

Write your
questions here!

8.1 Solving System of Equations by Graphing

Introduction: brought to you by study.com ***Video will story early***

Directions: Fill in the blanks below.

COMPARING AND CONTRASTING

Anytime you have more than one equation in a single problem, it is called a

_____.

Running Example:

Luke's Linear Equation

$$y = \underline{\hspace{1cm}} x + \underline{\hspace{1cm}}$$

Luke girl friend's linear equation

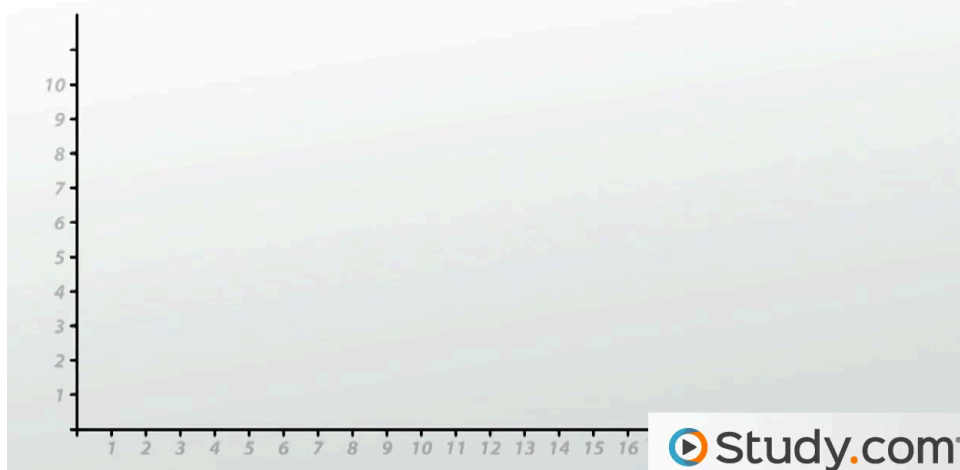
$$y = \underline{\hspace{1cm}} x + \underline{\hspace{1cm}}$$

1 mile/7 minutes

**1 mile/9 minutes
+2 mile head start**



GRAPHING A SYSTEM OF EQUATIONS



When will Luke's girlfriend catch up to him if he gets a 2-mile head start?

We will finish this problem in class together.

Write your
questions here!



A , or simply linear system, consists of two or more linear equations in the same variables. Here is an example:

$$\begin{aligned}x + 2y &= 7 \\ 3x - 2y &= 5\end{aligned}$$

Equation 1

Equation 2

The is the x and the y values that satisfy each equation. One way to find the solution is by graphing both equations and finding where they intersect.

Step 1

- Write both equations in slope-intercept form and graph; Sections 4.4, "4 Shortcuts," and Section 5.4)

Step 2

- Find the coordinates of the point of intersection.

Step 3

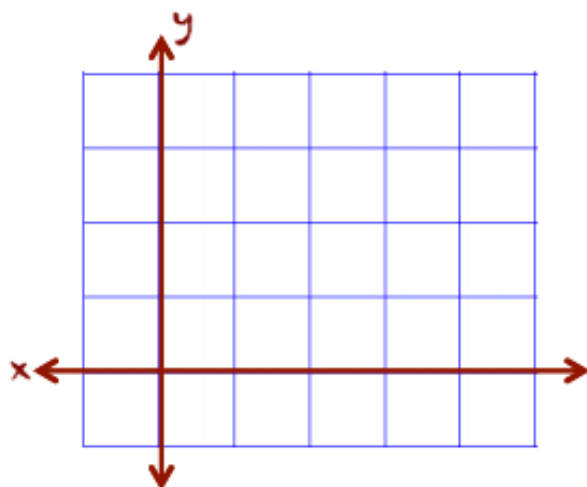
- Check the coordinates by substituting into the original equations.

Step 4

- Write your solution as a coordinate point.

Solve the following linear system by graphing:

$$\begin{aligned}y &= \frac{2}{3}x + 1 \\ y &= 3\end{aligned}$$



Solving Linear Systems with a Graphing Calculator

Write your
questions here!



