

## **Chapter 7: Systems of Equations & Inequalities**

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**Chapter 7: Systems of Equations and Inequalities**  
**Topic 1: Systems of Linear Equations – Two Variables**

**Does it fit?**

The solution to a system of equation is a

- Determine if  $(4, -1)$  is a solution to the system

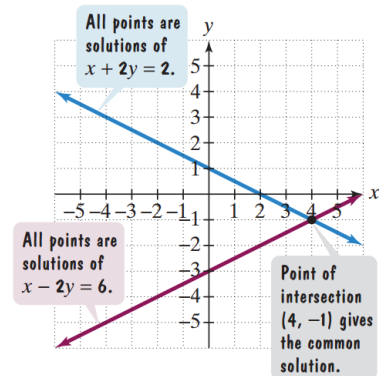
$$x + 2y = 2$$

$$x - 2y = 6$$

- Determine if  $(1, 2)$  is a solution to the system

$$2x - 3y = -4$$

$$2x + y = 4$$



**Method: Substitution**

*Best When*

Step 1:

Step 2:

Step 3:

Step 4:

Step 5:

- Solve the following system by substitution:

$$x + y = -1$$

$$4x - 3y = 24$$

4. Solve the following system by substitution:

$$y + 13 = 5x$$

$$2x + 3y = 12$$

5. Solve the following system by substitution:

$$5x - 4y = 9$$

$$x - 2y = -3$$

6. Solve the following system by substitution:

$$3x + 2y = -1$$

$$x - y = 3$$

## **Method: Elimination**

*Best when*

Step 1:

Step 2:

Step 3:

Step 4:

Step 5:

Step 6:

7. Solve the following system by elimination:

$$\begin{aligned}3x - 4y &= 11 \\ -3x + 2y &= -7\end{aligned}$$

8. Solve the following system by elimination:

$$\begin{aligned}3x + 2y &= 48 \\ 9x &= 8y - 24\end{aligned}$$

9. Solve the following system by elimination:

$$2x = 3y + 7$$

$$4x + 5y = 3$$

10. Solve the following system by elimination:

$$2x = 7y - 17$$

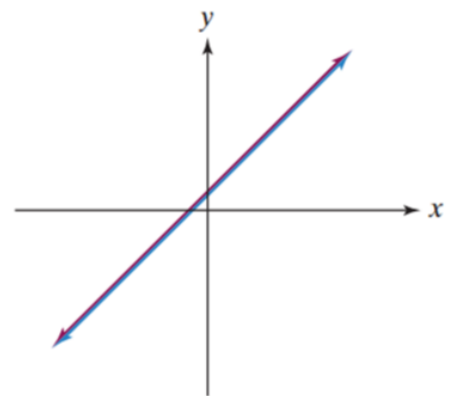
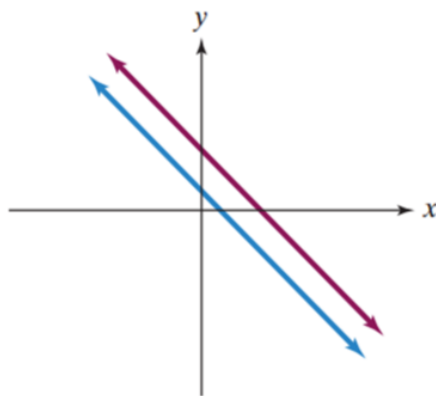
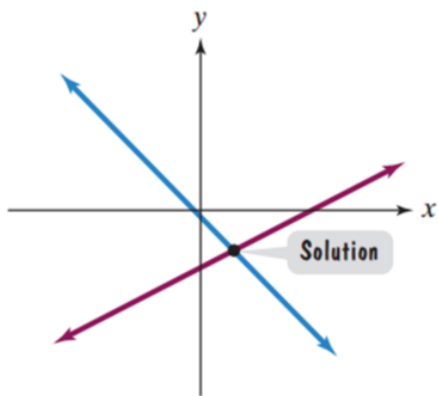
$$5y = 17 - 3x$$

## Identity & Inconsistent

If both variables eliminate during the solving process, you're left with a numerical statement.

