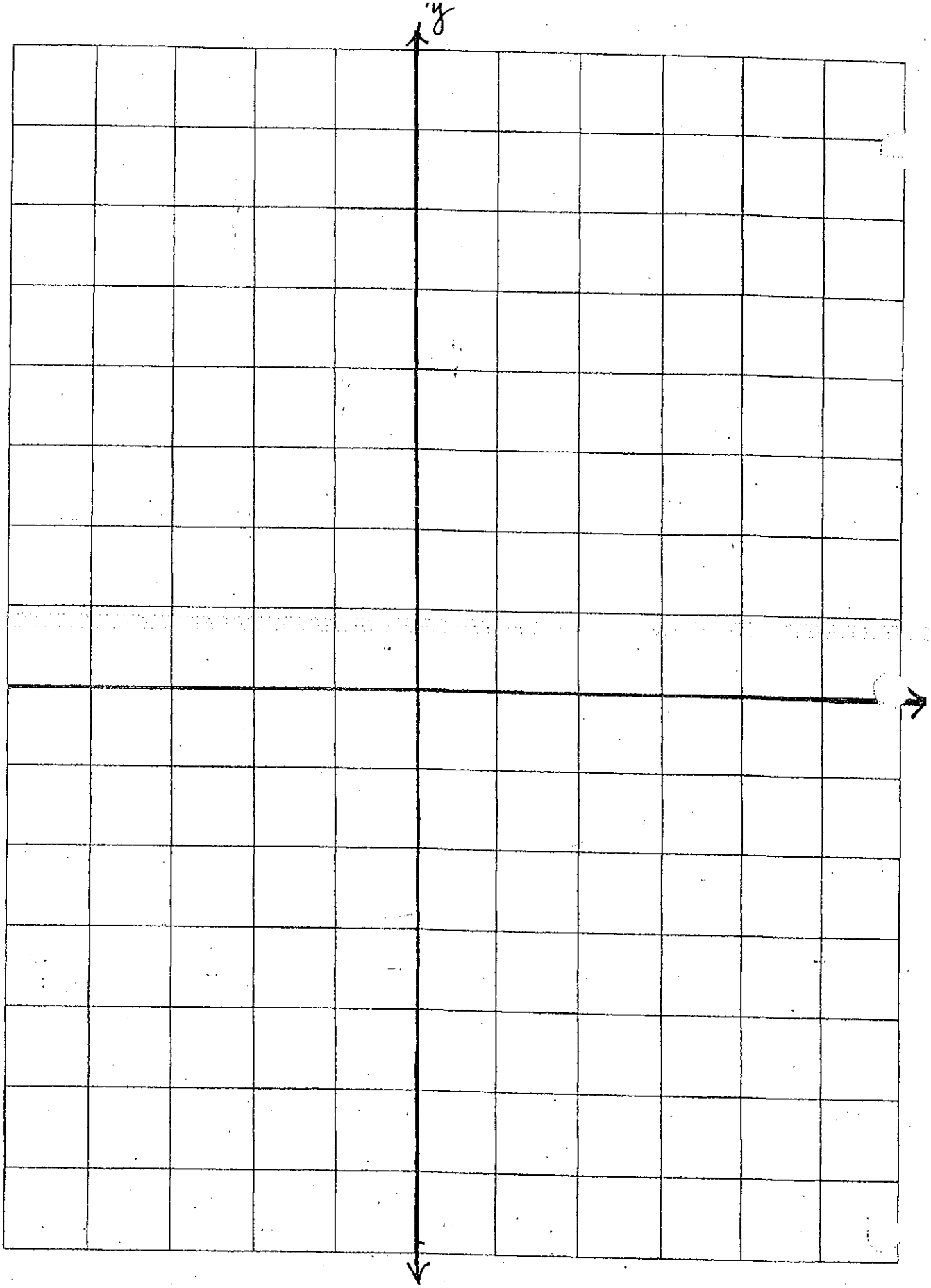
$-4y=-2$

$y=\frac{1}{2}$

Parallel Lines:



Perpendicular Lines.



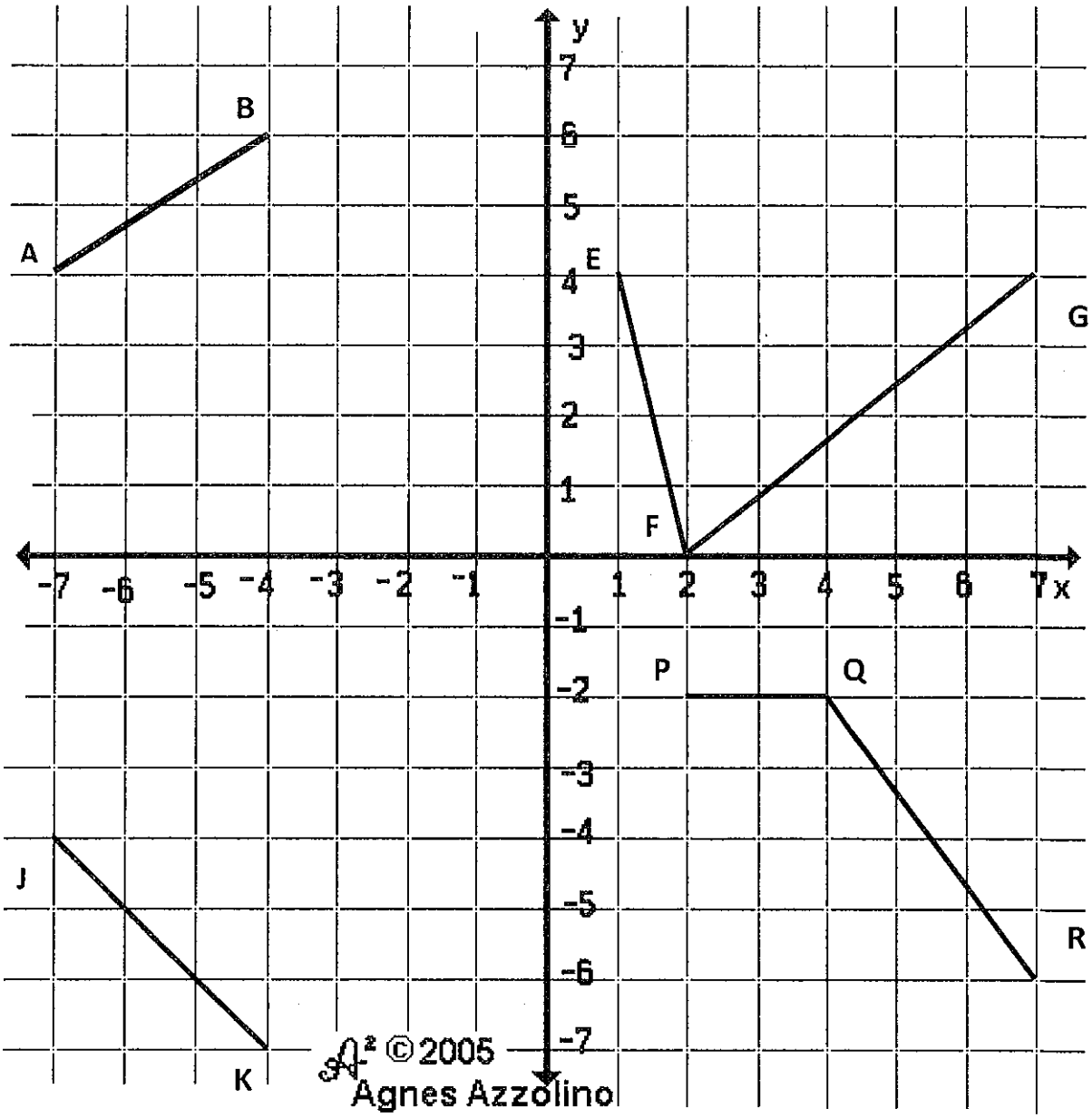
From the given slopes of two lines, identify whether the lines are parallel to, perpendicular to or just intersecting each other.

Slope of line 1	Slope of line 2	They are parallel, perpendicular or just intersecting
1. 3	3	
2. $\frac{7}{2}$	$-\frac{2}{7}$	
3. 4	-4	
4. 1	-1	
5. $\frac{3}{5}$	$\frac{3}{5}$	
6. $\frac{4}{11}$	$\frac{11}{4}$	
7. 0	Undefined	
8. 4	$\frac{1}{4}$	
9. Undefined	Undefined	

Quadrilaterals Practice 1

Construct the following figures on the plane below, and identify the slopes of each side.

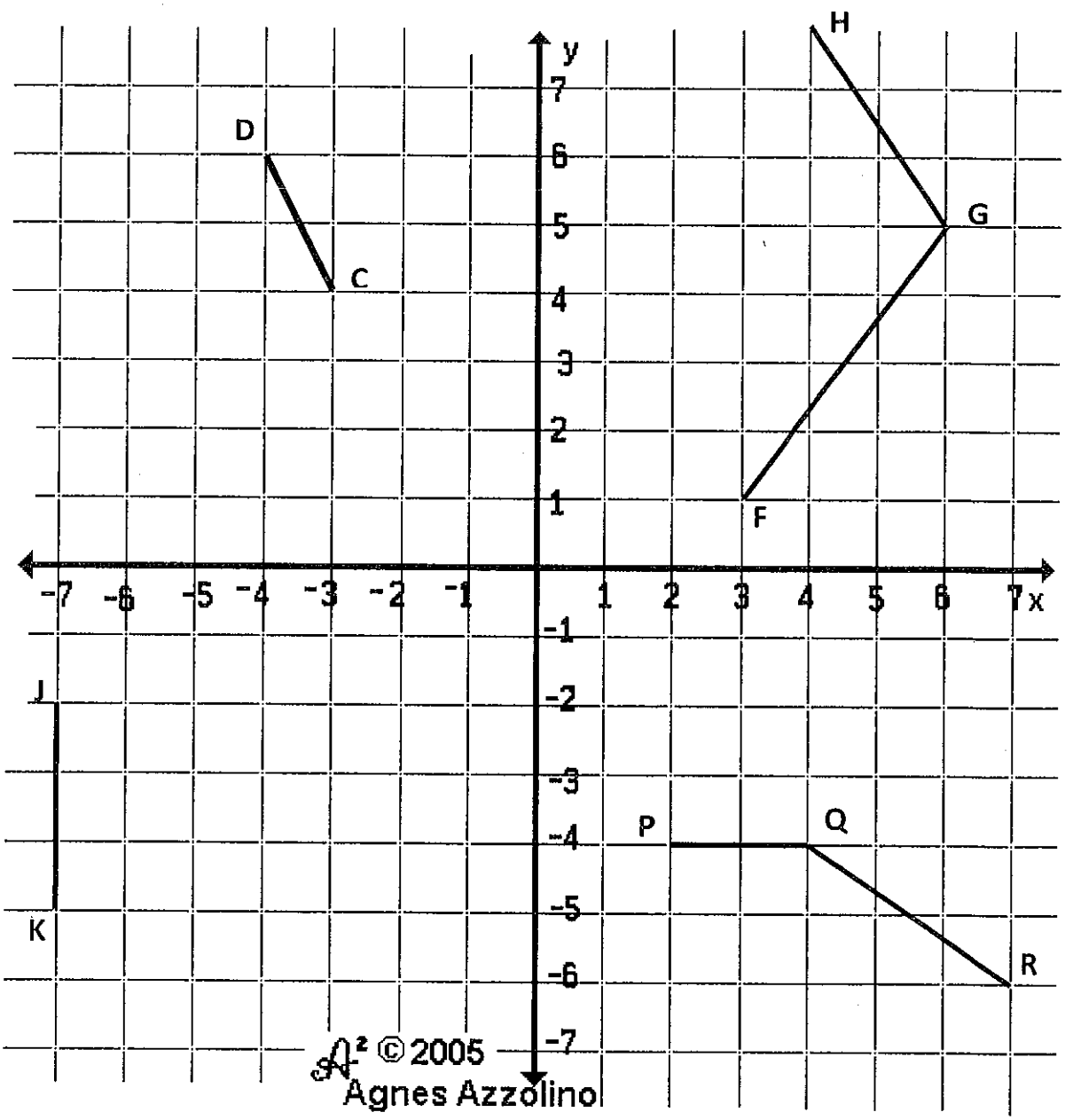
- Rectangle ABCD: *Slope of* $\overline{AB}$ _____ *Slope of* $\overline{BC}$ _____ *Slope of* $\overline{CD}$ _____ *Slope of* $\overline{AD}$ _____
- Parallelogram EFGH: *Slope of* $\overline{EF}$ _____ *Slope of* $\overline{FG}$ _____ *Slope of* $\overline{GH}$ _____ *Slope of* $\overline{EH}$ _____
- Square JKLM: *Slope of* $\overline{JK}$ _____ *Slope of* $\overline{KL}$ _____ *Slope of* $\overline{LM}$ _____ *Slope of* $\overline{JM}$ _____
- Parallelogram PQRS: *Slope of* $\overline{PQ}$ _____ *Slope of* $\overline{QR}$ _____ *Slope of* $\overline{RS}$ _____ *Slope of* $\overline{PS}$ _____



Quadrilaterals Practice 2

Construct the following figures on the plane below, and identify the slopes of each side.