Let's be honest. You love our TI-84's! And as I have been explaining how to solve linear systems by hand, you were thinking "Can't I just do this in the calculator?" So here you go:

Example: Solve the linear system using a calculator:

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

$$3y = x + 5$$



Step 1: Rewrite each equation in slope-intercept form.

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

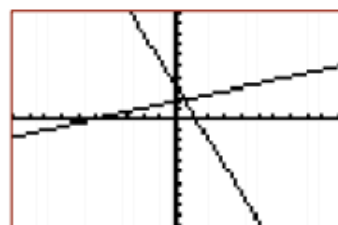
$$3y = x + 5$$

Step 2: Now, put each function into the calculator.

Keystrokes:
 $Y=$ () (-) 5 (÷) 2 () X,T,Θ,n (+) 3 ()
 () (1 (÷) 3 () X,T,Θ,n (+) (5 (÷) 3 ()

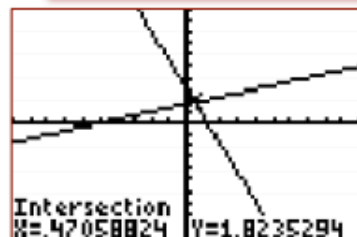
Plot1 Plot2 Plot3
 $Y_1 = (-5/2)X + 3$
 $Y_2 = (1/3)X + (5/3)$
 $Y_3 =$
 $Y_4 =$
 $Y_5 =$
 $Y_6 =$
 $Y_7 =$

Step 3: Pick a nice window (Usually $ZOOM$ 6 is a good starting point.) You may have to "Zoom Out" if you cannot see the lines by changing the window.



Step 4: Use the intersect function of your calculator to find the solution to the system:

Keystrokes:
 2^{nd} TRACE 5 ENTER ENTER ENTER



Notice that it now says $X = .47058824$ and $Y = 1.8235294$. These are your answers! Your solution would be $(0.47058824, 1.8235294)$.

Write your
questions here!



You try the next two examples by yourself.

1. $y + x = 11$
 $y = -2x + \frac{77}{5}$



Sketch your
graphs here!



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



Step 5: Checking your solution.

To check your solution, plug x and y into the original equations!

Is $(4,3)$ a solution of the following systems of equations?

$$\begin{aligned} y &= 3x - 11 \\ x - y &= -1 \end{aligned}$$

$$\begin{aligned} x &= 4 \\ y &= x + 1 \end{aligned}$$

Possible Outcomes When Solving by Graphing

Sometimes, weird things (i.e. Special Cases) can happen:

Examples:

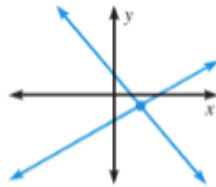
Solve each linear system by graphing:

1. $y = \frac{1}{2}x - 4$
 $y = \frac{1}{2}x + 2$

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

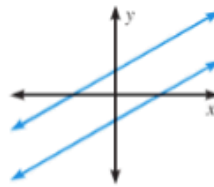
Number of Solutions of a Linear System

One solution



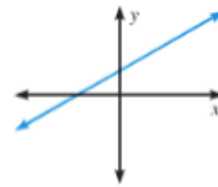
The lines intersect.
The lines have different slopes.

No solution



The lines are parallel.
The lines have the same slope and different y-intercepts.

Infinitely many solutions

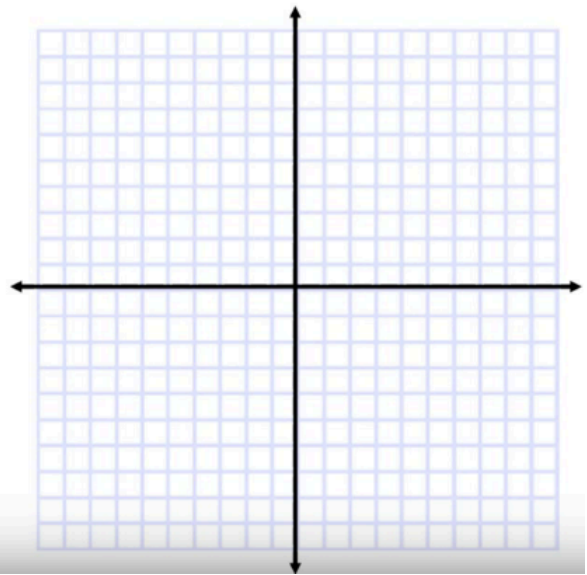


The lines coincide.
The lines have the same slope and the same y-intercept.

