

Name: key  
 Algebra 1

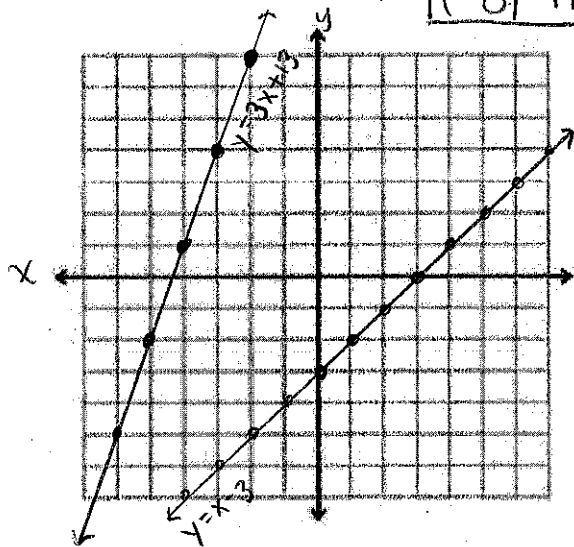
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### Unit 5: Systems of Equations and Inequalities Study Guide

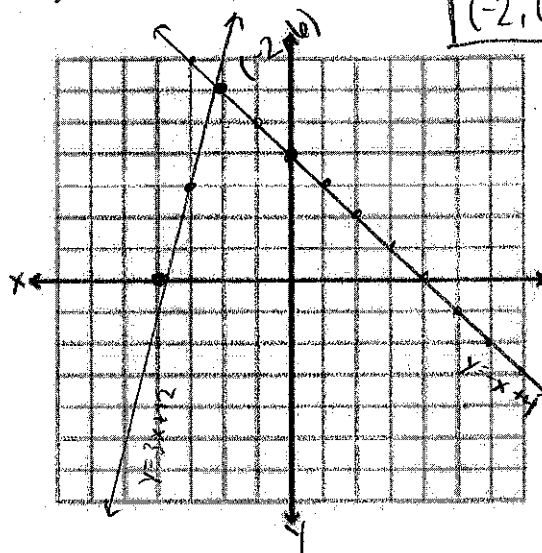
**LT#1: Solve systems of equations by graphing.**

Solve each system by graphing. Check your answer.

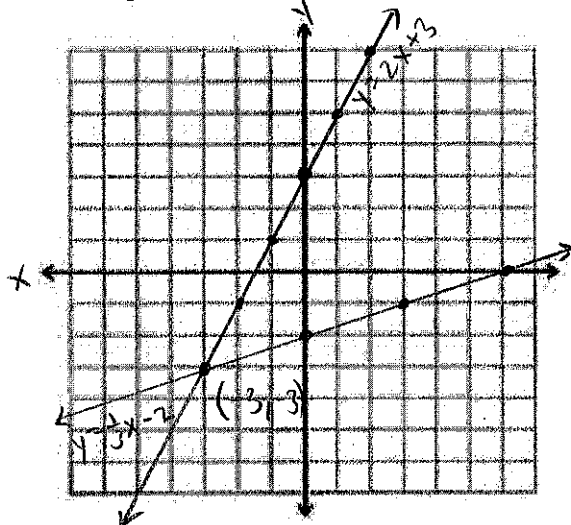
1.  $y = 3x + 13$   $m=3$   $b=13$   
 $y = x - 3$   $m=1$   $b=-3$       **$(-8, -11)$**