- Rectangle ABCD: *Slope of* $\overline{AB}$ _____ *Slope of* $\overline{BC}$ _____ *Slope of* $\overline{CD}$ _____ *Slope of* $\overline{AD}$ _____
- Parallelogram EFGH: *Slope of* $\overline{EF}$ _____ *Slope of* $\overline{FG}$ _____ *Slope of* $\overline{GH}$ _____ *Slope of* $\overline{EH}$ _____
- Square JKLM: *Slope of* $\overline{JK}$ _____ *Slope of* $\overline{KL}$ _____ *Slope of* $\overline{LM}$ _____ *Slope of* $\overline{JM}$ _____
- Parallelogram PQRS: *Slope of* $\overline{PQ}$ _____ *Slope of* $\overline{QR}$ _____ *Slope of* $\overline{RS}$ _____ *Slope of* $\overline{PS}$ _____



What Did the Electrician Say To His Daughter When She Came Home at 2 A.M.?

Write each equation in slope-intercept form, then find your answer in the rectangle below. Write the letter of the answer in the box containing the exercise number.

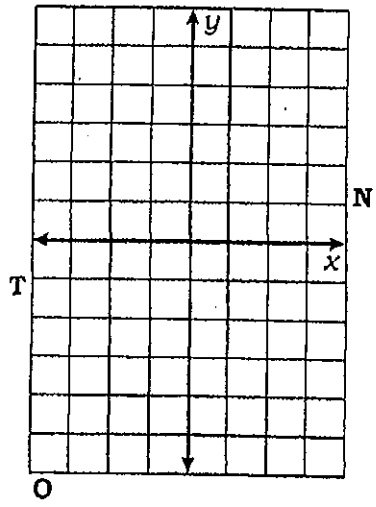
1. $-6x + 3y = -9$
2. $5x - y = 1$
3. $2y - 3x = 10$
4. $2y + x = 14$
5. $x - 4y - 8 = 0$
6. $3y + 18 = -8x + 3$
7. $9x - 2y = 7$
8. $x + 5y = 8x - 20$
9. $-2(3y - 1) - x = 0$

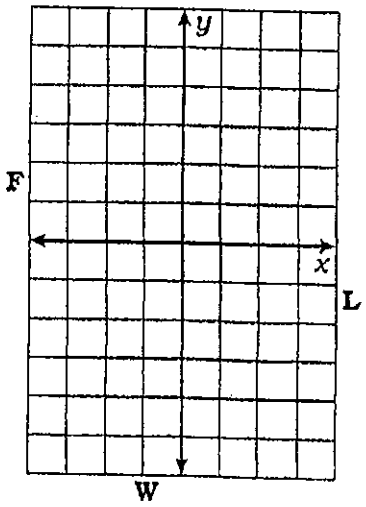
Answers 1-9

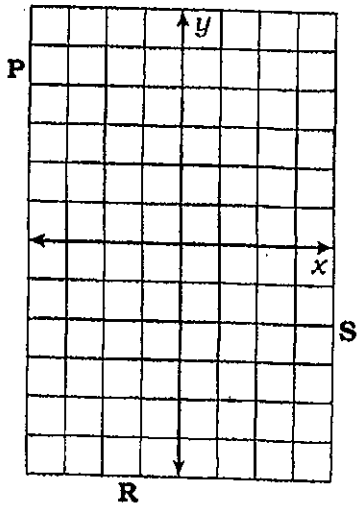
(F) $y = \frac{3}{2}x - 4$	(Y) $y = -\frac{1}{2}x + 7$	(I) $y = \frac{9}{2}x - \frac{7}{2}$	(U) $y = 2x - 3$
(U) $y = -\frac{8}{3}x - 5$	(I) $y = 5x - 1$	(B) $y = -\frac{8}{3}x + 7$	(N) $y = -\frac{1}{6}x + \frac{1}{3}$
(E) $y = \frac{7}{5}x - 4$	(K) $y = \frac{1}{4}x + 5$	(A) $y = \frac{3}{2}x + 5$	(E) $y = \frac{1}{4}x - 2$

Write each equation in slope-intercept form, then use the slope and y-intercept to graph it. The graph will cross a letter outside the grid. Write this letter in the box containing the exercise number.

10. $2x - y = -1$
11. $3y + 2x + 12 = 0$
12. $4y + 20 = 5x$
13. $3(x - 1) = 2x - y$
14. $7x - 1 = 3y + 8$
15. $9x + 18y = 0$

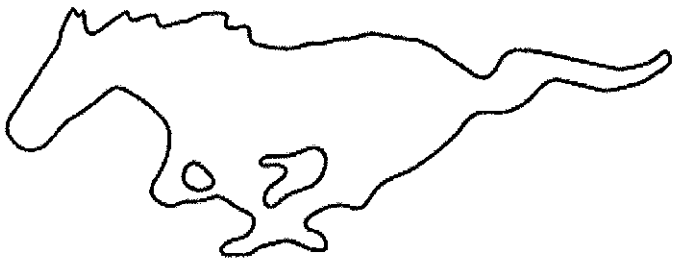






12	2	14	5	4	10	1	7	9	15	6	13	3	11	8

6



Name:_____
Date: _____

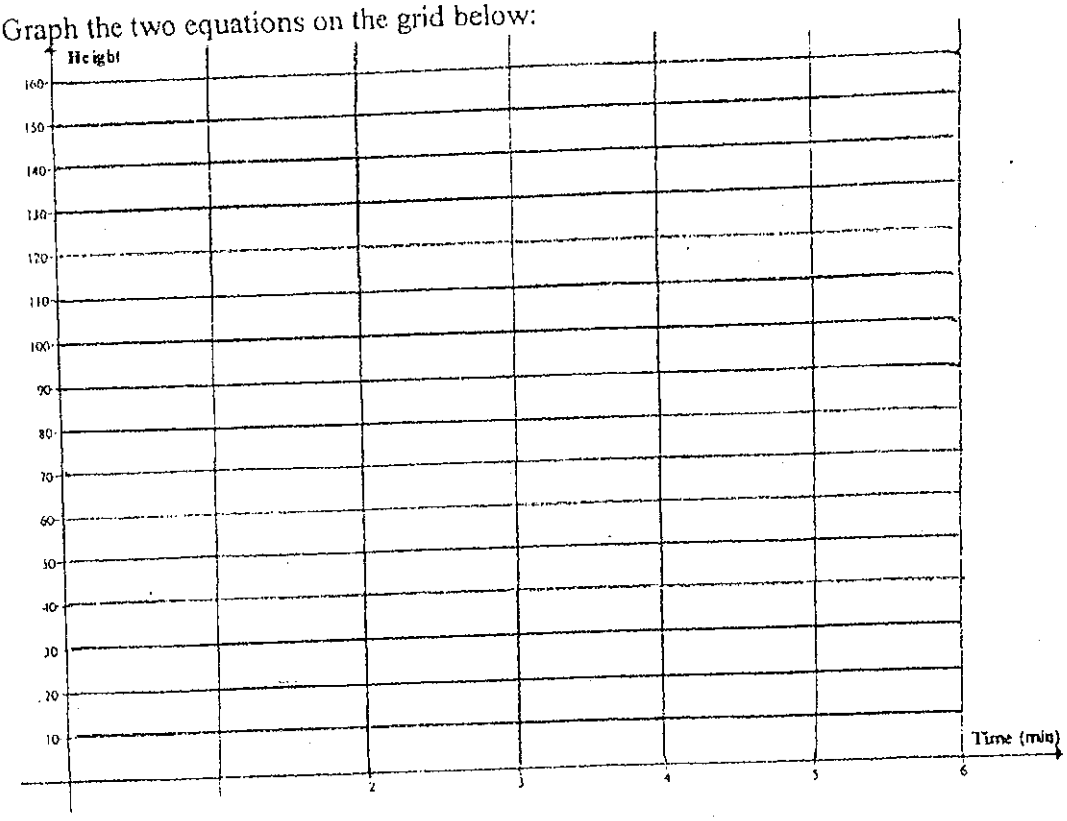
Two hot air balloons are flying in the air. Balloon 1 is 10 meters above the ground and rising at a rate of 15 meters per minute. Balloon 2 is 150 meters above the ground and descending at a rate of 20 meters per minute.

Let x be time in minutes and let y be height in meters. Create an equation describing the path of each balloon:

Balloon 1: y_1 = ____x + __

Balloon 2: y_2 = ____x + __

Graph the two equations on the grid below:



At what time will both balloons be at the same height?

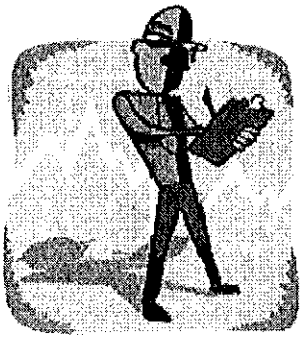
At what height will they be ?

Solving Linear Systems
Graphically

Case I.

Solve this system of equations graphically.

$$4x - 6y = 12$$
$$2x + 2y = 6$$



If you can graph a straight line, you can solve systems of equations graphically!

The process is very straightforward. Simply graph the two lines and look for the point where they intersect (cross).

Solve graphically:

$$4x - 6y = 12$$
$$2x + 2y = 6$$

To solve a system of equations graphically, graph both equations and see where they intersect. The intersection point is the solution.

1) First, solve each equation for "y ".

$4x - 6y = 12$

$4x = 6y + 12$

$4x - 12 = 6y$

$6y = 4x - 12$

$y = \frac{4x}{6} - \frac{12}{6}$

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

slope = $\frac{2}{3}$

y-intercept = -2

$2x + 2y = 6$

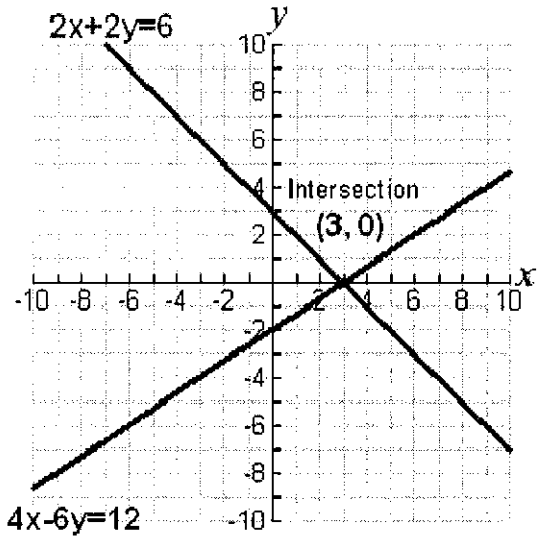
$2y = -2x + 6$

$y = \frac{-2x}{2} + \frac{6}{2}$

$y = -x + 3$

slope = -1

y-intercept = 3



2) Graph the lines.

The slope intercept method of graphing was used in this example.

3) The point of intersection of the two lines, (3,0), is the solution to the system of equations.

This means that (3,0), when substituted into either equation, will make them both true. See the check.

4) Check: Since the two lines cross at (3,0), the solution is $x = 3$ and $y = 0$. Checking these value shows that this answer is correct. Plug these values into the ORIGINAL equations and get a true result.

$4x - 6y = 12$	$2x + 2y = 6$
$4(3) - 6(0) = 12$	$2(3) + 2(0) = 6$
$12 - 0 = 12$	$6 + 0 = 6$
$12 = 12$ **(check)**	$6 = 6$ **(check)**

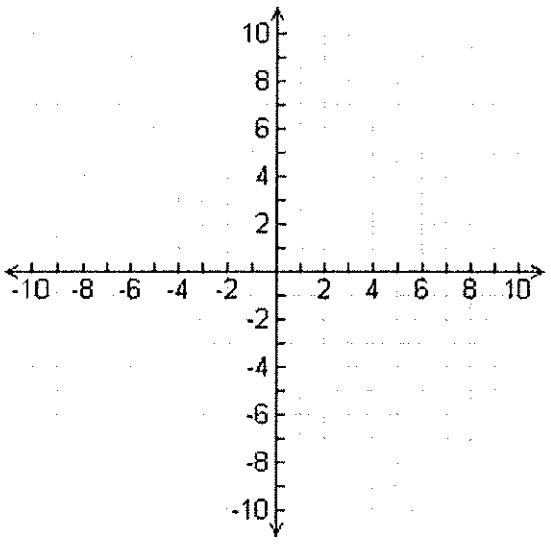
1) Solve each equation for y! Here's some space:

Now you try: $-2x + 2y = 6$

$3x - 2y = -8$

//

2) Next, graph both equations on the same grid.



3) Then, **identify the point** that makes both equations *true*.

True?

$$-2(\ ) + 2(\ ) = 6$$
$$3(\ ) - 2(\ ) = -8$$

4) Last, ***check*** your solution in ***each equation***.

Case II.

- **Solve the following system by graphing.**

$$7x + 2y = 16$$
$$-21x - 6y = 24$$

As usual, first solve each equation for "y ":

$7x + 2y = 16$

$2y = -7x + 16$

$y = \frac{-7}{2}x + 8$

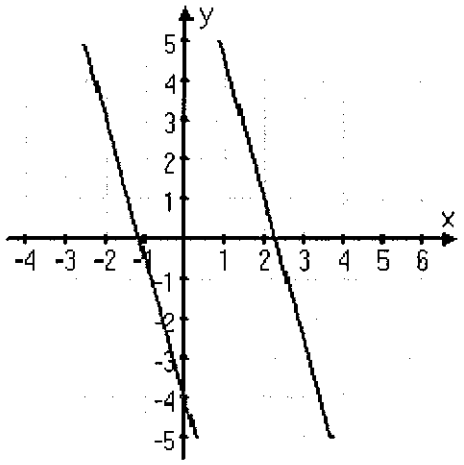
$-21x - 6y = 24$

$-6y = 21x + 24$

$y = \frac{21}{-6}x + \frac{24}{-6}$

$y = \frac{7}{-2}x - 4$

These lines have the same slope — namely, $m = {}^{-7}/_{2}$ — but different y-intercepts, so they are parallel. Since parallel lines never cross, the algebra tells me that there is no solution. But this is a "solving by graphing" problem, so I still have to draw the picture.



solution: no solution, because the lines are parallel.