Special cases:
What about these lines?

$$y = 2x + 1$$

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



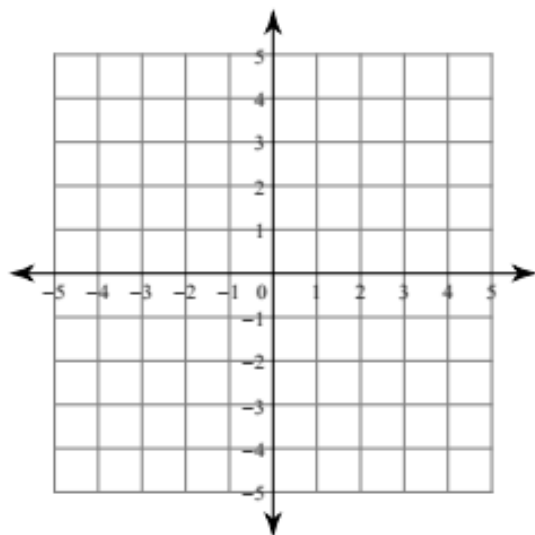
Now, summarize
your notes here!

Practice 8.1

Solve each linear system by graphing. *(Be sure to solve for y first!)*

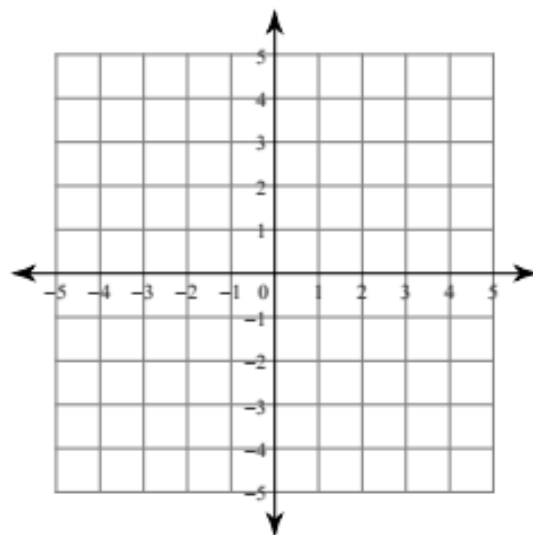
1) $y = \frac{8}{3}x + 4$

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