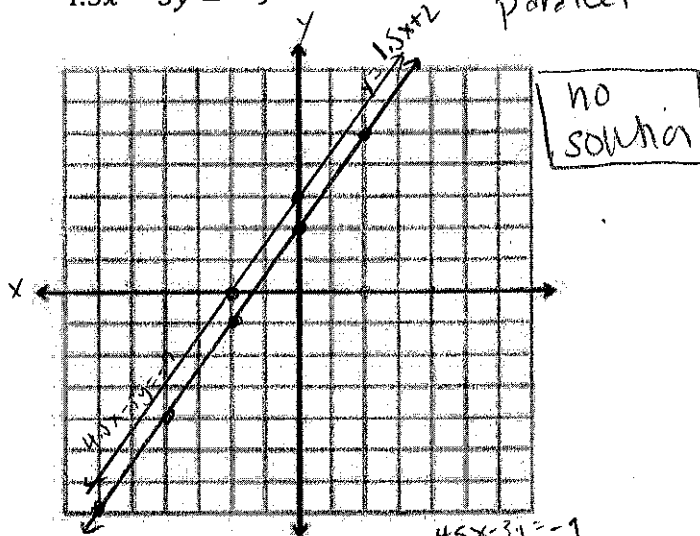
2.  $y = -x + 4$   $m=-1$   $b=4$   
 $y = 3x + 12$   $m=3$   $b=12$       **$(-2, 6)$**



3.  $y = 2x + 3$   $m=2$   $b=3$   
 $y = \frac{1}{3}x - 2$   $m=\frac{1}{3}$   $b=-2$       **$(-3, -3)$**



4.  $y = 1.5x + 2$   $m=1.5$   $b=2$   
 $4.5x - 3y = -9$      parallel



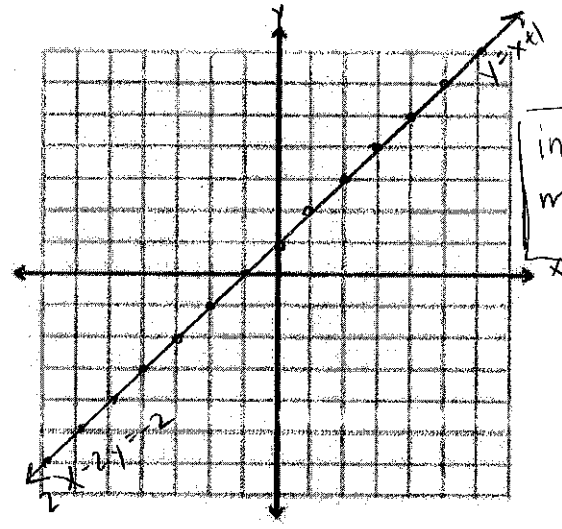
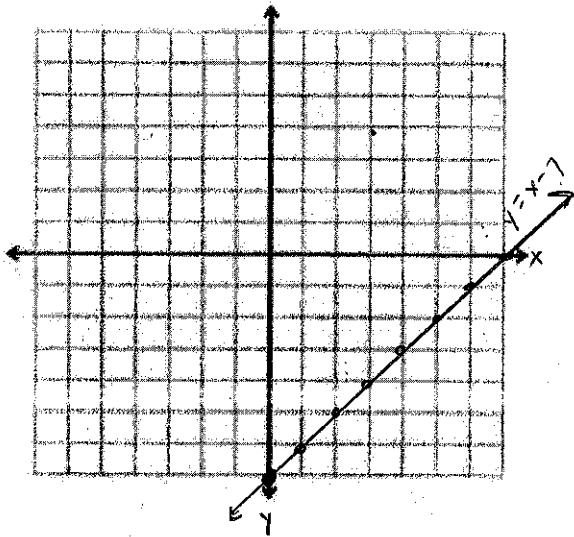
$x\text{-int. } (y=0)$       $y\text{-int. } (x=0)$       $4.5x - 3y = -9$   
 $4.5x = -9$       $-3y = -9$       $-3y = -4.5x - 9$   
 $x = -2$       $y = 3$       $y = 1.5x + 3$   
 $(-2, 0)$       $(0, 3)$

5.  $y = -2x - 21$   $m = -2$   $b = -21$   
 $y = x - 7$   $m = 1$   $b = -7$

$\left(-4\frac{2}{3}, -11\frac{2}{3}\right)$

6.  $y = x + 1$   $m = 1$   $b = 1$   
 $2x - 2y = -2$

$-2y = -2x - 2$   
 $y = x + 1$   
 $m = 1$   
 $b = 1$



7. Bella has written 24 songs to date. She writes an average of 6 songs per year. Brian started writing songs this year and expects to write about 12 songs per year. How many years from now will Brian have written as many songs as Bella? Write and graph a system of equations to find your answer.