Case III.

The third graph above, "Case 3", appears to show only one line. Actually, it's the same line drawn twice. These "two" lines, really being the same line, "intersect" at every point along their length. This is called a "dependent" system, and the "solution" is the whole line. The lines actually **coincide** or overlap, and the system has an **infinite number of solutions** (sometimes called " infinitely many"). This does NOT mean that *any* ordered pair of numbers make the equations true; it means there is an infinite number of pairs that do.

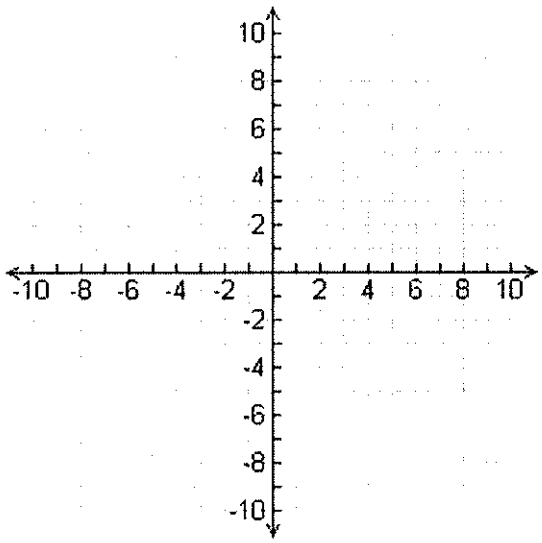
Solving for y (show steps) :

$3x + 4y = 12$

$6x + 8y = 20$

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

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



The third graph appears to show only one line. Actually, it's the same line drawn twice (the second line overlaps the first). These "two" lines are, in fact, the same line, The lines "intersect" at every point along their length and the solution to the system is the whole line. The lines actually overlap or **coincide**, and the system has an **infinite number of solutions** (infinitely many).

CC Math 1 Name_____

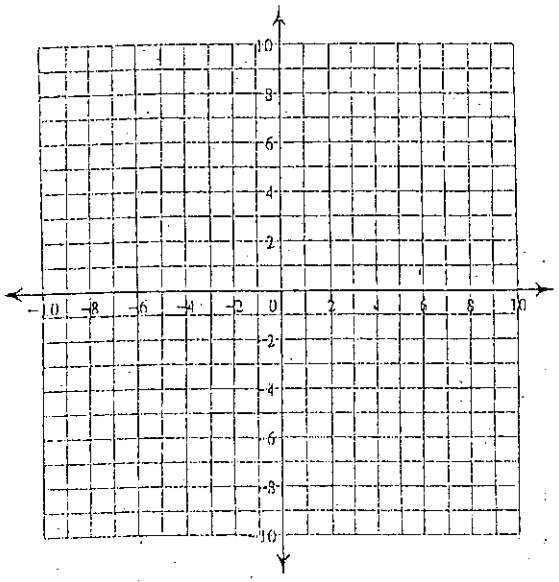
Notes: Solving Systems by Graphing

Date_____

Ive each system by graphing.

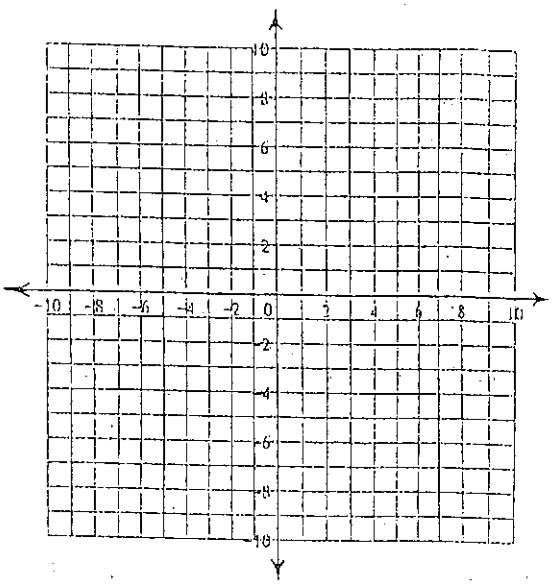
1) $y = -\frac{1}{3}x + 1$

$y = \frac{1}{3}x - 5$



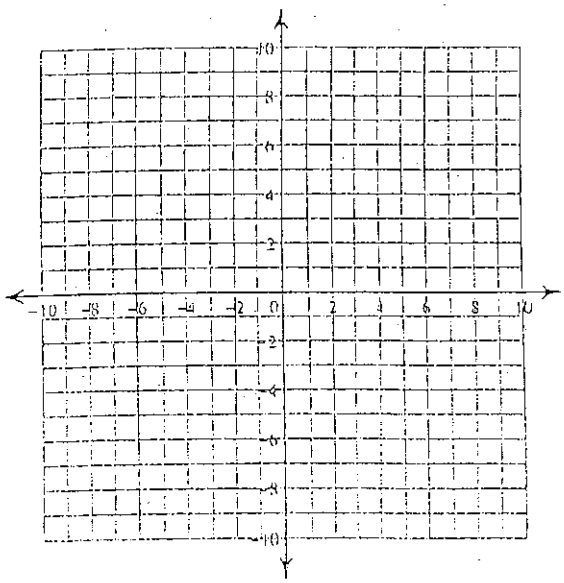
2) $y = 2x - 9$

$y = -\frac{1}{3}x - 2$



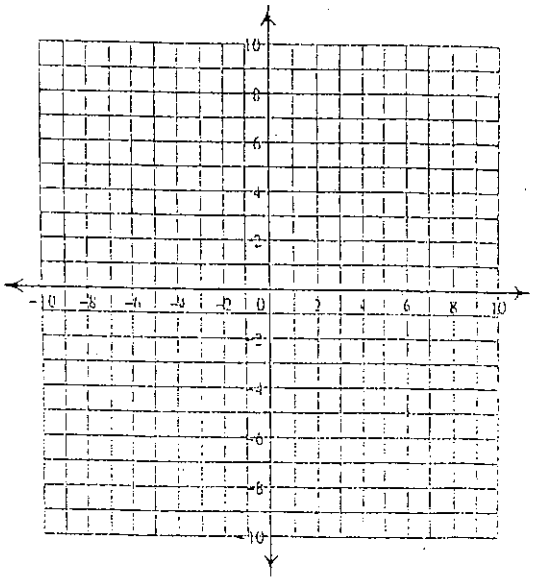
3) $y = -3x + 3$

$y = -3x - 5$



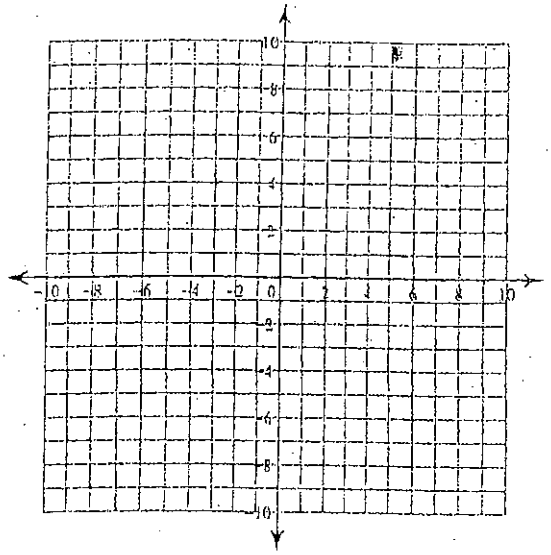
4) $y = \frac{1}{4}x + 6$

$y = \frac{7}{2}x - 7$



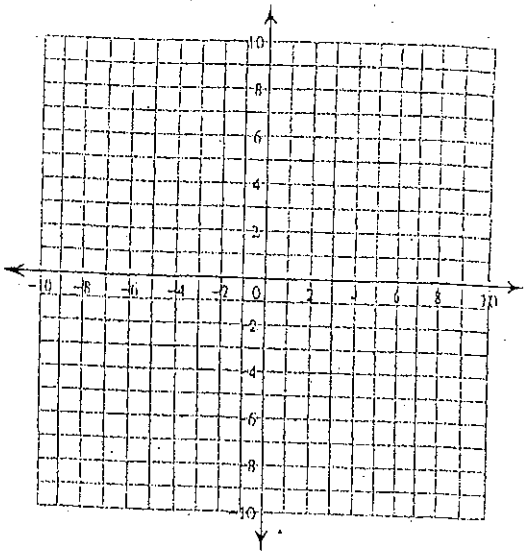
5) $y = -\frac{3}{2}x - 2$

$y = \frac{1}{3}x + 9$



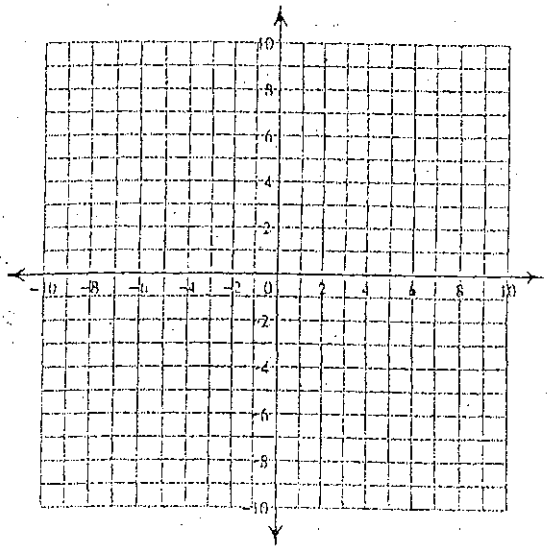
6) $y = -\frac{1}{3}x - 4$

$y = 4x + 9$



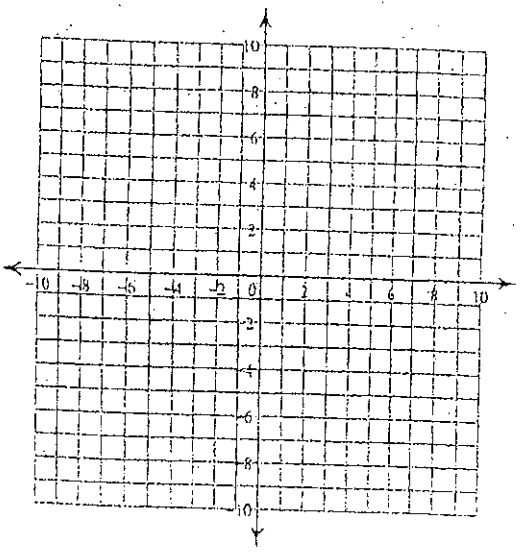
7) $y = 7x - 6$

$y = -2x + 3$



8) $y = -x - 6$

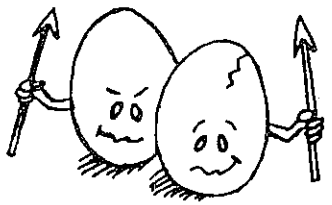
$y = \frac{1}{3}x - 2$



OBJECTIVE 6-a: To solve systems of equations by graphing.

What Were the Headlines After a Mad Scientist Trained Two Eggs to Attack a Candy Store With Sharp Sticks ?

Solve each system of equations below by graphing. Cross out the box containing your answer. When you finish, print the letters from the remaining boxes in the spaces at the bottom of the page.