Identity:

Inconsistent:



### Most Linear Systems

One Solution

### Inconsistent

NO Solutions

### Identity

INFINITE solutions

11. Solve the following system:

$$y = 3 - 2x$$

$$4x + 2y = 6$$

12. Solve the following system:

$$x + 2y = 4$$

$$3x + 6y = 13$$

**Chapter 7: Systems of Equations and Inequalities**  
**Topic 1: Homework**

$$23. \begin{cases} x + 2y = 2 \\ -4x + 3y = 25 \end{cases}$$

$$25. \begin{cases} 4x + 3y = 15 \\ 2x - 5y = 1 \end{cases}$$

$$27. \begin{cases} 3x - 4y = 11 \\ 2x + 3y = -4 \end{cases}$$

$$24. \begin{cases} 2x - 7y = 2 \\ 3x + y = -20 \end{cases}$$

$$26. \begin{cases} 3x - 7y = 13 \\ 6x + 5y = 7 \end{cases}$$

$$28. \begin{cases} 2x + 3y = -16 \\ 5x - 10y = 30 \end{cases}$$



Name: \_\_\_\_\_ Date: \_\_\_\_\_ Period: \_\_\_\_\_

**Chapter 7: Systems of Equations and Inequalities**  
**Topic 2: Systems of Linear Equations - Modeling**

Step 1:

Step 2:

Step 3:

Always check to ensure that you interpreted and solved correctly. An error in either of those steps will cause a wrong solution!

**Mixture Problem**

A chemist working on a flu vaccine needs to mix a 10% sodium-iodine solution with a 60% sodium-iodine solution to obtain 50 milliliters of a 30% sodium-iodine solution. How many milliliters of the 10% solution and of the 60% solution should be mixed?

Step 1:            Let  $x =$

                    Let  $y =$

Step 2:

Step 3 & Check:

## **Break-Even Analysis**

### **Revenue:**

*Revenue Function:*

### **Cost:**

*Cost Function:*

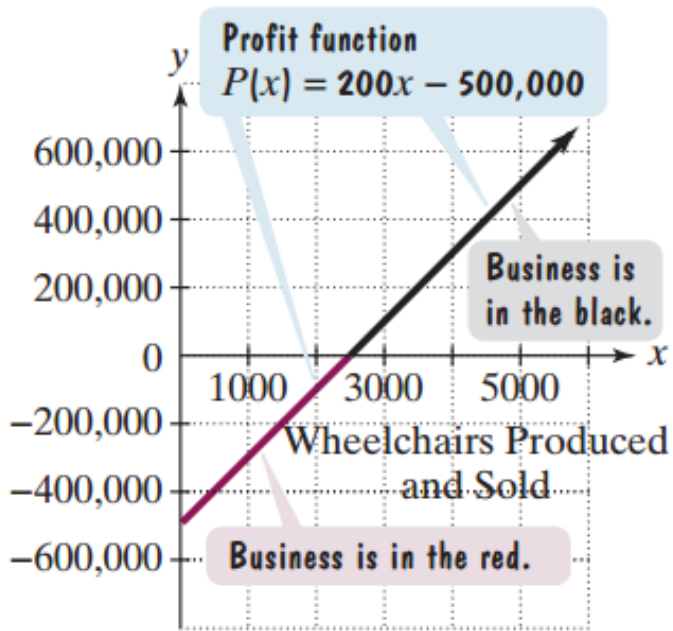
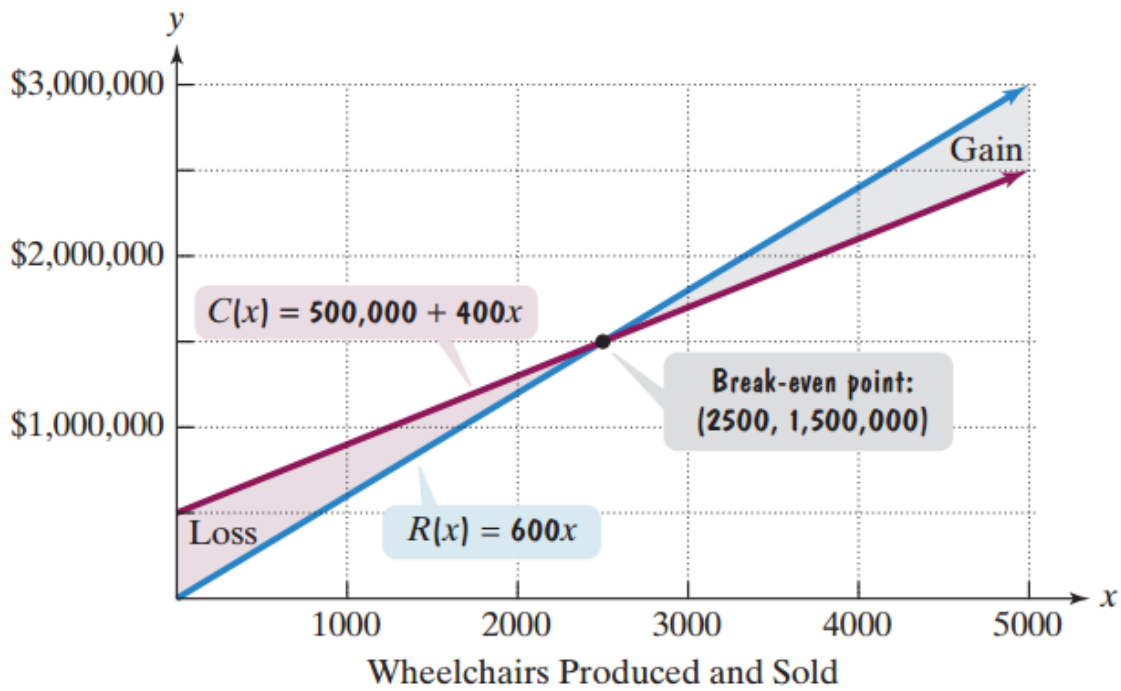
### **Break-Even Point:**