Bella

$b = 24$   
 $m = 6$

Brian

$b = 0$   
 $m = 12$

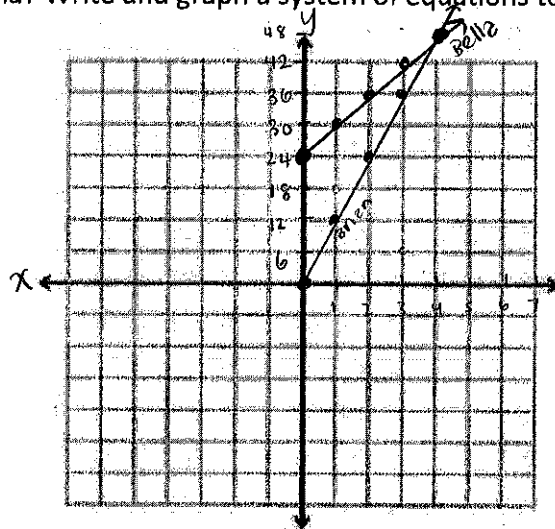
$x = \# \text{ years}$

$y = \# \text{ songs}$

$y = 6x + 24$

$y = 12x + 0$

4 years



8. Describe the graph of a system of equations that has no solution.

parallel lines

same slope, different y-intercept

**LT#2: Solve systems of equations using substitution.**

Solve each system using substitution. Tell whether the system has *one solution*, *infinitely many solutions*, or *no solution*.

9.  $y = 2x - 1$   
 $2x + 2y = 22$

$2x + 2(2x - 1) = 22$        $y = 2(4) - 1$

$2x + 4x - 2 = 22$        $y = 8 - 1$

$6x - 2 = 22$        $y = 7$

$\begin{array}{r} 6x - 2 = 22 \\ +2 \quad +2 \\ \hline 6x = 24 \\ \frac{6x}{6} = \frac{24}{6} \end{array}$

$(4, 7)$

$x = 4$       one solution

11.  $2x + y = -12 \rightarrow y = -2x - 12$   
 $-4x - 2y = 30 \rightarrow y = -2x - 15$

$\begin{array}{r} 2x + y = -12 \\ -2x - 2y = -15 \quad \text{parallel} \\ \hline y = -2x - 12 \end{array}$

$-4x - 2(-2x - 12) = 30$        $\boxed{\text{no solution}}$

$-4x + 4x + 24 = 30$

$24 = 30$

13.  $y = x - 7$   
 $3x - 3y = 21 \rightarrow y = x - 7$

$3x - 3(x - 7) = 21$

$3x - 3x + 21 = 21$

$21 = 21$

$\boxed{\text{infinitely many solutions}}$

10.  $-x + y = -13$   
 $3x - y = 19$

$\begin{array}{r} -x + y = -13 \\ +x \quad \quad +y \\ \hline y = x - 13 \end{array}$

$\begin{array}{r} -(3) + y = -13 \\ +3 \quad \quad +3 \\ \hline y = -10 \end{array}$

$3x - (x - 13) = 19$

$3x - x + 13 = 19$

$2x + 13 = 19$

$\begin{array}{r} -13 \quad -13 \\ 2x + 13 = 19 \\ \hline 2x = 6 \\ \frac{2x}{2} = \frac{6}{2} \\ x = 3 \end{array}$

$\boxed{(3, -10)}$

one solution

12.  $\frac{1}{3}y = \frac{7}{3}x + \frac{5}{3} \rightarrow y = 7x + 5$   
 $x - 3y = 5$

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

$x - 21x - 15 = 5$

$\begin{array}{r} -20x - 15 = 5 \\ +15 \quad +15 \\ \hline -20x = 20 \end{array}$