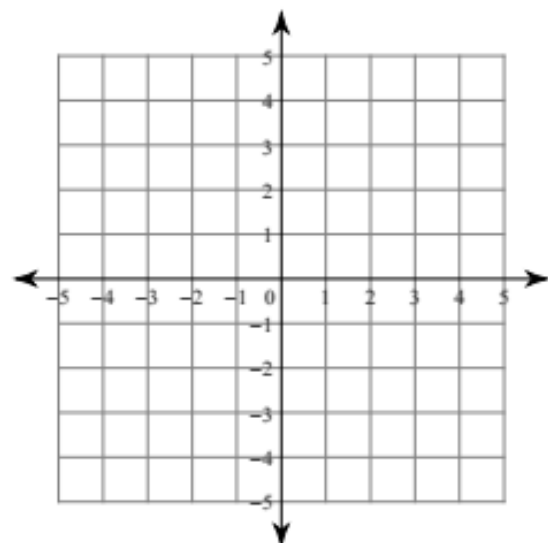


2) $y = \frac{1}{3}x + 1$

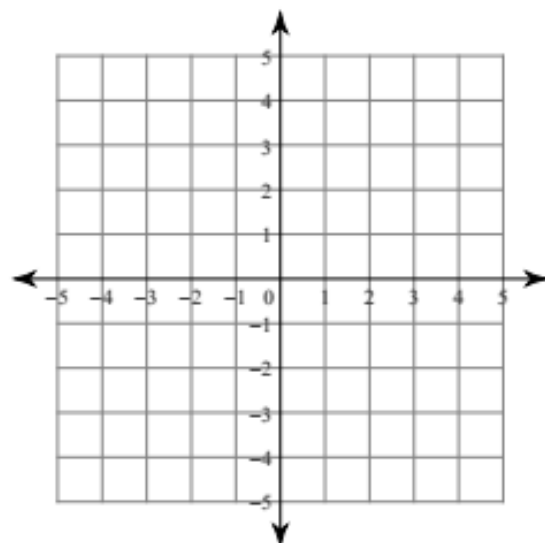
$$y = -\frac{1}{3}x + 3$$



3) $24 = -9x + 6y$
 $-12 - 4y = x$



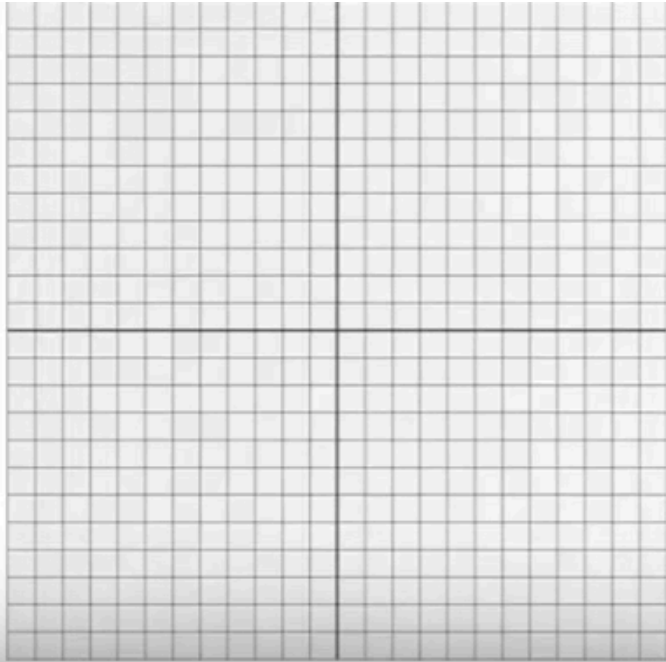
4) $-2y + 8x = 2$
 $3y - 3x = 6$



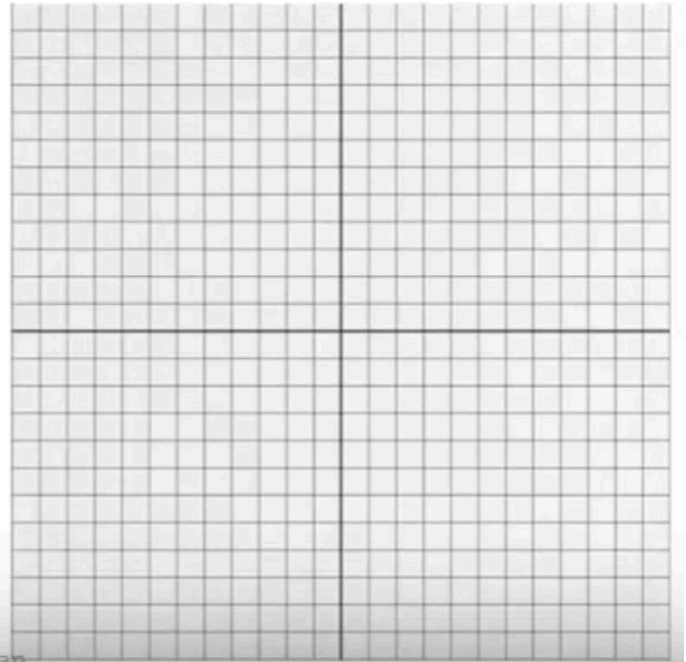
Solve and classify the systems of equations below.