### **Profit:**

*Profit Function:*

A company is planning to manufacture wheelchairs. Fixed cost will be \$500,000 and it will cost \$400 to produce each wheelchair. Each wheelchair will be sold for \$600.

- (a) Write the functions for producing and selling the wheelchairs.
- (b) Determine the breakeven point and describe what this means.
- (c) Write the profit function in simplest form.



A company that manufactures running shoes has a fixed cost of \$300,000. Additionally, it costs \$30 to produce each pair of shoes. They are sold at \$80 per pair.

- (a) Write the functions for producing and selling the shoes.
- (b) Determine the breakeven point and describe what this means.
- (c) Write the profit function in simplest form.

**Chapter 7: Systems of Equations and Inequalities**

**Topic 2: Homework**

- 55.** A wine company needs to blend a California wine with a 5% alcohol content and a French wine with a 9% alcohol content to obtain 200 gallons of wine with a 7% alcohol content. How many gallons of each kind of wine must be used?
- 56.** A jeweler needs to mix an alloy with a 16% gold content and an alloy with a 28% gold content to obtain 32 ounces of a new alloy with a 25% gold content. How many ounces of each of the original alloys must be used?
- 57.** For thousands of years, gold has been considered one of Earth's most precious metals. One hundred percent pure gold is 24-karat gold, which is too soft to be made into jewelry. In the United States, most gold jewelry is 14-karat gold, approximately 58% gold. If 18-karat gold is 75% gold and 12-karat gold is 50% gold, how much of each should be used to make a 14-karat gold bracelet weighing 300 grams?

**Chapter 7: Systems of Equations and Inequalities**  
**Topic 3: Systems of Linear Equations - Three Variables**

**Ordered Triple, Does it fit?**

1. Show that the ordered triple  $(-1, 2, -2)$  is a solution to the system

$$\begin{aligned}x + 2y - 3z &= 9 \\2x - y + 2z &= -8 \\-x + 3y - 4z &= 15\end{aligned}$$

2. Show that the ordered triple  $(-1, -4, 5)$  is a solution to the system

$$\begin{aligned}x - 2y + 3z &= 22 \\2x - 3y - z &= 5 \\3x + y - 5z &= -32\end{aligned}$$

## Solving Triple-Linear Systems

3. Solve the system:

$$2x + y + z = 15$$

$$6x - 3y - z = 35$$

$$-4x + 4y - z = -14$$

4. Solve the system:

$$4x + y - 3z = -6$$

$$-2x + 4y + 2z = 38$$

$$5x - y - 7z = -19$$

**A variable is missing from one equation!**

5. Solve the system:

$$x + z = 8$$

$$x + y + 2z = 17$$

$$x + 2y + z = 16$$



6. Solve the system:

$$\begin{aligned}x + 4y - z &= 20 \\3x + 2y + z &= 8 \\2x - 3y + 2z &= -16\end{aligned}$$