(1) $y = \frac{2}{3}x - 1$

$y = -x + 4$

(2) $y = -2x + 1$

$y = x - 5$

(3) $y = \frac{1}{2}x - 3$

$y = \frac{3}{2}x - 1$

(4) $y = 2x$

$x + y = 3$

(5) $x + y = 0$ → $y = -x$

$-x \quad -x$

$3x + y = -4$

$-3x \quad -3x$

$y = -3x - 4$

(6) $x = 3 - 3y$

$x + 3y = -6$

(7) $x + 2y = -4$

$4y = 3x + 12$

(8) $y = -2$

$2x - 5y = 20$

(9) $4x + 3y = -15$

$y = x + 2$

TW (−4, 0)	EG (−4, −5)	OS no solution	GS (4, 1)	WE (3, 1)	ET (−2, −4)	SP (−1, 6)	TR (−3, −1)
EA (−3, 5)	TS (1, 2)	RA (0, 3)	TI (2, −3)	MI (4, −3)	SS (5, −2)	NT (−1, 0)	UP (−2, 2)

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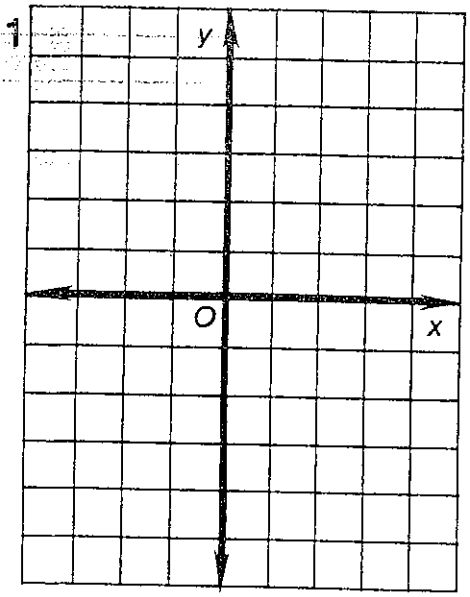
1



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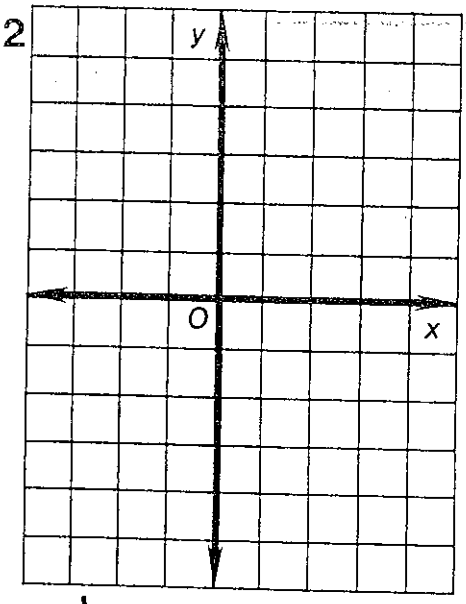

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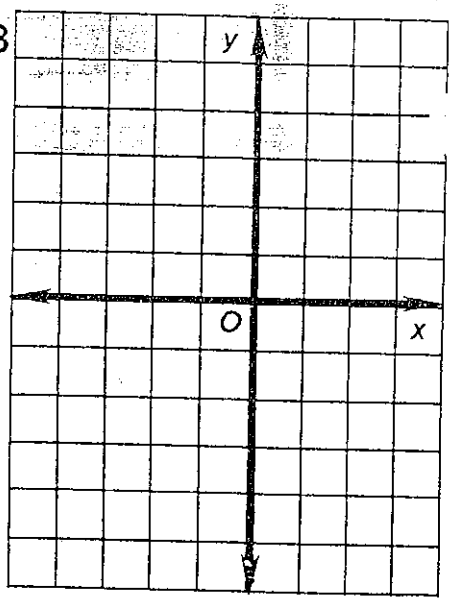

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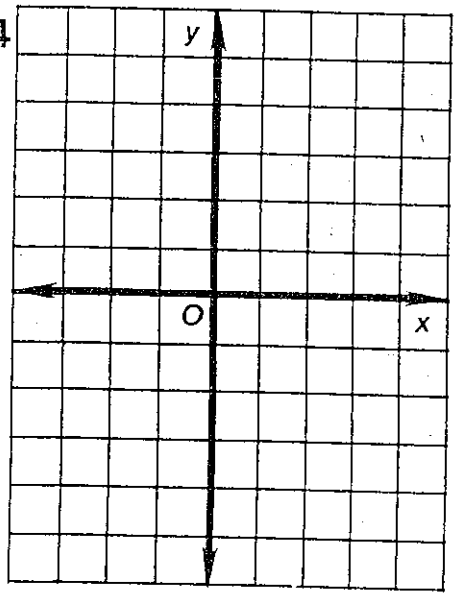

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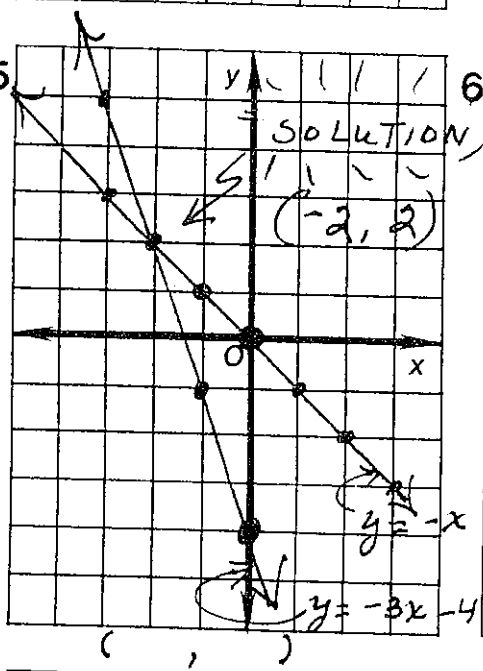

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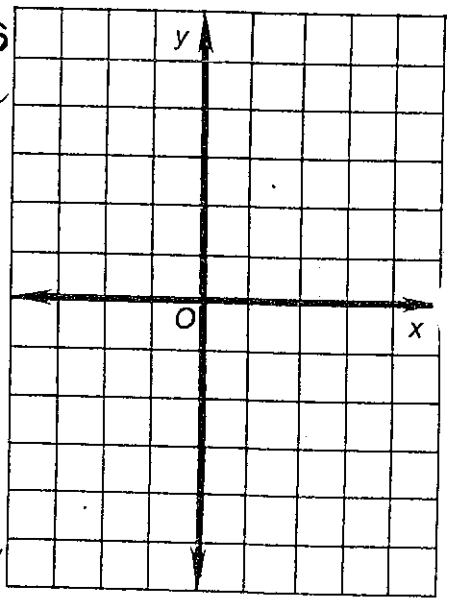

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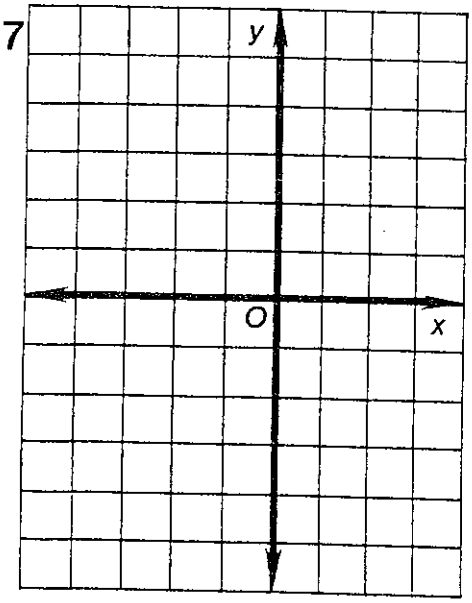

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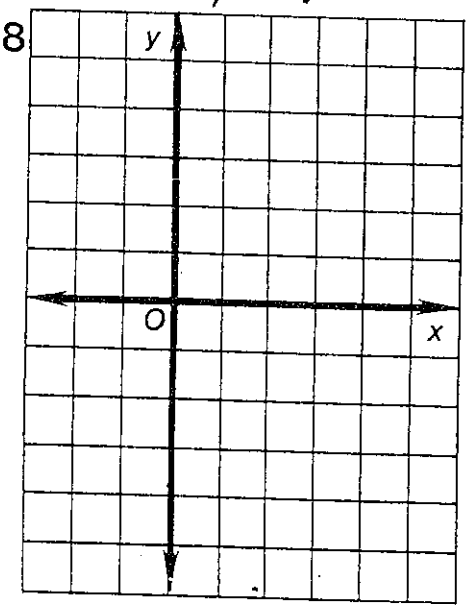

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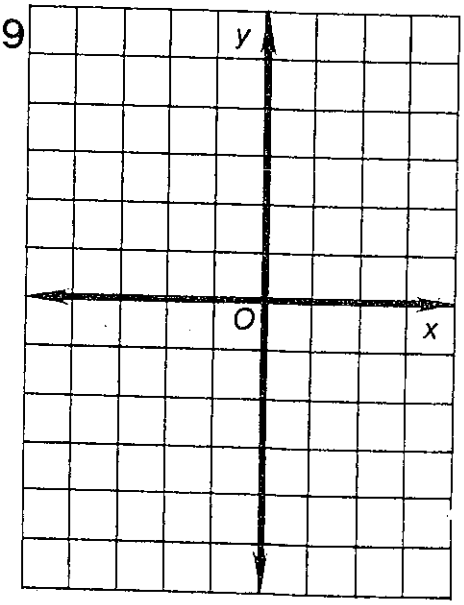


18

Solving Systems of linear equations by Substitution

Ex. Solve this system of equations using substitution. Check.

$$3y - 2x = 11$$
$$y + 2x = 9$$

The substitution method is used to eliminate one of the variables by replacement when solving a system of equations.

Think of it as "grabbing" what one variable equals from one equation and "plugging" it into the other equation.

Let's look at an example using the substitution method:

Solve this system of equations (and check):

$$3y - 2x = 11$$
$$y + 2x = 9$$

1. Solve one of the equations for either "x =" or "y =". This example solves the second equation for "y =".

To make the problem easy, solve for the eq. and variable with a coefficient of 1 or -1!

$$3y - 2x = 11$$
$$y = \boxed{9 - 2x}$$

2. Replace the "y" value in the first equation by what "y" now equals (the expression in *the box*). Grab the "y" value and plug it into the other equation.

$$3(\quad) - 2x = 11$$

3. Solve this new equation for "x".

$$(27 - 6x) - 2x = 11$$
$$27 - 6x - 2x = 11$$
$$27 - 8x = 11$$
$$-8x = -16$$
$$x = 2$$

4. Place this new "x" value into *the box* from step #1 in order to solve for "y". Pick the easier one to work with!

$$y = 9 - 2x$$
$$y = 9 - 2(2)$$
$$y = 9 - 4$$
$$y = 5$$

5. Check: substitute $x = 2$ and $y = 5$ into BOTH ORIGINAL equations. If these answers are correct, BOTH equations will be TRUE!

$$3y - 2x = 11$$
$$3(5) - 2(2) = 11$$
$$15 - 4 = 11$$
$$11 = 11 \text{ (check!)}$$

$$y + 2x = 9$$
$$5 + 2(2) = 9$$
$$5 + 4 = 9$$
$$9 = 9 \text{ (check!)}$$

That's what a solution to a system is- the value that makes both equations true!

Remember how the graphing method found this same point?

Now, use the same steps to solve this system: $\begin{cases} x + 3y = -4 \\ 2x + 5y = -6 \end{cases}$ (Hint: This time, solve the top equation for x.

Do you see why?)

Step 1:

Step 2:

Step 3:

Step 4:

Step 5:

Why Does the President Put Vegetables in His Blender?

Solve each system of equations below by the substitution method. Find the solution in the nearest answer column and notice the two letters next to it. Print these letters in the two boxes at the bottom of the page that contain the number of that exercise.

Answers 1–6:

(4, 2)	LD
(6, −1)	NG
(1, 2)	TR
(4, 8)	HE
(1, −3)	HO
(6, −3)	NT
(5, 3)	FO
(9, 2)	PI
(7, 3)	TH
(5, 2)	IS

(1) $y = 2x$
$x + y = 12$

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

(3) $y = 2x - 5$
$4x - y = 7$

(4) $2x - 3y = 12$
$x = 4y + 1$

(5) $y = -x + 5$
$x - 4y = 10$

(6) $x - y = 2$
$4x - 3y = 11$

(7) $-2x + 3y = 14$
$x + 2y = 7$

(8) $6x - y = -4$
$2x + 2y = 15$

(9) $x + y = 1$
$2x - y = -2$

(10) $5x - 3y = -11$
$x - 2y = 2$

(11) $x - y = 3$
$6x + 4y = 13$

(12) $2x - y = 16$
$-x + 2y = -8$

Answers 7–12:

$\left(\frac{1}{2}, -3\right)$	IN
$\left(8, -\frac{1}{2}\right)$	VE
$\left(-\frac{1}{3}, \frac{4}{3}\right)$	RL
(8, 0)	AS
(−3, 4)	TE
$\left(\frac{1}{2}, 7\right)$	HI
$\left(\frac{5}{2}, \frac{4}{3}\right)$	LO
(−1, 4)	RW
$\left(\frac{5}{2}, -\frac{1}{2}\right)$	PE
(−4, −3)	ED

1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12

Common Core Math 1 Name_____

Applications of Substitution

Date_____

1) Japera is selling wrapping paper for a school fundraiser. Customers can buy rolls of plain wrapping paper and rolls of holiday wrapping paper. Japera sold fourteen rolls of plain wrapping paper and five rolls of holiday wrapping paper for a total of $216. If a roll of holiday wrapping paper costs twice as much as a roll of plain wrapping paper, find the cost of each type.

2) Fransisco is selling pies for a school fundraiser. Customers can buy apple pies and pumpkin pies. Fransisco sold 7 apple pies and 3 pumpkin pies for a total of $193. An apple pie costs one dollar less than a pumpkin pie. Find the cost of an apple pie.

3) Peter Griffin is selling two types of back scratchers at a baseball game. Customers can buy regular and heavy duty at a baseball game. Peter sold 8 of the regular scratchers and 14 of the heavy duty for a total of $274. If a heavy duty scratcher costs one dollar less than twice the price of a regular. Find the cost each of each scratcher.

4) Ya'Sear has three dollars in change. All of the coins are dimes and quarters. The number of quarters is twice the number of dimes. How much money does he have in dimes?

Warm-up

Solve the following

1. $5(r+3)-6=2r$ 2. $6-3d=5(2-d)$ 3. $8-3(p-4)=2p$

Solving Linear Systems by Elimination

Ex. 1

Use elimination to solve each system of equations.

$3x - 5y = -16$
$2x + 5y = 31$

Since the coefficients of the y terms, -5 and 5, are additive inverses, you can eliminate the y terms by adding the equations.

$3x - 5y = -16$ Write the equations in column form and add.
$(+)\ 2x + 5y = 31$
$5x = 15$ Notice that the y variable is eliminated.

$\frac{5x}{5} = \frac{15}{5}$ Divide each side by 5.

$x = 3$ Simplify.

Now substitute 3 for x in either equation to find the value of y.