5. $6x - 2y = 8$
 $3x - y = 4$

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

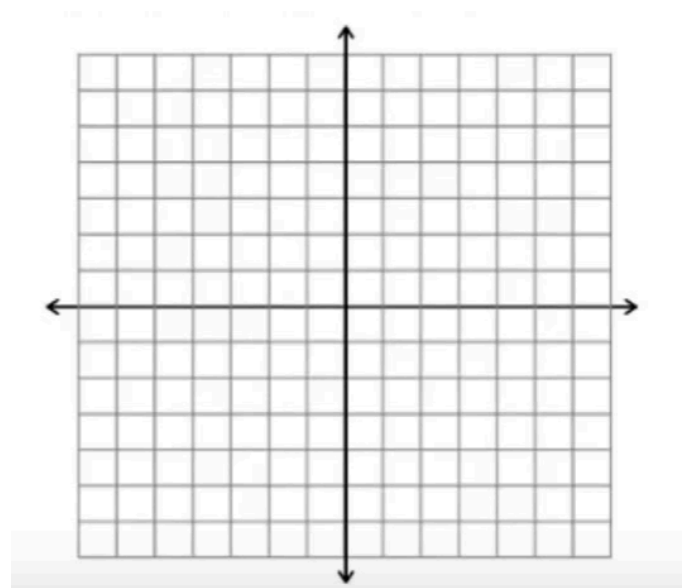
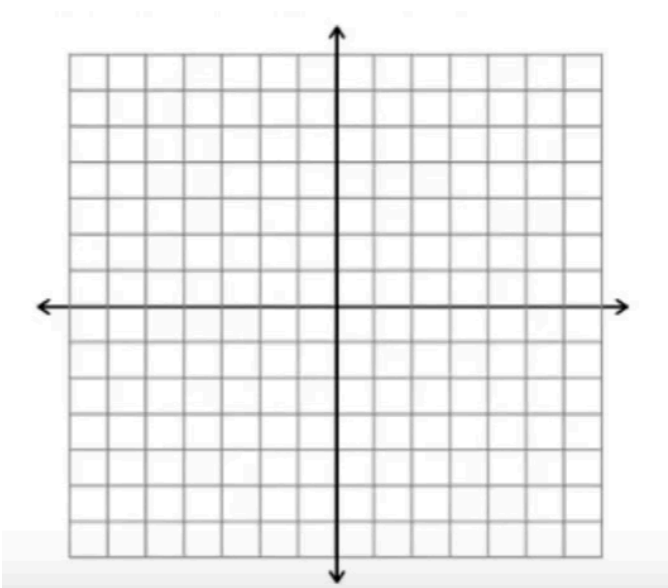


Roshan



7. $5x - 2y = -10$
 $2x - 4y = 12$

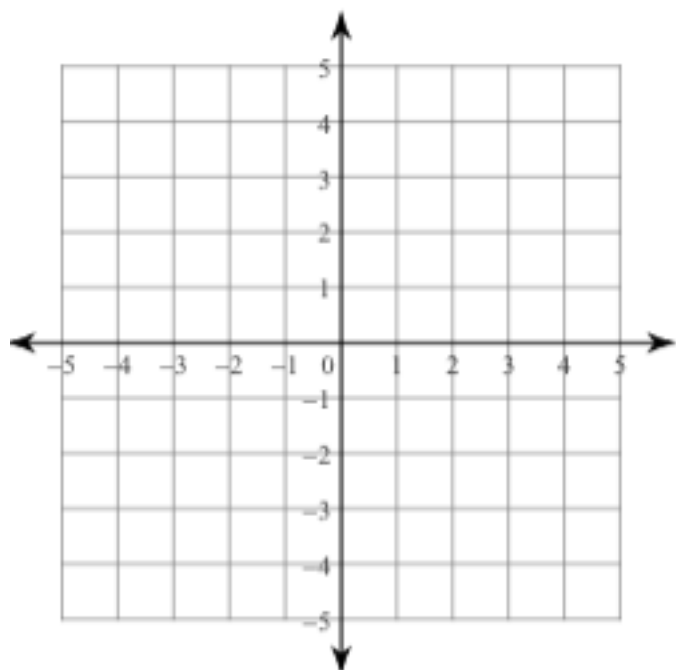
8. $y = x$
 $x = -7$



9.