7. Solve the system:

$$\begin{aligned}2y - z &= 7 \\x + 2y + z &= 17 \\2x - 3y + 2z &= -1\end{aligned}$$

**Chapter 7: Systems of Equations and Inequalities**  
**Topic 3: Homework**

$$7. \begin{cases} 4x - y + 2z = 11 \\ x + 2y - z = -1 \\ 2x + 2y - 3z = -1 \end{cases}$$

$$8. \begin{cases} x - y + 3z = 8 \\ 3x + y - 2z = -2 \\ 2x + 4y + z = 0 \end{cases}$$

$$9. \begin{cases} 3x + 2y - 3z = -2 \\ 2x - 5y + 2z = -2 \\ 4x - 3y + 4z = 10 \end{cases}$$

$$10. \begin{cases} 2x + 3y + 7z = 13 \\ 3x + 2y - 5z = -22 \\ 5x + 7y - 3z = -28 \end{cases}$$

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Period: \_\_\_\_\_

**Chapter 7: Systems of Equations and Inequalities**  
**Topic 4: Systems of Non-Linear Equations - Two Variables**

**Eliminate a Variable Using the Substitution Method**

1. Solve by the substitution method:

$$x^2 = 2y + 10$$

$$3x - y = 9$$

2. Solve by the elimination method:

$$4x^2 + y^2 = 13$$

$$x^2 + y^2 = 10$$

3. Solve by the substitution method:

$$y = x^2 + 4$$

$$x^2 + y^2 = 25$$

4. Solve the system:

$$x - y = 3$$

$$(x - 2)^2 + (y + 3)^2 = 4$$

5. Solve the system:

$$x + 2y = 0$$

$$(x - 1)^2 + (y - 1)^2 = 5$$

6. Solve the system:

$$3x^2 + 2y^2 = 35$$

$$4x^2 + 3y^2 = 48$$

7. Solve the system:

$$y = x^2 + 3$$

$$x^2 + y^2 = 9$$

8. Solve the system:

$$x^2 = y - 1$$

$$4x - y = -1$$

**Chapter 7: Systems of Equations and Inequalities****Topic 4: Homework**

11. 
$$\begin{cases} y^2 = x^2 - 9 \\ 2y = x - 3 \end{cases}$$

12. 
$$\begin{cases} x^2 + y = 4 \\ 2x + y = 1 \end{cases}$$

13. 
$$\begin{cases} xy = 3 \\ x^2 + y^2 = 10 \end{cases}$$

14. 
$$\begin{cases} xy = 4 \\ x^2 + y^2 = 8 \end{cases}$$

15. 
$$\begin{cases} x + y = 1 \\ x^2 + xy - y^2 = -5 \end{cases}$$

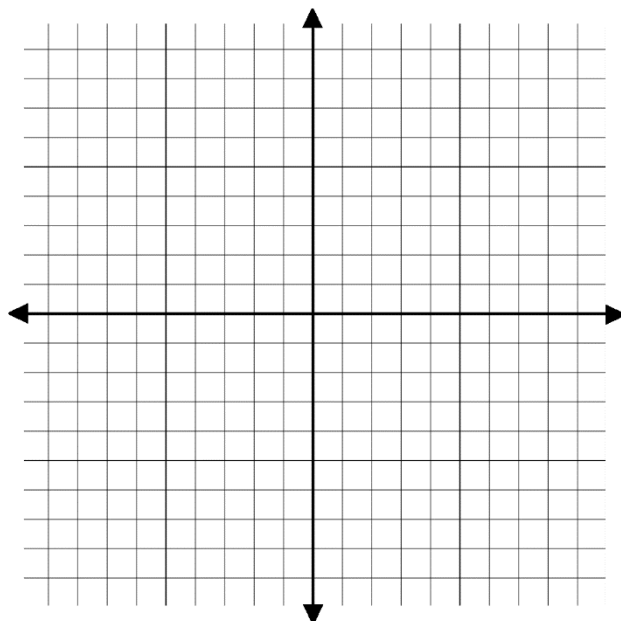
16. 
$$\begin{cases} x + y = -3 \\ x^2 + 2y^2 = 12y + 18 \end{cases}$$