$3x - 5y = -16$ First equation
$3(3) - 5y = -16$ Replace x with 3.
$9 - 5y = -16$ Simplify.
$9 - 5y - 9 = -16 - 9$ Subtract 9 from each side.
$-5y = -25$ Simplify.
$\frac{-5y}{-5} = \frac{-25}{-5}$ Divide each side by -5.
$y = 5$ Simplify.

The solution is (3, 5).

Ex. 2

Use elimination to solve the system of equations.

$3x + 4y = 6$
$5x + 2y = -4$

Multiply the second equation by -2 so the coefficients of the y terms are additive inverses. Then add the equations.

$3x + 4y = 6$
$5x + 2y = -4$ Multiply by -2.

$3x + 4y = 6$
$(+)\ -10x - 4y = 8$
$-7x = 14$ Add the equations.

$\frac{-7x}{-7} = \frac{14}{-7}$ Divide each side by -7.

$x = -2$ Simplify.

Now substitute -2 for x in either equation to find the value of y.

$3x + 4y = 6$ First equation
$3(-2) + 4y = 6$ $x = -2$
$-6 + 4y = 6$ Simplify.
$-6 + 4y + 6 = 6 + 6$ Add 6 to each side.
$4y = 12$ Simplify.
$\frac{4y}{4} = \frac{12}{4}$ Divide each side by 4.

Ex 5

$3x + 4y = -25$ Multiply by 3.
$2x - 3y = 6$ Multiply by 4.

$$\begin{array}{rrl} 9x + 12y = -75 & & \\ (+)\ 8x - 12y = 24 & & \\ \hline 17x = -51 & & \text{Add the equations.} \\ \frac{17x}{17} = \frac{-51}{17} & & \text{Divide each side by 17.} \\ x = -3 & & \text{Simplify.} \end{array}$$

Now substitute -3 for x in either equation to find the value of y.

$$\begin{array}{rl} 2x - 3y = 6 & \text{Second equation} \\ 2(-3) - 3y = 6 & x = -3 \\ -6 - 3y = 6 & \text{Simplify.} \\ -6 - 3y + 6 = 6 + 6 & \text{Add 6 to each side.} \\ -3y = 12 & \text{Simplify.} \\ \frac{-3y}{-3} = \frac{12}{-3} & \text{Divide each side by } -3. \\ y = -4 & \text{Simplify.} \end{array}$$

The solution is $(-3, -4)$, which matches the result obtained with Method 1.

Practice!

Solving Linear Systems by Elimination

Ex: $3m - 2n = 13$
$m + 2n = 7$

Ex: $-5x + 3y = 6$
$x - y = 4$

Ex: $4x - y = 10$
$5x + 2y = -7$

What Do You Call It When Someone Pays Back a Loan Quickly?

Solve each system of equations below by the addition method. Find the solution in the coordinate system and notice the letter at that point. Print this letter in each box at the bottom of the page that contains the number of that exercise.

(1) $x + y = 5$
$3x - y = 7$

(2) $2x + y = 3$
$-2x + 5y = -9$

(3) $3x + 5y = 0$
$2x - 5y = -25$

(4) $-4x - y = -6$
$4x + 3y = 18$

(5) $2x - y = -5$
$-2x - 5y = 11$

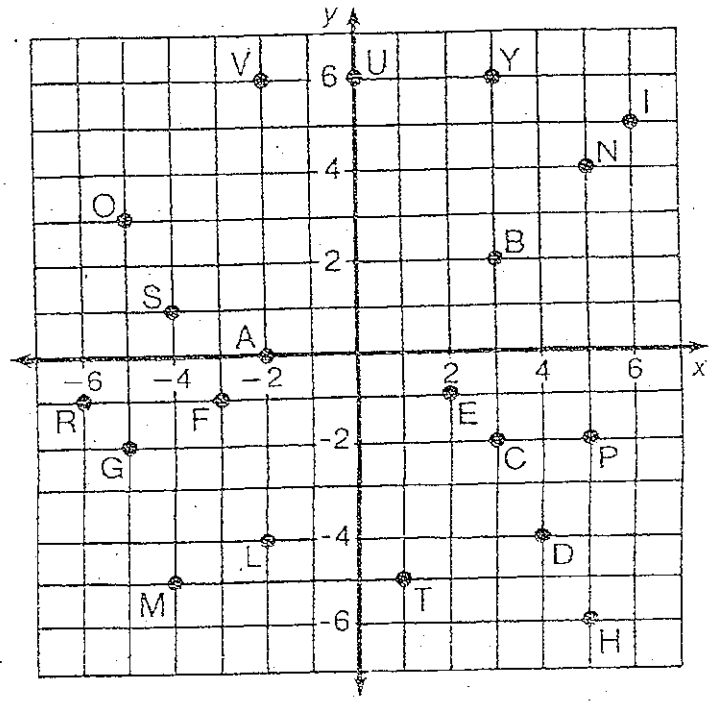
(6) $8 = 4x - 3y$
$17 = x + 3y$

(7) $-6 = 3x + y$
$10 = -5x - y$

(8) $3x + 8y = -1$
$-3x + y = -17$

(9) $x + 2y = 15$
$5x = 2y + 3$

(10) $7x - y = 12$
$-3y = 7x + 8$



(11) $y = 3x + 13$
$2x = y - 9$

(12) $4x + 12 = -7y$
$-y + 12 = 4x$

7	11	4	12	12	2	6	12	2	1	10	8	7	9	3	5	5

What Kind of Shoes Does a Frog Wear?

Solve each system of equations by the addition method. (You may first have to multiply both sides of one equation by -1.) Find your answer below and cross out the letter above it. When you finish, the answer to the title question will remain.

(1) $5x - 2y = 4$
$x + 2y = 8$

(2) $-3x + 2y = 11$
$3x - 4y = -19$

(3) $3x + y = 13$
$x + y = 3$

(4) $6x - 2y = 10$
$x - 2y = -5$

(5) $5x + y = 2$
$5x - 3y = 14$

(6) $7x - 4y = -10$
$4y = x - 2$

(7) $x = 5 - 9y$
$4x + 9y = -7$

(8) $3x = 5y - 9$
$2y = 3x + 3$

(9) $x + 2y = -2$
$4x + 2y = -17$

(10) $-6x - 5y = 20$
$-y = 6x + 4$

(11) $-3x + y = -2$
$-2 = 7x - y$

(12) $10x - 5 = 3y$
$2x - 3y = 1$

S	H	O	L	D	P	R	E	S	A	N	T	I	O	E	N	A	I	D	R
$(0, -4)$	$(\frac{1}{2}, 0)$	$(3, 7)$	$(\frac{1}{3}, 2)$	$(-2, -1)$	$(-5, 3)$	$(3, 4)$	$(\frac{1}{2}, 2)$	$(2, 3)$	$(-4, 1)$	$(2, -4)$	$(-2, 2)$	$(-1, -5)$	$(-1, 6)$	$(-1, 4)$	$(-5, \frac{3}{2})$	$(5, -3)$	$(5, -2)$	$(-5, 4)$	$(1, -3)$

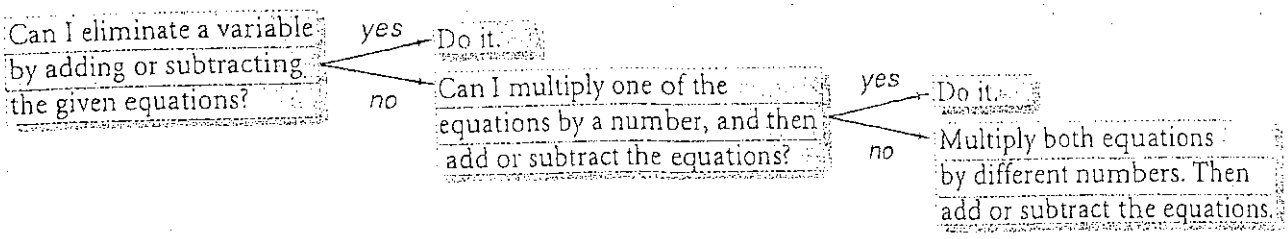
Solving Linear Systems by Elimination

$4x - 7y = 10$
$3x + 2y = -7$

Ex: $2x - 3y = 2$
$5x + 4y = 28$

Ex: $3x = 4y - 10$
$5x - 8y = -2$

When you solve systems using elimination, plan a strategy. A flowchart like this one may help you to decide how to eliminate a variable.



Did You Hear About...

A	B	C	D	E	F
G	H	I	J	K	L ?

Solve each system of equations below using multiplication with the addition method. Find the solution in the answer column and notice the word next to it. Write this word in the box containing the letter of that exercise. Keep working and you will hear about some "udder" nonsense.

(A) $5x - 2y = 4$
$3x + y = 9$

(B) $3x - 5y = 13$
$x - 2y = 5$

(C) $7x + 2y = -1$
$3x - 4y = 19$

(D) $x + 2y = 6$
$5x + 3y = 2$

(E) $2x + 3y = 7$
$3x + 4y = 10$

(F) $7x - 3y = -5$
$3x + 2y = 11$

(G) $3x - 5y = 7$
$5x - 2y = -1$

(H) $4x + 3y = 9$
$3x + 4y = 12$

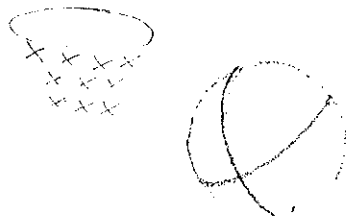
(I) $5x - 3y = 16$
$4x + 5y = -2$

(J) $4x - 3y = -20$
$-x - 8y = 5$

(K) $-3x + 7y = -1$
$-2x + 5y = 0$

(L) $5x + 6y = -11$
$3x + y = -4$

TWEET	(1, 2)
HIS	(2, 1)
SELLING	(−5, 0)
BIRDSEED	(−1, −2)
UDDER	(2, 0)
THE	(2, 3)
SINGING	(−5, 4)
STARTED	(2, −2)
FED	(−2, 4)
BUTTER	(−1, 3)
COWS	(1, 4)
MILK	(−1, −1)
FARMER	(1, −2)
AND	(0, 3)
WINGS	(2, −4)
WHO	(1, −4)
MOO	(1, 3)
CHEEP	(5, 2)
BEEF	(3, −2)



Basketball Altogether 292 tickets were sold for a high school basketball game. An adult ticket costs \$3. A student ticket costs \$1. Ticket sales were \$470. Use the system to find the number of each type of ticket sold.

number of tickets sold: $a + s = 292$
money collected: $3a + s = 470$

First, eliminate one variable.

$$\begin{array}{rl} a + s = 292 & \\ 3a + s = 470 & \\ \hline -2a + 0 = -178 & \leftarrow \text{Subtract the equations to eliminate } s. \\ a = 89 & \leftarrow \text{Solve for } a. \end{array}$$

Then, find the value of the eliminated variable.

$$\begin{array}{rl} 89 + s = 292 & \leftarrow \text{Substitute 89 for } a \text{ in the first equation.} \\ s = 203 & \leftarrow \text{Solve for } s. \end{array}$$

There were 89 adult tickets sold and 203 student tickets sold.

Sales Suppose your class receives \$1084 for selling 205 packages of greeting cards and gift wrap. Let w = the number of packages of gift wrap sold and c = the number of packages of greeting cards sold. Use the system to find the number of each type of package sold.

total number of packages: $w + c = 205$
total amount of sales: $4w + 10c = 1084$

In the first equation, the coefficient of w is 1. In the second equation, the coefficient of w is 4. So multiply the first equation by 4. Then subtract to eliminate w.

$$\begin{array}{rl} w + c = 205: \quad 4w + 4c = 820 & \leftarrow \text{Multiply each side of the first equation by 4.} \\ \underline{4w + 10c = 1084} & \\ -6c = -264 & \leftarrow \text{Subtract the two equations.} \\ c = 44 & \leftarrow \text{Solve for } c. \end{array}$$

Find w.

$$\begin{array}{rl} w + c = 205 & \leftarrow \text{Use the first equation.} \\ w + 44 = 205 & \leftarrow \text{Substitute 44 for } c. \\ w = 161 & \leftarrow \text{Solve for } w. \end{array}$$

The class sold 161 packages of gift wrap and 44 packages of greeting cards.

4. Could you have multiplied the first equation by 10 rather than 4 and then solved the system? Why or why not?

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Using Systems of Equations to Solve Word Problems

Ex. 1 The sum of two numbers is 48, and their difference is 24. What are the numbers?

Ex. 2 Mario spent a total of $64 for a pair of jeans and a shirt. The jeans cost $6 more than the shirt. What was the cost of the jeans?

Ex. 3 A group of students and their chaperones visit the Morehead Planetarium. Two adults and 5 students paid $77. Three adults and 7 students paid $111. Find the adult ticket price and the student ticket price.

Common Core Math 1 Name_____

Applications of Elimination

Date_____

1) Mei and Nicole each improved their yards by planting rose bushes and ivy. They bought their supplies from the same store. Mei spent $180 on 14 rose bushes and 4 pots of ivy. Nicole spent $96 on 6 rose bushes and 8 pots of ivy. What is the cost of one rose bush and the cost of one pot of ivy?

2) Mark's school is selling tickets to the annual talent show. On the first day of ticket sales the school sold 3 senior citizen tickets and 4 child tickets for a total of $45. The school took in $76 on the second day by selling 4 senior citizen tickets and 8 child tickets. Find the price of a senior citizen ticket and the price of a child ticket.

3) Jose and Amanda each improved their yards by planting grass sod and ornamental grass. They bought their supplies from the same store. Jose spent $144 on 12 ft^2 of grass sod and 3 bunches of ornamental grass. Amanda spent $179 on 13 ft^2 of grass sod and 9 bunches of ornamental grass. What is the cost of one ft^2 of grass sod and the cost of one bunch of ornamental grass?