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

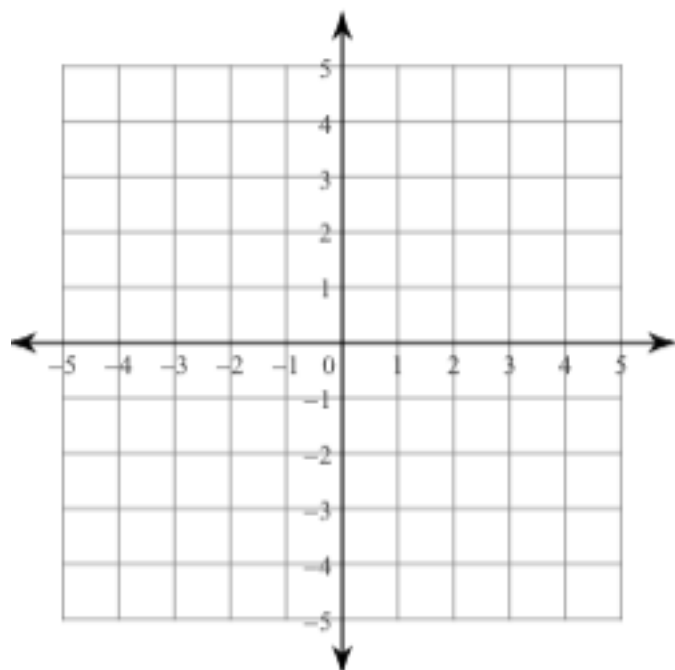
$$y = \frac{1}{2}x - 3$$



10.

$$y = -x - 4$$

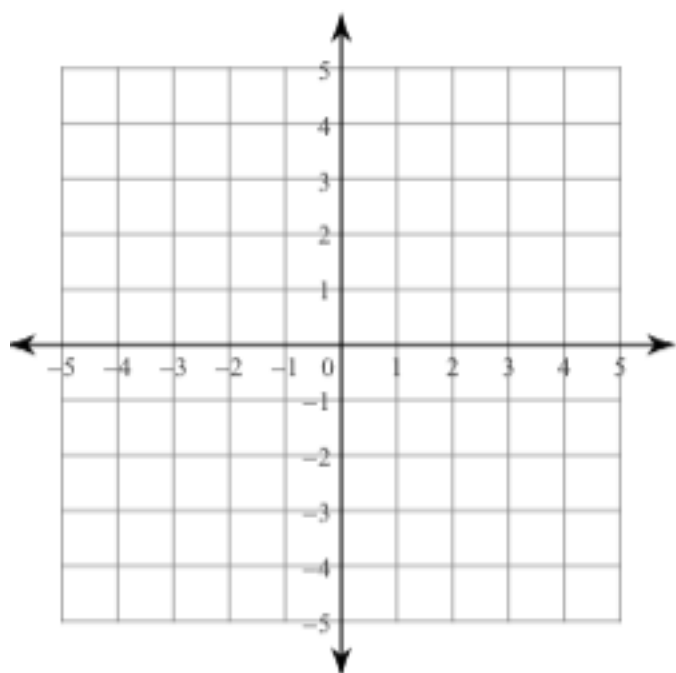
$$y = x - 2$$



11.

$$2x - y = -4$$

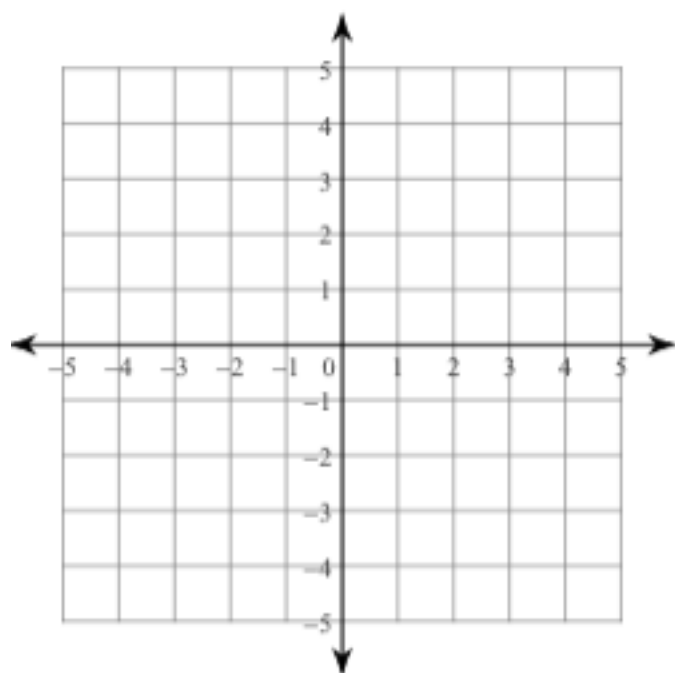
$$2x - y = -2$$



12.