$\begin{array}{r} -20x = 20 \\ \frac{-20x}{-20} = \frac{20}{-20} \\ x = -1 \end{array}$

$\frac{1}{3}y = \frac{7}{3}(-1) + \frac{5}{3}$

$\frac{1}{3}y = -\frac{7}{3} + \frac{5}{3}$

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

$y = -2$

$\boxed{(-1, -2)}$

one solution

14.  $3x + y = -13$   
 $-2x + 5y = -54$

$\begin{array}{r} 3x + y = -13 \\ -3x \quad \quad -3y \\ \hline y = -3x - 13 \end{array}$

$3(\frac{11}{17}) + y = -13$

$y = -11\frac{1}{17}$

$-2x + 5(-3x - 13) = -54$

$-2x - 15x - 65 = -54$

$\begin{array}{r} -17x - 65 = -54 \\ +65 \quad +65 \\ \hline -17x = 11 \end{array}$

$\begin{array}{r} -17x = 11 \\ \frac{-17x}{-17} = \frac{11}{-17} \\ x = -\frac{11}{17} \end{array}$

$\boxed{(-\frac{11}{17}, -11\frac{1}{17})}$

one solution

$$x = y + 20$$

15. Eliza is the owner of a hair salon. She charges \$20 more per haircut than her assistant. Yesterday the assistant gave 12 haircuts. Eliza gave 6 haircuts. The total earnings from haircuts were \$750. How much does Eliza charge for a haircut? Solve by writing and solving a system of equations.

$x =$  Eliza charges  $y =$  assistant charges

$$\begin{aligned} x &= y + 20 \\ 12y + 6x &= 750 \end{aligned}$$

$$12y + 6(y + 20) = 750$$

$$12y + 6y + 120 = 750$$

$$\begin{array}{r} 12y + 6y + 120 = 750 \\ -120 \quad -120 \\ \hline 18y = 630 \\ \frac{18}{18} \quad \frac{630}{18} \\ y = 35 \end{array}$$

$$\begin{aligned} x &= 35 + 20 \\ x &= 55 \end{aligned}$$

**LT#4:** Solve systems by adding or subtracting to eliminate a variable.

Solve each system using elimination. Tell whether the system has *one solution*, *infinitely many solutions*, or *no solution*.

16.  $\begin{cases} -5(x + 2y = 23) - 5x - 10y = -115 \\ 5x + 10y = 55 \end{cases}$

$$\begin{aligned} -5x - 10y &= -115 \\ (+) \quad 5x + 10y &= 55 \\ \hline \end{aligned}$$

$$0 + 0 = -60$$

$$0 = -60$$

no solution

17.  $\begin{cases} -3(7x + y = 6) - 21x - 3y = -18 \\ 5x + 3y = 34 \end{cases}$

$$\begin{aligned} -21x - 3y &= -18 \\ (+) \quad 5x + 3y &= 34 \\ \hline \end{aligned}$$

$$-16x + 0 = 16$$

$$-16x = 16$$

$$\frac{-16}{-16} \quad \frac{16}{-16}$$

$$x = -1$$

$$5(-1) + 3y = 34$$

$$-5 + 3y = 34$$

$$\begin{array}{r} -5 + 3y = 34 \\ +5 \quad +5 \\ \hline \end{array}$$

$$3y = 39$$

$$\frac{3}{3} \quad \frac{39}{3}$$

$$y = 13$$

$(-1, 13)$

one solution

$$18. \begin{cases} 5x + 4y = -83 \\ 3x - 3y = -12 \end{cases} \begin{matrix} \cdot 3 \\ \cdot 4 \end{matrix} \Rightarrow \begin{cases} 15x + 12y = -249 \\ 12x - 12y = -48 \end{cases}$$

$$\begin{array}{r} 15x + 12y = -249 \\ (+) \quad 12x - 12y = -48 \\ \hline 27x + 0 = -297 \\ 27x = -297 \\ \hline 27 \quad 27 \\ \hline x = -11 \end{array}$$