4) Jacob and Jasmine are selling cookie dough for a school fundraiser. Customers can buy packages of sugar cookie dough and packages of double chocolate cookie dough. Jacob sold 10 packages of sugar cookie dough and 2 packages of double chocolate cookie dough for a total of $94. Jasmine sold 7 packages of sugar cookie dough and 14 packages of double chocolate cookie dough for a total of $280. Find the cost each of one package of sugar cookie dough and one package of double chocolate cookie dough.

5) Jessica and Gabriella are selling wrapping paper for a school fundraiser. Customers can buy rolls of plain wrapping paper and rolls of holiday wrapping paper. Jessica sold 5 rolls of plain wrapping paper and 6 rolls of holiday wrapping paper for a total of $137. Gabriella sold 13 rolls of plain wrapping paper and 12 rolls of holiday wrapping paper for a total of $295. What is the cost each of one roll of plain wrapping paper and one roll of holiday wrapping paper?

What Kind of Monkey Can Fly?

Solve each problem below using a system of two equations in two variables. Find the solution in the answer column and notice the letter next to it. Write this letter in each box that contains the number of that exercise.

(1) Three times the larger of two numbers is equal to four times the smaller. The sum of the numbers is 21. Find the numbers.

(2) The difference between two numbers is 16. Five times the smaller is the same as 8 less than twice the larger. Find the numbers.

(3) The larger of two numbers is 1 more than twice the smaller. The sum of the numbers is 20 less than three times the larger. Find the numbers.

(4) Two records and three tapes cost $31. Three records and two tapes cost $29. Find the cost of each record and each tape.

(5) The sum of two numbers is the same as four times the smaller number. If twice the larger is decreased by the smaller, the result is 30. Find the numbers.

(6) A group of students go out for lunch. If two have hamburgers and five have hot dogs, the bill will be $8.00. If five have hamburgers and two have hot dogs, the bill will be $9.50. What is the price of a hamburger?

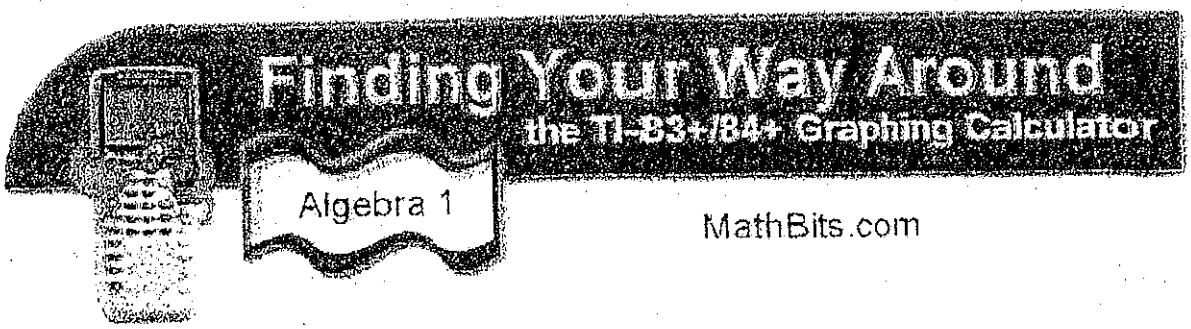
(S)	22, 6
(K)	16, 9
(R)	18, 6
(M)	11, 10
(B)	$20, $35
(I)	12, 9
(P)	$1.35
(N)	13, 6
(O)	14
(T)	$1.50
(L)	$8, $5
(A)	24, 8
(D)	$23, $41
(H)	$5, $7
(E)	17

(7) The price of a sweater is $5 less than twice the price of a shirt. If four sweaters and three shirts cost $200, find the price of each shirt and each sweater.

(8) A shipment of TV sets, some weighing 30 kg each and the others weighing 50 kg each, has a total weight of 880 kg. If there are 20 TV sets all together, how many weigh 50 kg?

2	4	8	6	2	1	5	7	2	7	8	8	3

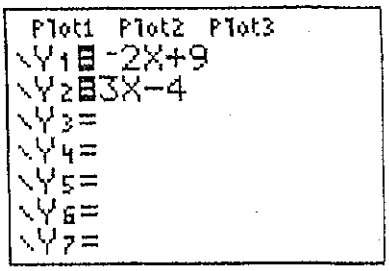
40



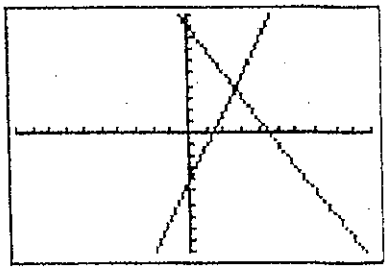
Solving Systems of Equations

1. Solve the system: $y = -2x + 9$ and $y = 3x - 4$

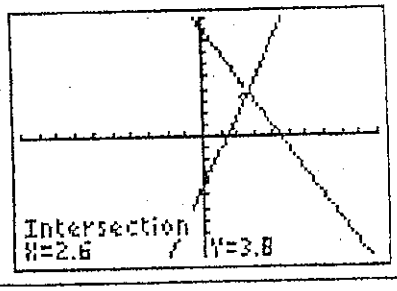
1. Enter the first equation into Y_1.
2. Enter the second equation into Y_2.
3. Hit **GRAPH.**



4. Use the **INTERSECT** option to find where the two graphs intersect (the answer).
   2nd TRACE (CALC) #5 intersect
   Move spider close to the intersection.
   Hit **ENTER** 3 times.



5. Answer: $x = 2.6$ and $y = 3.8$



2. Solve the system: $x - 2y = 14$ and $x + 3y = 9$

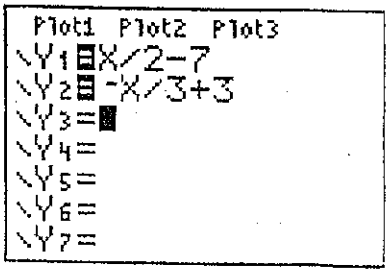
The graphing calculator will only accept entries that start with $y =$, so we need to solve these equations for $y =$.

$$y = \frac{x}{2} - 7$$

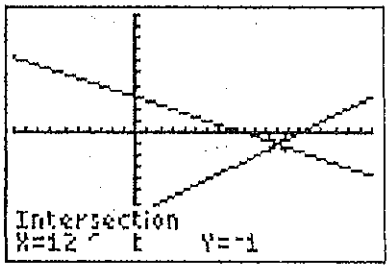
$$y = -\frac{x}{3} + 3$$

1. Enter the first equation into Y_1.
2. Enter the second equation into Y_2.
3. Hit **GRAPH**. The graphs appear to intersect OFF the window. We need MORE x-values to the right hand side of the graph. Go to **WINDOW**. Increase the size of **Xmax**. Hit **GRAPH.**

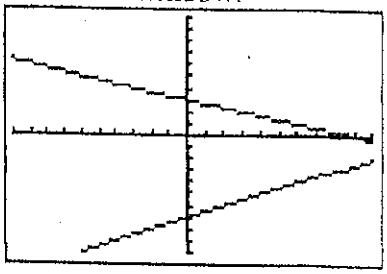
4. Use the **INTERSECT** option to find where the two graphs intersect (the answer).
   2nd TRACE (CALC) #5 intersect
   Move spider close to the intersection.
   Hit **ENTER** 3 times.



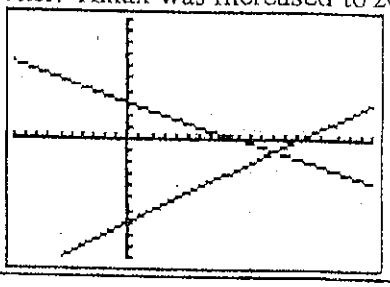
5. Answer: $x = 12$ and $y = -1$



Oops!! They don't cross in the window.



Better! Xmax was increased to 20.



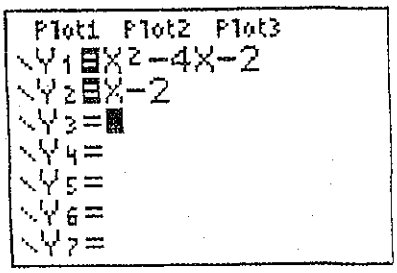
3. Solve linear quadratic system: $y = x^2 - 4x - 2$ and $y = x - 2$

1. Enter the first equation into Y_1.
2. Enter the second equation into Y_2.
3. Hit **GRAPH.**

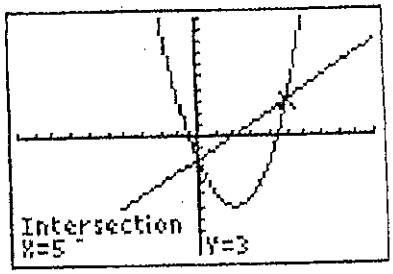
4. Use the **INTERSECT** option twice to find the

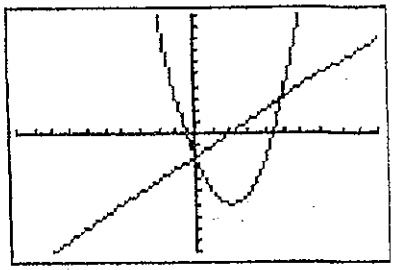
two locations where the graphs intersect (the answers).

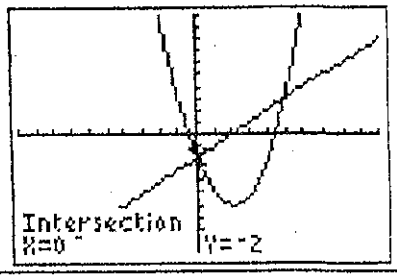
2nd TRACE (CALC) #5 intersect
Move spider close to the intersection.
Hit **ENTER** 3 times.



5. Answer: (5,3) and (0,-2)







Finding Your Way Around TABLE of CONTENTS

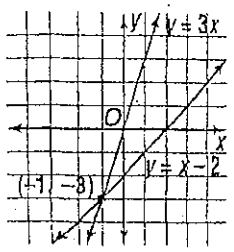
Graphing Systems of Equations

The ordered pair $(-1, -3)$ is the solution of the system of equations

$$y = x - 2$$
$$y = 3x$$

because when -1 is substituted for x and -3 is substituted for y, both equations are true.

$$y = x - 2 \qquad y = 3x$$
$$-3 \stackrel{?}{=} -1 - 2 \qquad -3 \stackrel{?}{=} 3(-1)$$
$$-3 = -3 \checkmark \qquad -3 = -3 \checkmark$$



You can also graph both equations to show that $(-1, -3)$ is the solution of the system.

The graphs appear to intersect at $(-1, -3)$. Since $(-1, -3)$ is the solution of each equation, it is the solution of the system of equations.

You can also use a graphing calculator to solve the system of equations.

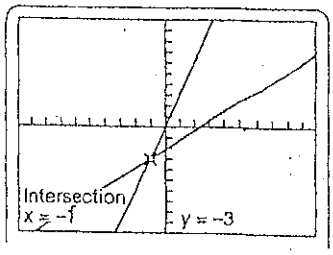
Step 1 Enter these keystrokes in the Y= screen:

X, T, θ, n | − | 2 | ENTER

3 | X, T, θ, n | ENTER | GRAPH

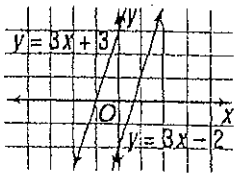
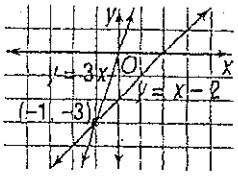
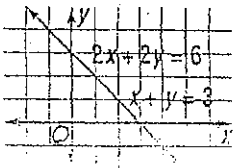
Step 2 Use the INTERSECT feature to find the intersection point.

2nd | [CALC] 5 | ENTER | ENTER | ENTER



The solution is $(-1, -3)$.