$$x + y = 3$$

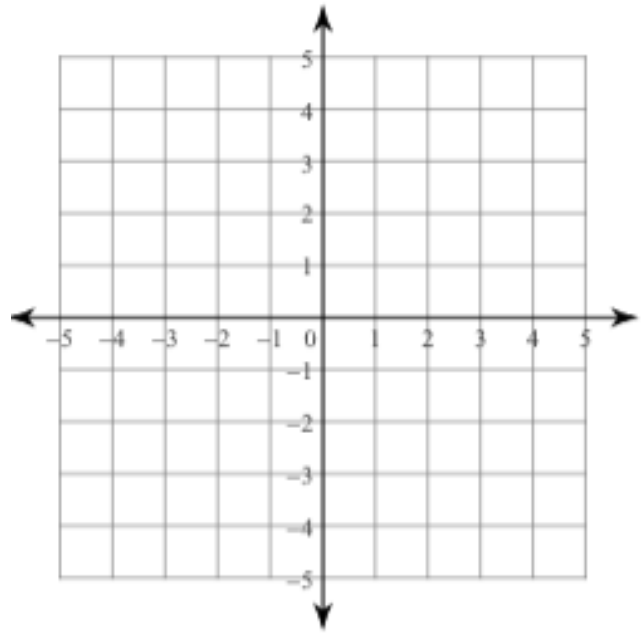
$$x + y = -1$$



13. Solve the linear system by graphing.

$$y = -7x - 3$$

$$y = 4$$



Solve each system of equation below by using a graphing calculator. (Be sure to solve for y first)

14. $y = -3x - 19$
 $y = -\frac{7}{9}x + 1$

15. $y = -\frac{2}{3}x + 15$
 $y = \frac{7}{2}x - 10$

16. $y = -\frac{1}{14}x + 19$
 $y = \frac{17}{14}x + 1$

17. $y = -\frac{2}{3}x + 15$
 $y = \frac{7}{2}x - 10$

18. $y = -1$
 $y = -\frac{5}{2}x + 4$

19. $y = 4x - 1$
 $-2y = -8x + 2$

20. $y = 3x - 6$
 $y - 3x = 1$

21. Is (3,8) a solution of the system?

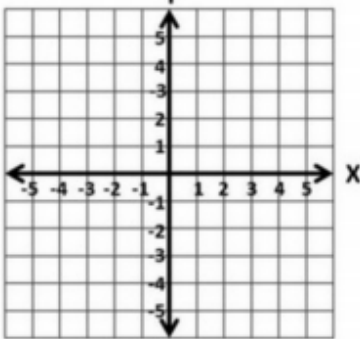
$$y = -5x + 1$$

$$y = 3x - 2$$

22. Is (-1, 7) a solution for the system of linear equations?

$$\begin{cases} x + 2y = 13 \\ 3x - y = -11 \end{cases}$$

SKILLZ Review

Solve for x.	Evaluate if $x = -4$	Graph and label each line.
1. $-12 = \frac{3x}{4} - 2$	3. $x^2 + 3x$	5. Graph the line $y = 3x - 2$ 
2. $-28 = -20 - \frac{1x}{4}$	4. $7 - 6x^3$	6. Graph the line $y = -\frac{3}{2}x$

7. **SAT/ACT** Which of the following best describes the graph of the equations?

$$4y = 3x + 8$$

$$-6x = -8y + 24$$

A The lines are parallel.
B The lines are perpendicular.
C The lines have the same x -intercept.
D The lines have the same y -intercept.
E The lines are the same.

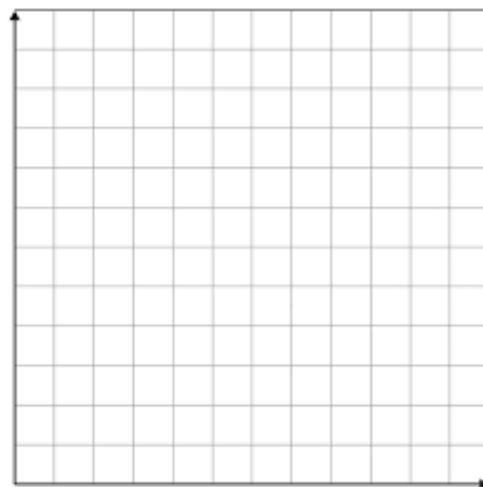
Application and Extension

- Solve the system of equations by using your graphing calculator.