$$\begin{array}{r} 3(-11) - 3y = -12 \\ -33 - 3y = -12 \\ +33 \quad +33 \\ \hline -3y = 21 \\ \hline -3 \quad -3 \\ \hline y = -7 \end{array}$$

$$\boxed{(-11, -7)}$$

$$20. \begin{cases} 4x + y = 21 \\ -2x + 6y = 9 \end{cases} \cdot 2 \Rightarrow \begin{cases} 4x + y = 21 \\ -4x + 12y = 18 \end{cases}$$

$$\begin{array}{r} 4x + y = 21 \\ (+) \quad -4x + 12y = 18 \\ \hline 0 + 13y = 39 \\ 13y = 39 \\ \hline 13 \quad 13 \\ \hline y = 3 \end{array}$$

$$\begin{array}{r} 4x + 3 = 21 \\ -3 \quad -3 \\ \hline 4x = 18 \\ \hline 4 \quad 4 \\ \hline x = 4.5 \end{array}$$

$$\boxed{(4.5, 3)}$$

$$19. \begin{cases} 9x + \frac{1}{2}y = 51 \\ 7x + \frac{1}{3}y = 39 \end{cases} \begin{matrix} \cdot 2 \\ \cdot 3 \end{matrix} \Rightarrow \begin{cases} 18x + y = 102 \\ 21x + y = 117 \end{cases}$$

$$\begin{array}{r} 18x + y = 102 \\ - (21x + y = 117) \\ \hline -3x + 0 = -15 \\ -3x = -15 \\ \hline -3 \quad -3 \\ \hline x = 5 \end{array}$$

$$\begin{array}{r} 9(5) + \frac{1}{2}y = 51 \\ 45 + \frac{1}{2}y = 51 \\ -45 \quad -45 \\ \hline 2 \cdot \frac{1}{2}y = 6 \cdot 2 \\ y = 12 \end{array}$$

$$\boxed{(5, 12)}$$

$$21. \begin{cases} y = 3x - 27 \\ x - \frac{1}{3}y = 9 \end{cases}$$

$$\begin{array}{r} x - \frac{1}{3}y = 9 \\ -x \quad -x \\ \hline -3 \left( -\frac{1}{3}y = -x + 9 \right) \\ y = 3x - 27 \\ y = 3x - 27 \end{array}$$

$\Rightarrow$  infinitely many solutions

**LT#5:** Choose the best method for solving a system of linear equations.

22. It takes a florist 3 h 15 min to make 3 small centerpieces and 3 large centerpieces. It takes 6 h 20 min to make 4 small centerpieces and 7 large centerpieces. How long does it take to make each small centerpiece and each large centerpiece? Write and solve a system of equations to find your answer.

$x$  = # small centerpieces

$y$  = # large centerpieces

$$3 \text{ h } 15 \text{ min} = 180 \text{ min} + 15 \text{ min} = 195 \text{ min}$$

$$6 \text{ h } 20 \text{ min} = 360 \text{ min} + 20 \text{ min} = 380 \text{ min}$$

$$4(3x + 3y = 195)$$

$$3(4x + 7y = 380)$$

$$12x + 12y = 780$$

$$12x + 21y = 1140$$

$$\begin{array}{r} 12x + 12y = 780 \\ - (12x + 21y = 1140) \\ \hline 0 - 9y = -360 \end{array}$$

$$\begin{array}{r} 3x + 3(40) = 195 \\ 3x + 120 = 195 \\ -120 \quad -120 \\ \hline 3x = 75 \\ \hline \frac{3x}{3} = \frac{75}{3} \\ x = 25 \end{array}$$