Solutions of Systems of Equations

Graph	Description of Graph	Number of Solutions
		
		
		

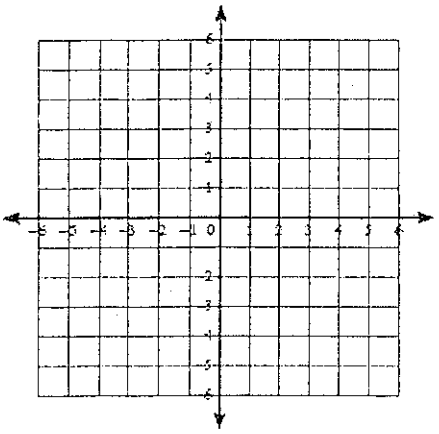
Common Core Math 1B
Unit 7B Review

Name _____
Date _____

Solve the following systems through graphing

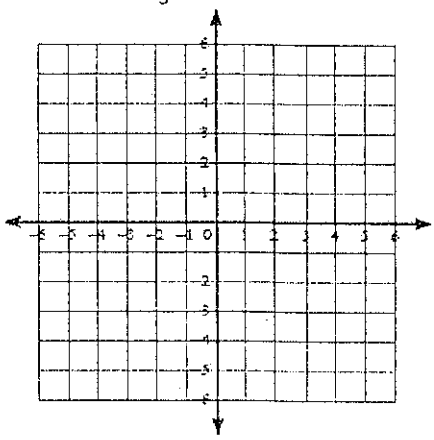
1. $y = 2x - 4$

$y = -\frac{2}{3}x + 4$



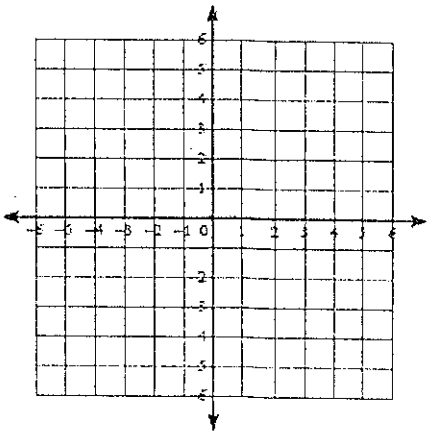
2. $x = 3$

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



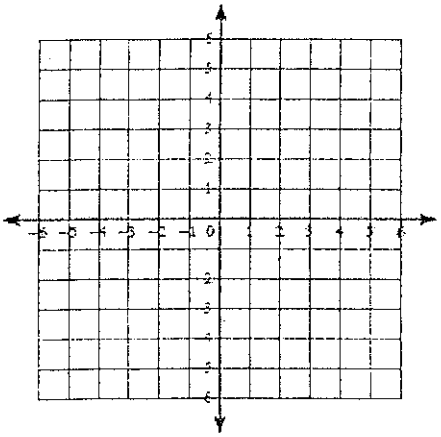
3. $y = -3x + 5$

$6x - 2y = 10$



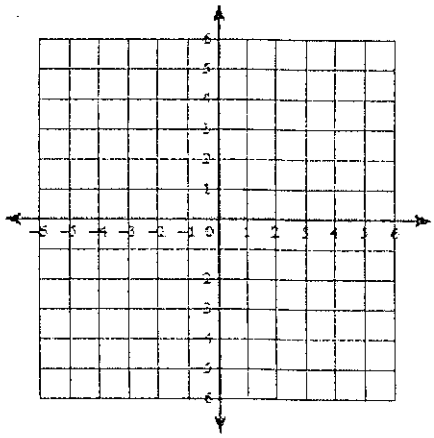
4. $y < x - 4$

$y \leq -\frac{2}{3}x + 4$



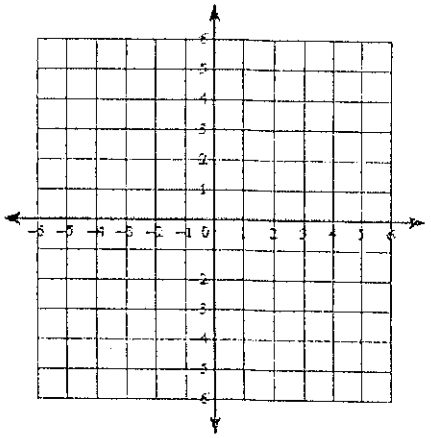
5. $y > 3$

$y < -\frac{5}{4}x$



6. $y < -3x + 5$

$6x - 2y < 0$



Solve each system using elimination or substitution.

7. $3x - 2y = -23$
$-x + y = 9$

8. $\frac{2}{3}x + 4y = -2$
$x = -3$

9. $5x + 4y = -3$
$-9x - 10y = 4$

10. $7x - 8y = 2$
$x - y = 0$

11. $x - y = 10$
$y = x + 5$

12. $y = \frac{1}{3}x + 4$
$3y - x = 12$

13. $x = 3$
$y = 8$

14. $x = 2$
$x = 9$

15. $x = 1$
$y = 2x^2 + x - 5$

16. Sally has 20 coins in her piggy bank, all dimes and quarters. The total amount of money in her piggy bank is $3.05. How many of each coin does she have?

17. Maria and Molly are selling cheesecakes for a school fundraiser. Customers can buy French silk cheesecakes and strawberry cheesecakes. Maria sold 10 French silk cheesecakes and 5 strawberry cheesecakes for a total of $120. Molly sold 11 French silk cheesecakes and 12 strawberry cheesecakes for a total of $184. What is the cost each of one French silk cheesecake and one strawberry cheesecake?

18. The sum of two numbers is 24 and their difference is 15. What are the two numbers?

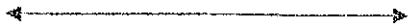
19. Majesta and Abby are buying food for a party. Majesta buys 15 burgers and 17 chicken sandwiches for a total of $85.30. Abby buys 16 burgers and 11 chicken sandwiches for a total of $75.65. What is the cost of a burger and what is the cost of a chicken sandwich?

20. Henry has a potbellied piggy bank where he holds his life savings. It contains a total of 98 coins, made up of only dimes and nickels. He has amassed a whopping $7.80. How many of each coin does he have?

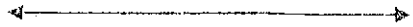
21. The sum of two numbers is thirty-five. The larger number is one less than three times the smaller. Find the two numbers.

Review:

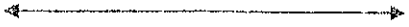
1. Graph $x > -3$



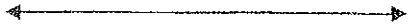
2. Graph $x \geq 11$



3. Solve $3x + 5 < 26$. Then graph your solution set.

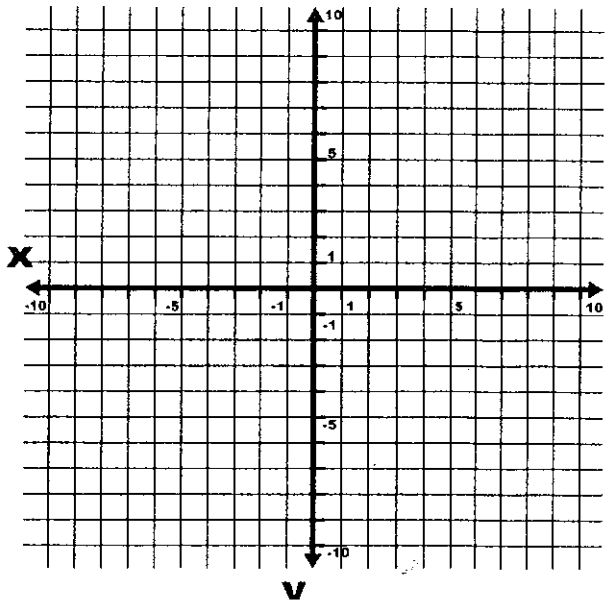


4. Solve $-2x - 1 \leq 7$; then graph your solution set.

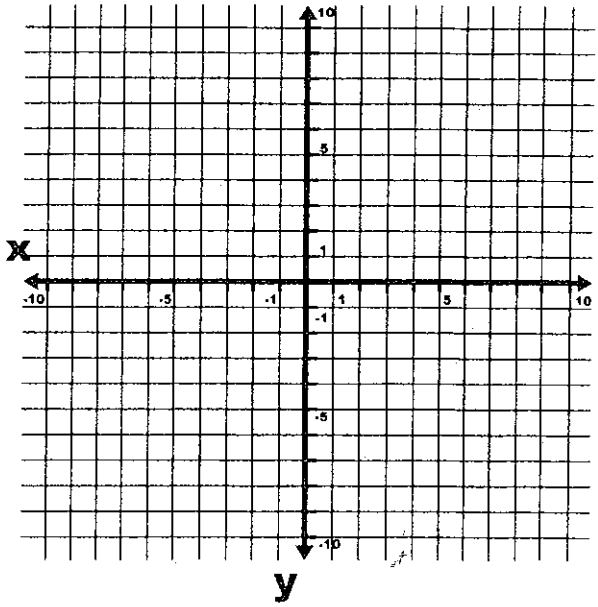


Notes: Graphing Linear Inequalities

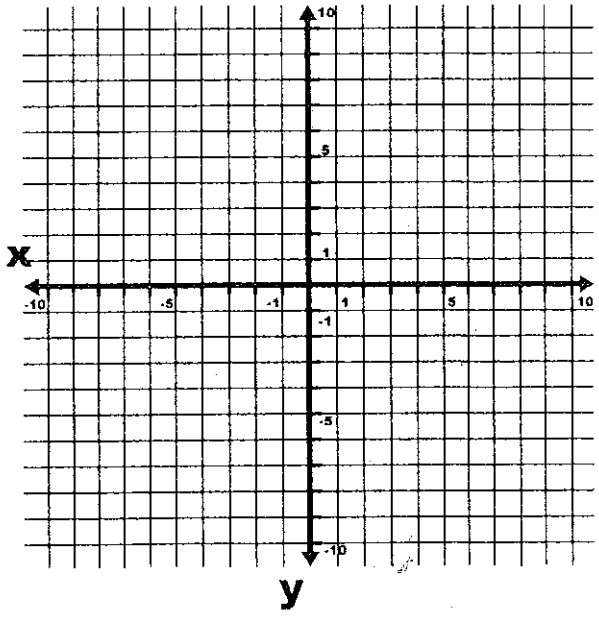
Example 1. Graph $y < \frac{3}{2}x - 4$



Example 2. Graph $y \geq -2x + 5$



Example 3. Graph $\begin{cases} y < x + 5 \\ y \geq 3x + 3 \end{cases}$



Warm-up

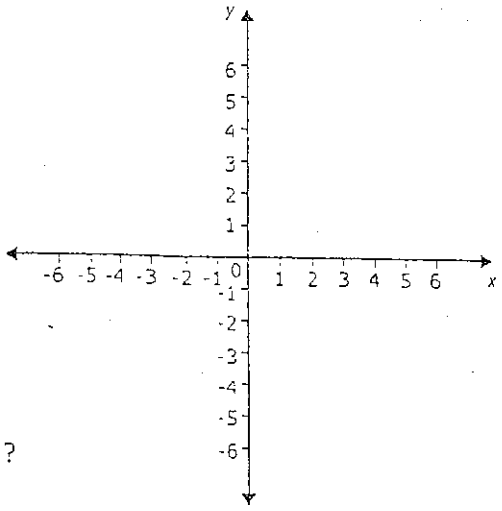
Graph the inequalities on the same coordinate plane.

1. $y < -\frac{1}{2}x + 3$

2. $y \geq 4x - 1$

3. Look at the coordinate plane now that you have graphed both inequalities. If we had to pick a point that would satisfy both inequalities, circle where you think the point would be located.

   What made you pick this area on the graph?

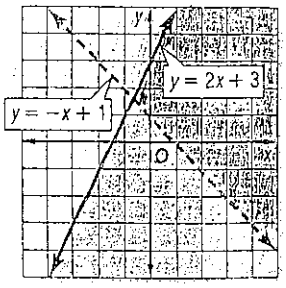


SYSTEMS OF INEQUALITIES To solve a system of inequalities, you need to find the ordered pairs that satisfy all the inequalities involved. One way to do this is to graph the inequalities on the same coordinate plane. The solution set is represented by the intersection, or overlap, of the graphs.

Example 1 Solve by Graphing

Solve the system of inequalities by graphing.

$y < -x + 1$
$y \leq 2x + 3$

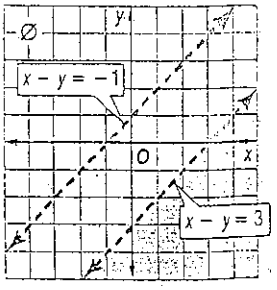


The solution includes the ordered pairs in the intersection of the graphs of $y < -x + 1$ and $y \leq 2x + 3$. This region is shaded in green at the right. The graphs of $y = -x + 1$ and $y = 2x + 3$ are boundaries of this region. The graph of $y = -x + 1$ is dashed and is *not* included in the graph of $y < -x + 1$. The graph of $y = 2x + 3$ is included in the graph of $y \leq 2x + 3$.

Example 2 No Solution

Solve the system of inequalities by graphing.

$x - y < -1$
$x - y > 3$



The graphs of $x - y = -1$ and $x - y = 3$ are parallel lines. Because the two regions have no points in common, the system of inequalities has no solution.

Graphing Systems of Inequalities

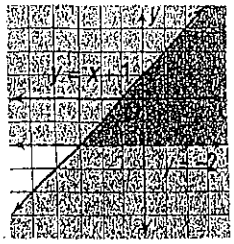
To graph a system of linear inequalities, first graph a boundary line for each inequality. Then shade on one side of each boundary line. The region where the shaded areas overlap contains the solutions of the system of inequalities.

Example: Solve the system of inequalities by graphing.

$y > -2$
$y \leq x + 1$

Step 1 Graph the boundary lines $y = -2$ and $y = x + 1$. Since y is *greater than* -2, make the line $y = -2$ dashed. The line $y = x + 1$ is solid because y is *less than or equal to* $x + 1$.

Step 2 Because $y > -2$ has a *greater than* symbol, shade above the boundary line. Shade below the boundary line for $y \leq x + 1$ because this inequality contains a *less than* symbol.



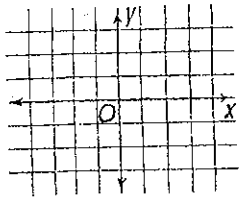
The region where the shaded areas intersect is the solution of the system of inequalities.

Use the following rules to help you graph inequalities.

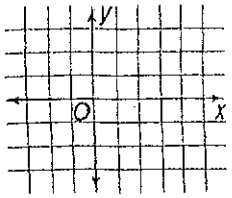
Inequality	Example	Boundary Line	Where to Shade
$y < ax + b$	$y < 2x$		
$y \leq ax + b$	$y \leq -x + 1$		
$y > ax + b$	$y > 5x - 2$		
$y \geq ax + b$	$y \geq -4x$		

Solve each system of inequalities by graphing. If the system does not have a solution, write no solution.