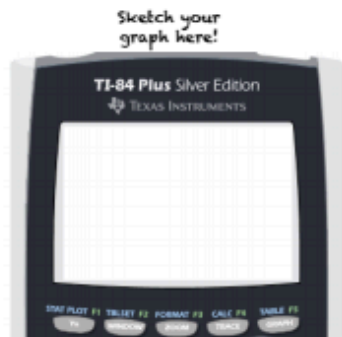
Wren and Jenni are reading the same book. Wren is on page 14 and reads 2 pages every night. Jenni is on page 6 and reads 3 pages every night. After how many nights will they have read the same number of pages? How many pages will that be?

- Write a systems of equations



- Label the x and y axis based on the context of the problem. Then sketch the window on your calculator screen (First Quadrant only)
- Solve

2. The Algebros thought it would be super-cool to start up a Twitter account (@TheAlgebros). When they created their account, they had 3 followers (their 3 mothers) and each day they added 4 followers. A rival Flippedmath group, "The Radicals," did the same, but started with 15 followers and added 1 follower per day.



Hint: Adjust your window to:
 $X: -5 \rightarrow 15$
 $Y: -10 \rightarrow 50$

TheAlgebros Equation: _____

TheRadicals Equation: _____

What is the solution to your system? _____

- How long will it take @TheAlgebros to have the same number of followers as The Radicals?
- How many followers will each group have after 1 year?

3. Compare two cab companies by writing an equation and graphing the charge of a fair based on the number of miles you have to go.

The **Yellow Cab** Company charges just \$0.25 a mile,
 but it costs \$5 to get in the cab.



Equation (A): _____

Express Cab charges no fee to get in the cab,
 but \$1.50 a mile for the ride.

Equation (B): _____

- If you are going 7 miles, which cab company should you call?
- If you are going 3 miles, which company should you call?
- For what length of drive is the cost equal?

3. Use the gym flyer below to answer the following questions.

MORE THAN 24 MEMBERSHIP

At Club 24, workout "More Than 24" days in a month, and your next month is **FREE!**

ENROLLMENT IN THE "MORE THAN 24" MEMEBERSHIP IS JUST **\$1 DOWN \$20 MONTH**

Unlimited Access to **ALL 5** Connecticut Locations
Online Nutrition Counseling with our unique VitaBot system
COMPLIMENTARY "FIRST PHASE" Meeting
FREE Weekend Guest Passes and **1/2 PRICE** on Weekdays
1/2 PRICE on Juice Bar purchases and Cooler Drinks
FREE Virtual Spinning & **FREE** Virtual Studio Classes

A

MEMBERSHIP MUST BE BILLED TO A CHECKING ACCOUNT, CREDIT/DEBIT CARD FOR MINIMUM OF 12 MONTHS. SUBJECT TO \$10 MEMBERSHIP CARD FEE AT TIME OF SIGN-UP AND \$29 ANNUAL MAINTENANCE FEE BILLED SEPTEMBER 1ST.

BASE MEMBERSHIP

\$69 DOWN \$10.99 MONTH

Access to any **ONE** location
Access to Cardio & Weight Areas
FREE "FIRST PHASE" Meeting

B

MUST BE BILLED TO A CHECKING ACCOUNT, CREDIT/DEBIT CARD. SUBJECT TO \$10 MEMBERSHIP CARD FEE AND \$29 ANNUAL MAINTENANCE FEE BILLED SEPTEMBER 1ST.

FITNESS MEMBERSHIP

\$199 FOR 12 MONTHS

FREE "Fast Track" Consultation
Access to **ALL 5 CT** locations

C

MUST BE USED CONSECUTIVELY. SUBJECT TO \$10 MEMBERSHIP CARD FEE. RENEWAL NOT GUARANTEED TO BE THE SAME, AND IS SUBJECT TO RATES AT THAT TIME.

a) Write equations for each option

Equation for (A): _____

Equation for (B): _____

Equation for (C): _____

b) Use your graphing calculator to determine the time ranges each type of membership is best. (**Window Range:** $-10 < x < 15$ & $-10 < y < 210$)