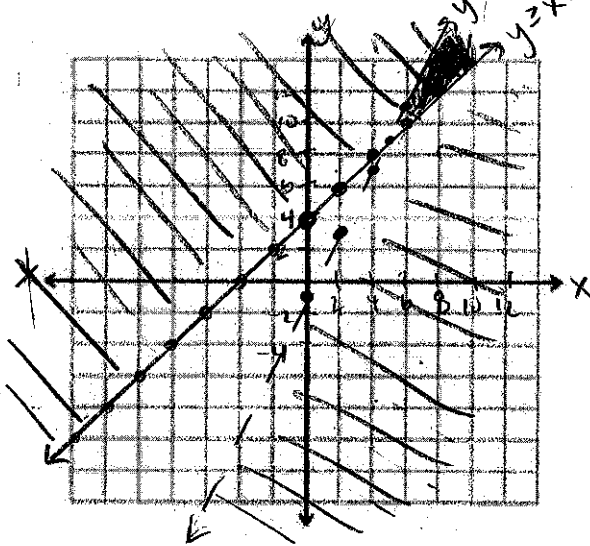
$$\boxed{x = 25 \text{ min}}$$

$$\begin{array}{r} 0 - 9y = -360 \\ -9 \quad -9 \\ \hline y = 40 \end{array}$$

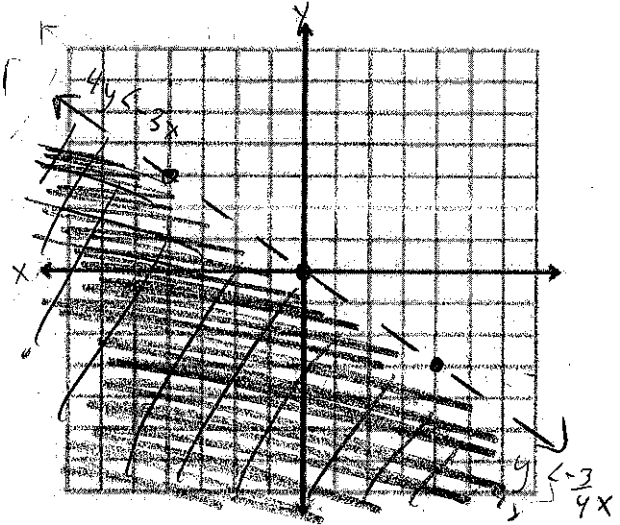
- LT#6:** Graph linear inequalities in two variables.  
**LT#7:** Use linear inequalities with modeling real-world situations.  
**LT#8:** Solve systems of linear inequalities by graphing.  
**LT#9:** Model real-world situations using systems of linear inequalities.

Solve each system of inequalities by graphing.

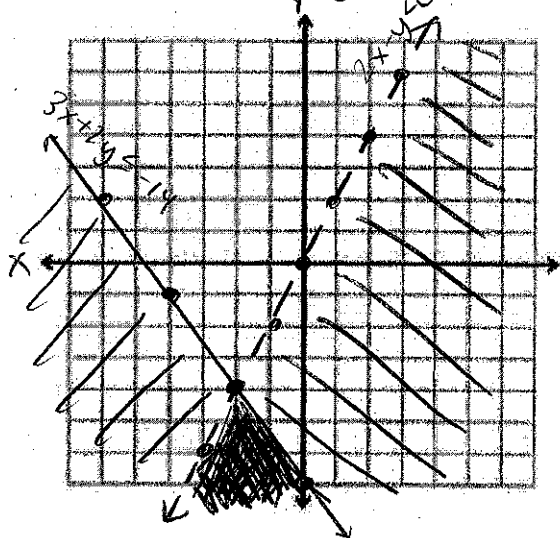
23.  $y \geq x + 4$   $m=1$   $b=4$   
 $y < 2x - 1$   $m=2$   $b=-1$