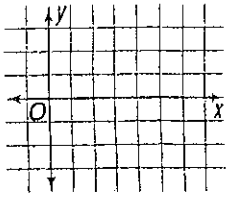
1. $y < 1$
   $y > -3$



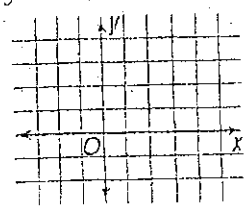
2. $x > 4$
   $x < -1$



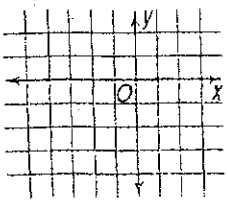
3. $y \geq -2$
   $x \leq 5$



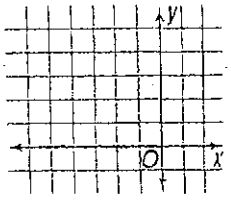
4. $x \leq 2$
   $y > x$



5. $y < x$
   $x \leq -1$



6. $y \geq 0$
   $y \leq x + 3$



NAME _____ DATE _____ PERIOD ____

6-6

Practice

Graphing Inequalities in Two Variables

Determine which ordered pairs are part of the solution set for each inequality.

1. $3x + y \geq 6$, $\{(4, 3), (-2, 4), (-5, -3), (3, -3)\}$

2. $y \geq x + 3$, $\{(6, 3), (-3, 2), (3, -2), (4, 3)\}$

3. $3x - 2y < 5$, $\{(4, -4), (3, 5), (5, 2), (-3, 4)\}$

Match each inequality with its graph.

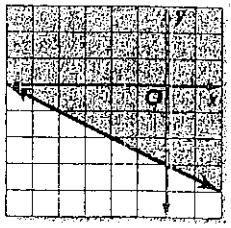
4. $5y - 2x \leq 10$

5. $3y > 3x + 9$

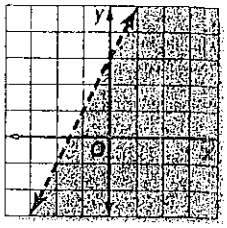
6. $y - 2x < 3$

7. $x + 2y \geq -6$

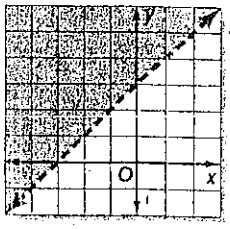
a.



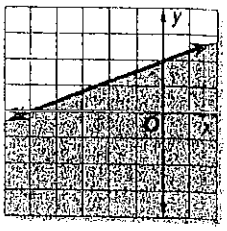
b.



c.

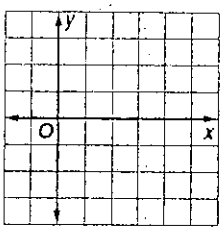


d.

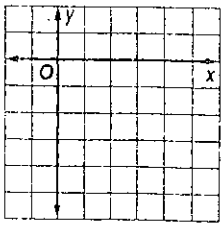


Graph each inequality.

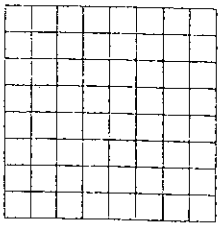
8. $2y - x < -4$



9. $2x - 2y \geq 8$



10. $3y > 2x - 3$



11. **MOVING** A moving van has an interior height of 7 feet (84 inches). You have boxes in 12 inch and 15 inch heights, and want to stack them as high as possible to fit. Write an inequality that represents this situation.

BUDGETING For Exercises 12 and 13, use the following information.

Satchi found a used bookstore that sells pre-owned videos and CDs. Videos cost \$9 each, and CDs cost \$7 each. Satchi can spend no more than \$35.

12. Write an inequality that represents this situation.

13. Does Satchi have enough money to buy 2 videos and 3 CDs?

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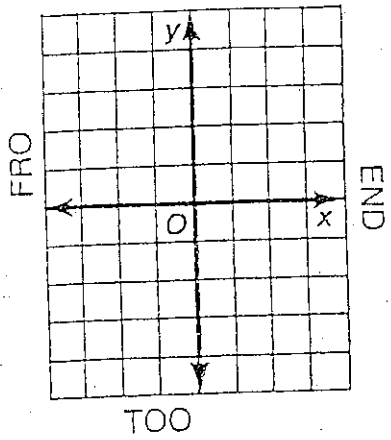
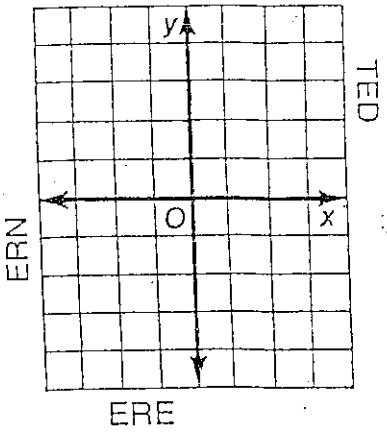
What Did the Toothless Old Termite Say When He Entered a Tavern ?

Graph each pair of inequalities below and indicate the solution set of the system with crosshatching or shading. The crosshatching or shading, if extended, would cover a set of three letters. Print these letters in the three boxes at the bottom of the page that contain the exercise number.

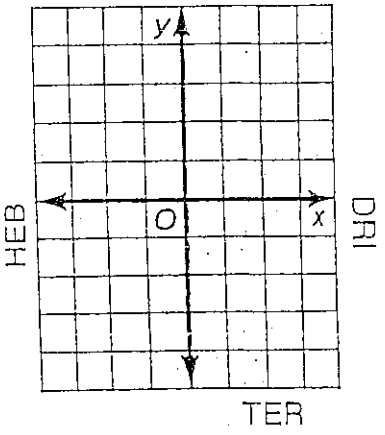
(1) $y \leq x - 1$
$y \geq -3$



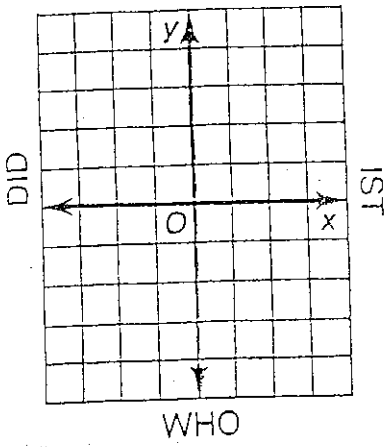
(2) $x \leq 2$
$y \leq \frac{2}{3}x - 1$



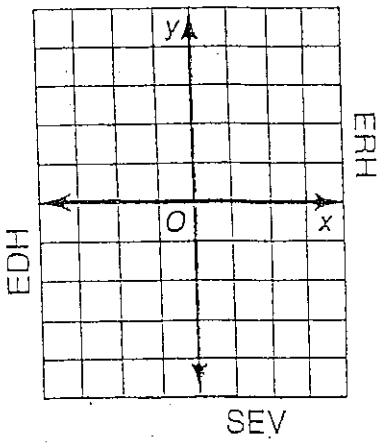
(3) $y < -x + 1$
$y > \frac{1}{2}x - 2$



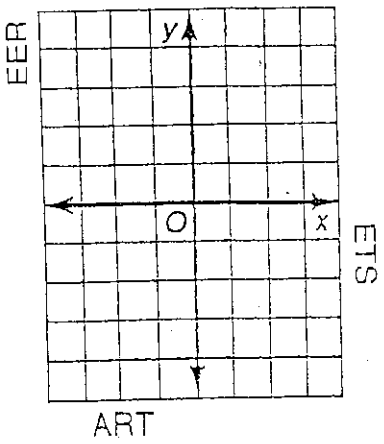
(4) $y < x$
$3x + 2y > 4$



(5) $x - 3y \leq 12$
$x > 2$



(6) $y \leq 1$
$2x + y < 1$

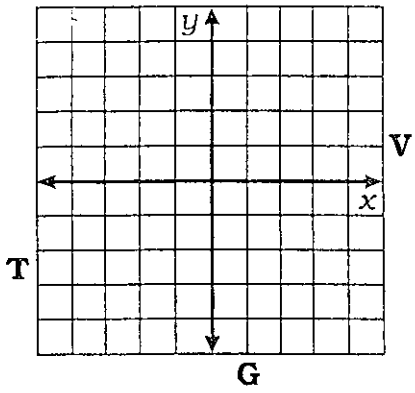


4	4	4	3	3	3	6	6	6	1	1	1	5	5	5	2	2	2

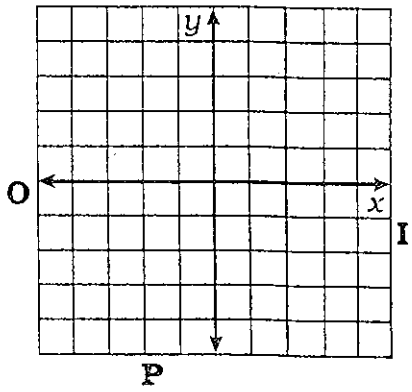
Which Member of Fred Ferd's Family Thinks He's a Pen?

Show the solution region for each system with crosshatching or shading. The crosshatching or shading, if extended, would cover a letter. Write this letter in each box with the exercise number.

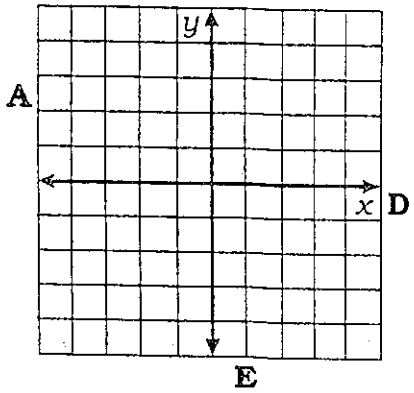
1. $y \geq \frac{3}{4}x - 2$
$y \leq 1$



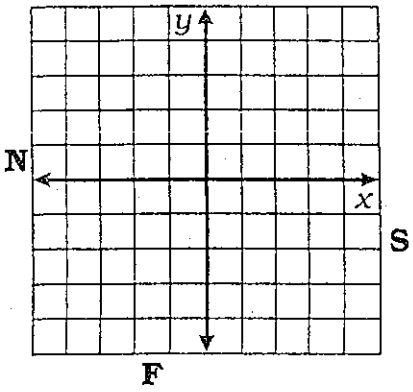
2. $y \geq -2x - 3$
$y \leq \frac{1}{3}x + 2$



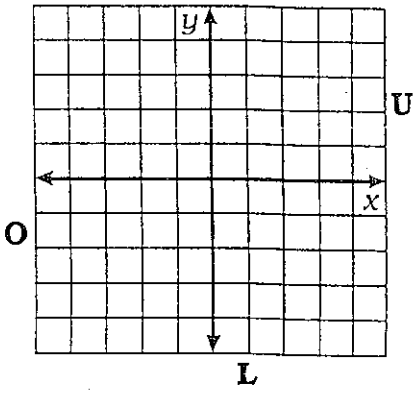
3. $y < \frac{3}{2}x + 3$
$y < -x + 1$



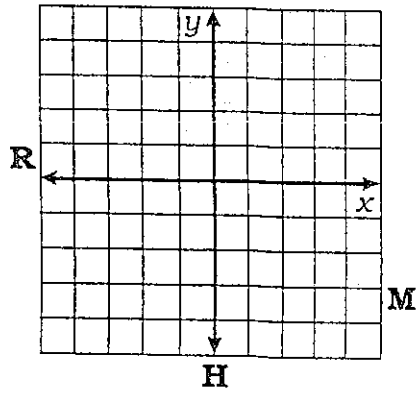
4. $y \leq x$
$5x + 3y > -6$



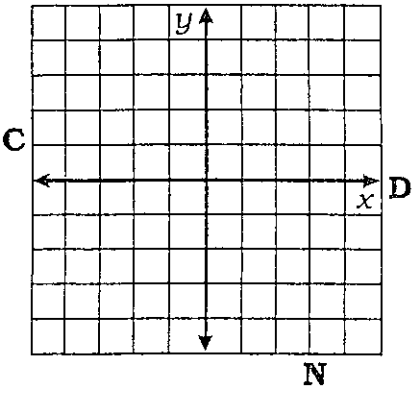
5. $y + 3 > 0$
$-2x - 5y \geq 5$



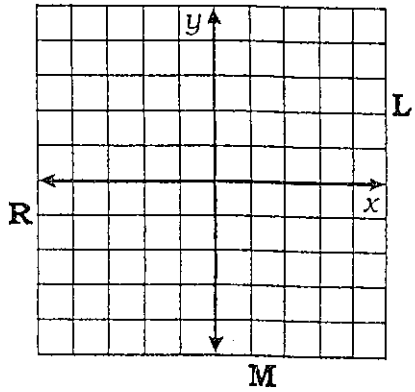
6. $x < 2$
$x - 2y > 6$



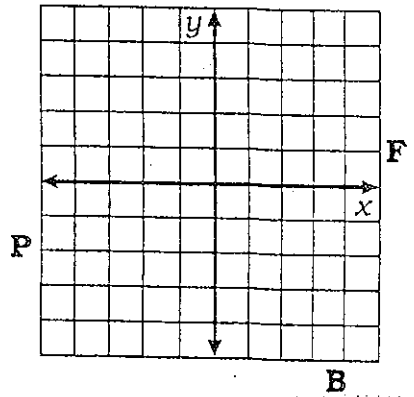
7. $8x + 12y < 24$
$35x - 20y \leq 80$



8. $10x + 10y \leq 30$
$y - 3x > 0$



9. $y + 2 \leq 0$
$2 - x \leq 0$



6	2	4	9	2	7	9	8	5	1	6	3	8