**Chapter 7: Systems of Equations and Inequalities****Topic 5: Systems of Inequalities****Graphing a Linear Inequality in Two Variables**

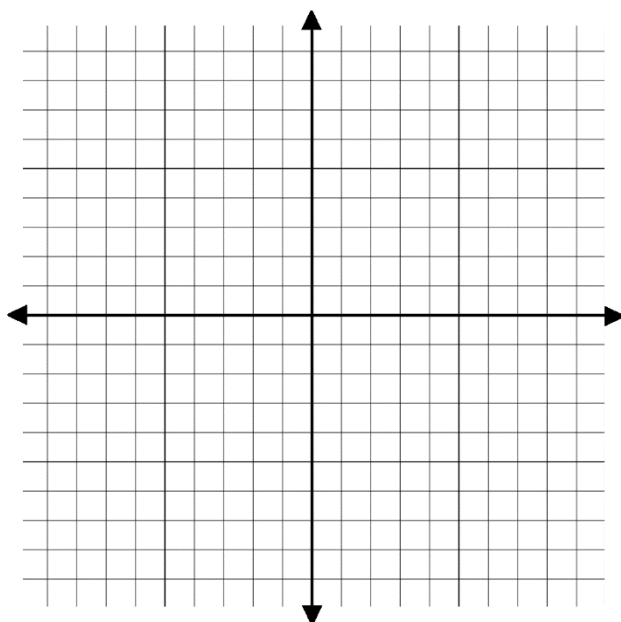
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**Examples:**