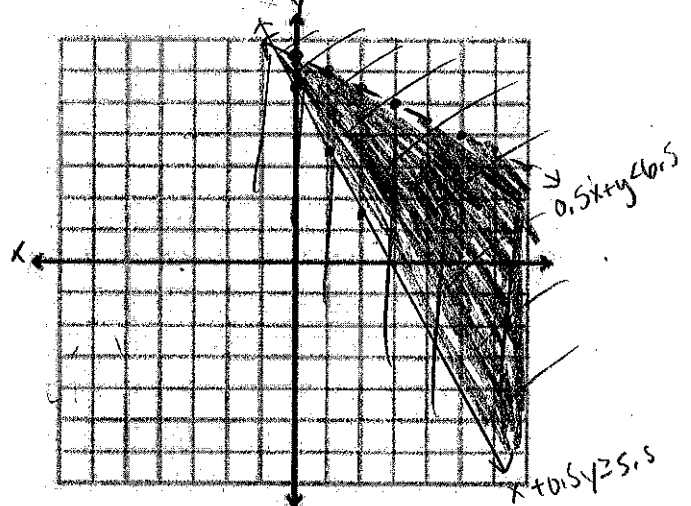
24.  $4y < -3x$   $m=-\frac{3}{4}$   $b=0$   
 $y < -\frac{3}{4}x$   $m=-\frac{3}{4}$   $b=0$



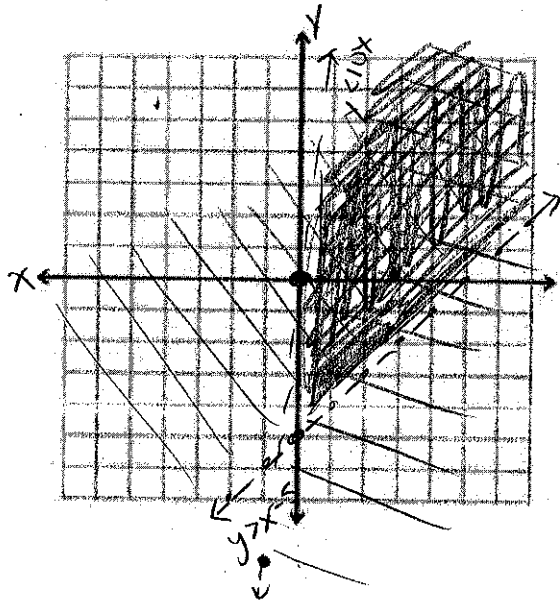
25.  $2x - y > 0 \Rightarrow y < 2x$   $m=2$   $b=0$   
 $3x + 2y \leq -14 \Rightarrow y \leq -\frac{3}{2}x - 7$   $m=-\frac{3}{2}$   $b=-7$



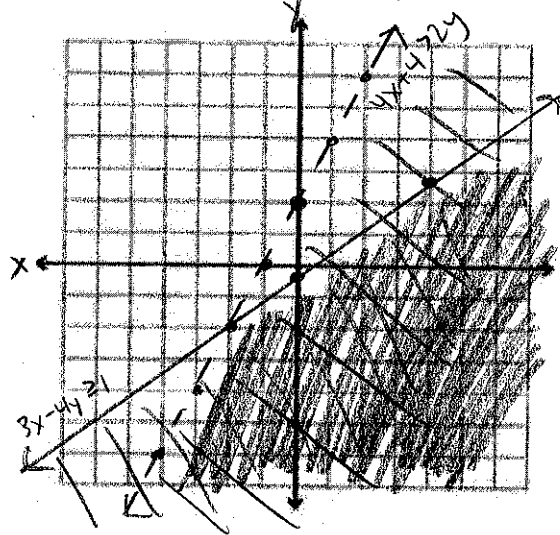
26.  $x + 0.5y \geq 5.5 \Rightarrow y \geq -2x + 11$   
 $0.5x + y < 6.5 \Rightarrow y < -0.5x + 6.5$



27.  $y < 10x$   $m=10$   $b=0$   
 $y > x - 5$



28.  $4x + 4 > 2y \Rightarrow y < 2x + 2$   $m=2$   $b=2$   
 $3x - 4y \geq 1 \Rightarrow y \leq \frac{3}{4}x - \frac{1}{4}$



29. You have 60 megabytes (MB) of space left on your portable media player. You can choose to download song files that use 3.5 MB or video files that use 8 MB. You want to download at least 12 files. What is a graph showing the numbers of song and video files you can download?

$s = \# \text{ song files}$      $v = \# \text{ video files}$

# Files:  $s + v \geq 12$

MB:  $3.5s + 8v \leq 60$