1. Graph:  $3x - 5y < 15$

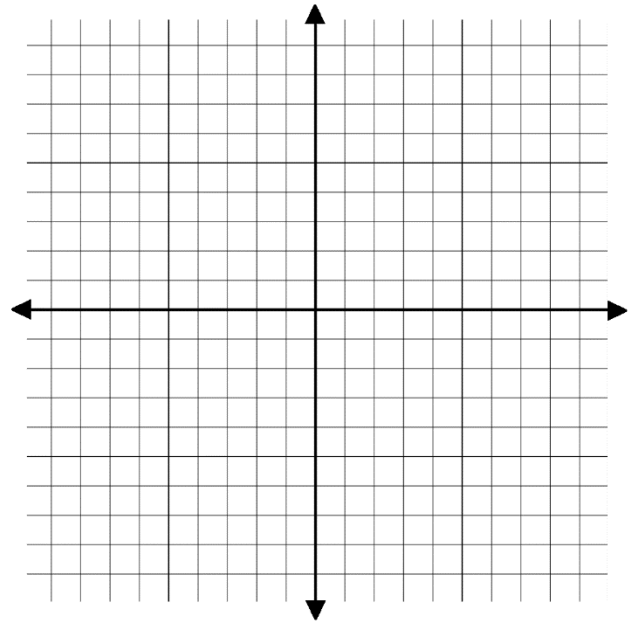


2. Graph:  $2y \geq x$

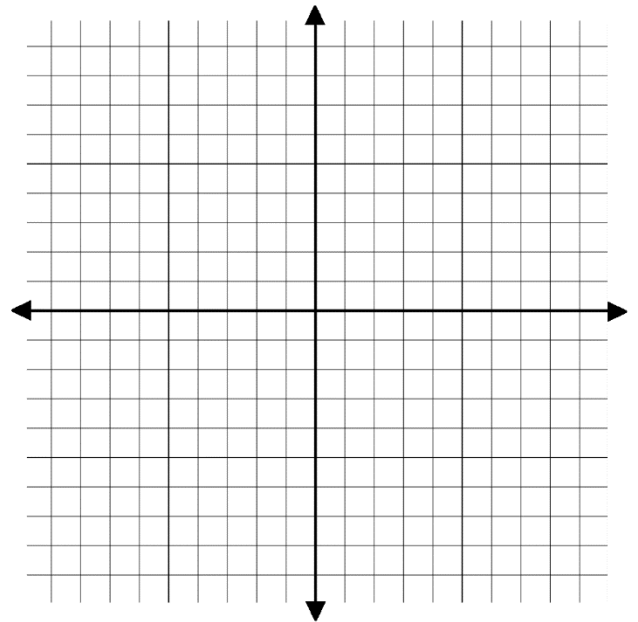




3. Graph:  $2x - 4y \geq 8$



4. Graph:  $y \leq \frac{2}{3}x$

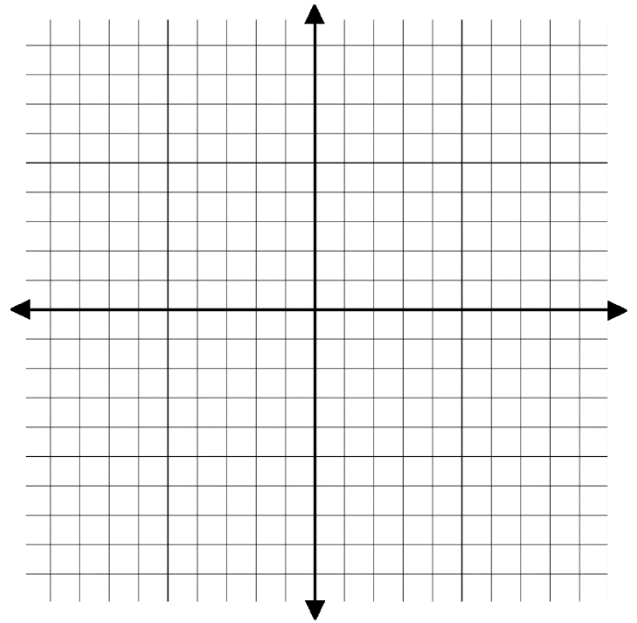


## Graphing a Non-Linear Inequality in Two Variables

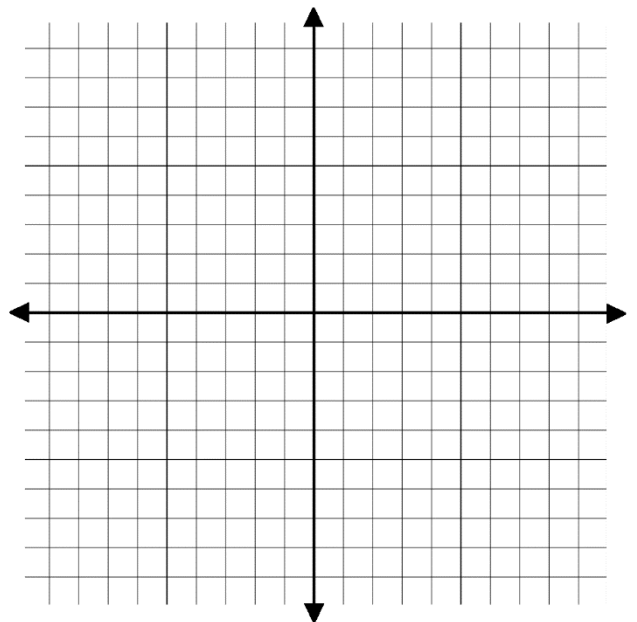
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### Examples:

1. Graph:  $x^2 + y^2 \leq 9$



2. Graph:  $(x - 3)^2 + (y - 1)^2 > 25$



## Graphing a System of Inequalities

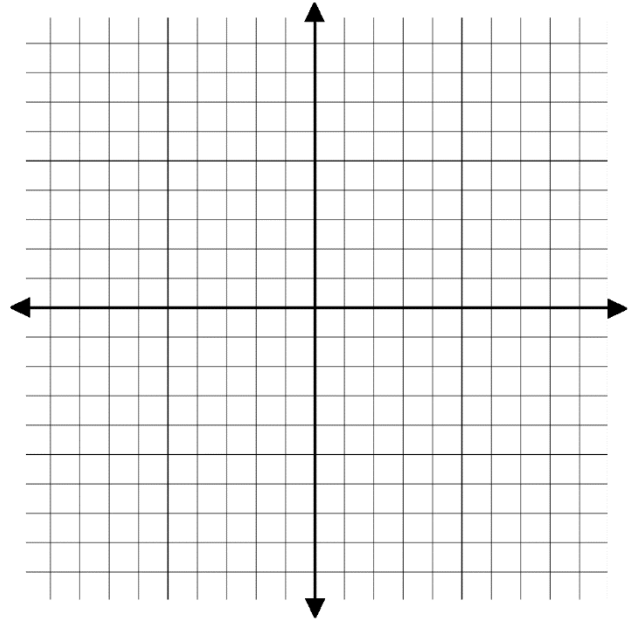
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### Examples:

1. Graph the system of equations:

$$2x - y < 4$$

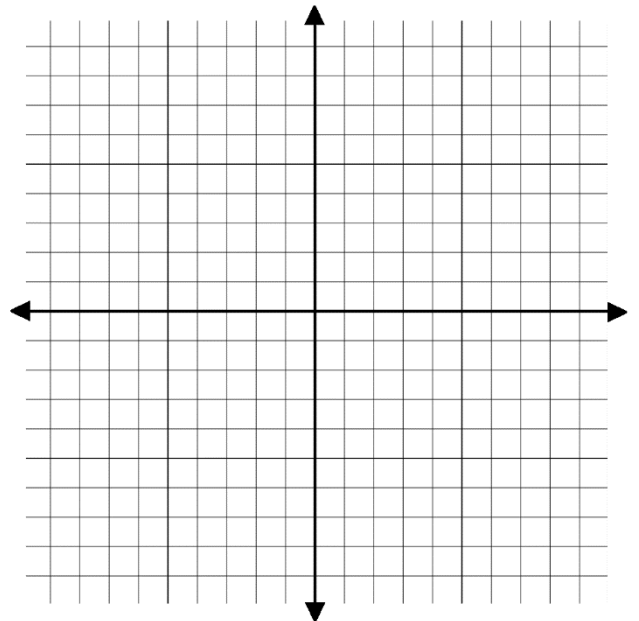
$$x + y \geq -1$$



2. Graph the system of equations:

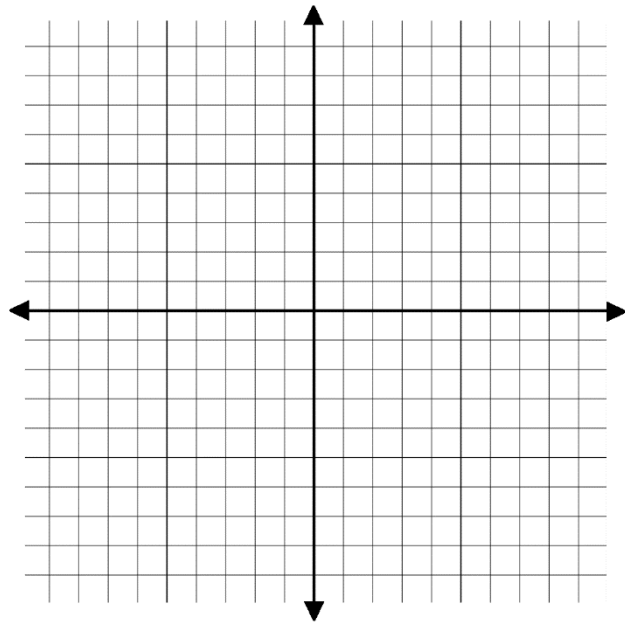
$$y \geq x^2 - 4$$

$$x - y \geq 2$$



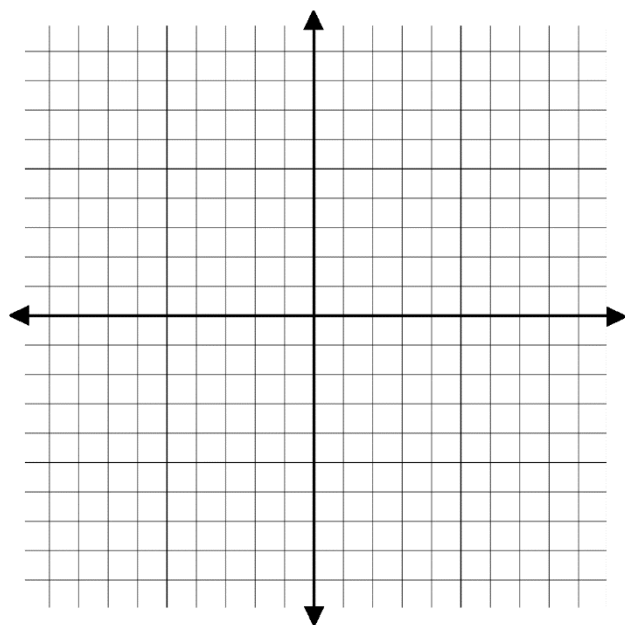
3. Graph the system of equations:

$$\begin{aligned}x - y &< 2 \\ -2 \leq x &< 4 \\ y &< 3\end{aligned}$$



4. Graph the system of equations:

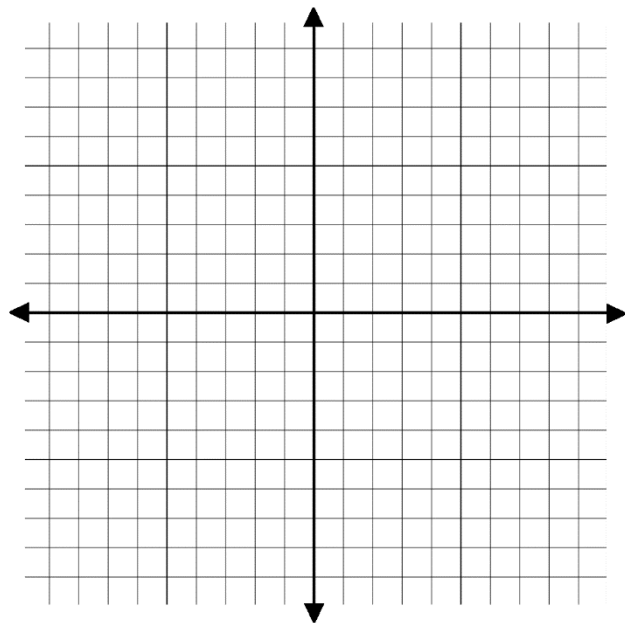
$$\begin{aligned}x + 2y &> 4 \\ 2x - 3y &\leq -6\end{aligned}$$



5. Graph the system of equations:

$$y \leq x^2 - 4$$

$$x + y \leq 2$$

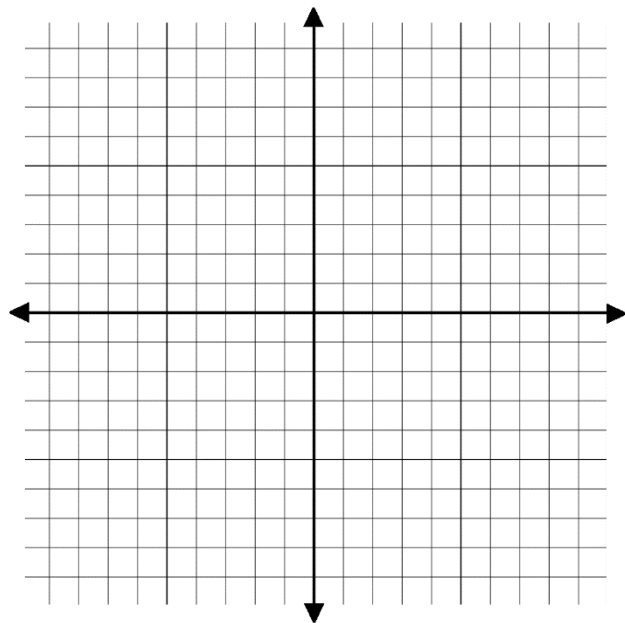


6. Graph the system of equations:

$$x + y < 2$$

$$-2 \leq x < 1$$

$$y > -3$$



**Chapter 7: Systems of Equations and Inequalities**  
**Topic 5: Homework**

$$27. \begin{cases} 3x + 6y \leq 6 \\ 2x + y \leq 8 \end{cases}$$

$$29. \begin{cases} 2x - 5y \leq 10 \\ 3x - 2y > 6 \end{cases}$$

$$31. \begin{cases} y > 2x - 3 \\ y < -x + 6 \end{cases}$$

$$33. \begin{cases} x + 2y \leq 4 \\ y \geq x - 3 \end{cases}$$

$$28. \begin{cases} x - y \geq 4 \\ x + y \leq 6 \end{cases}$$

$$30. \begin{cases} 2x - y \leq 4 \\ 3x + 2y > -6 \end{cases}$$

$$32. \begin{cases} y < -2x + 4 \\ y < x - 4 \end{cases}$$

$$34. \begin{cases} x + y \leq 4 \\ y \geq 2x - 4 \end{cases}$$