# Identifying Slope and y-intercept

slope

$y = mx + b$

y-intercept

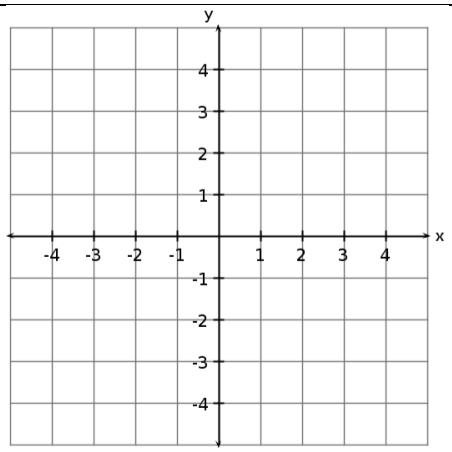
## Practice 1 – Identifying m and b

**1.** For each of the following, identify the slope and y-intercept, OR use the slope and y-intercept to write an equation.

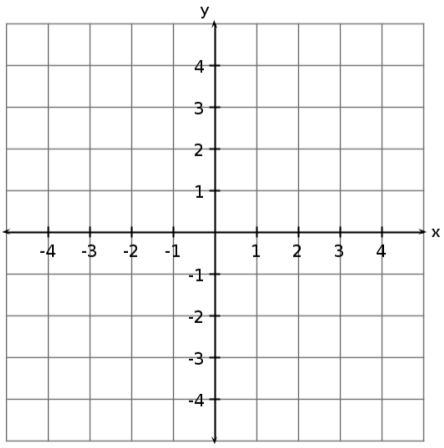
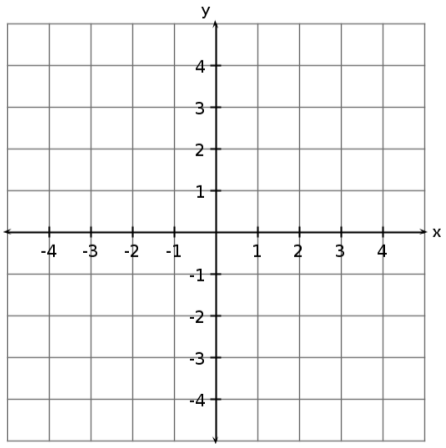
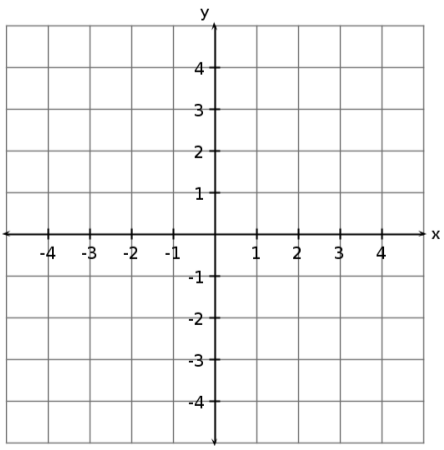
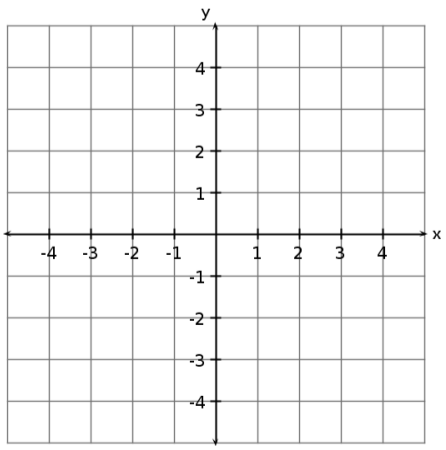
| | | Slope | y-intercept |
|---|---|---|---|
| **a.** | $y = \frac{9}{10}x + 5$ | m = | b = |
| **b.** | $y = \frac{-1}{3}x - 6$ | | |
| **c.** | | 9 | $-\frac{1}{2}$ |
| **d.** | $y = -x + 3$ | | |
| **e.** | $y = x - \frac{3}{4}$ | | |
| **f.** | $y = \frac{8}{9}x$ | | |
| **g.** | $y = 8 + 3x$ | | |
| **h.** | | 1 | 0 |
| **i.** | $y = \frac{4}{5}x + 5$ | | |
| **j.** | $y = -3 - x$ | | |
| **k.** | $y = \frac{2}{3}x + 5$ | | |
| **l.** | $y = -3.4 + 2.5x$ | | |
| **m.** | | 1.3 | $-2.3$ |
| **n.** | $y = -0.4x - \frac{3}{7}$ | | |
| **o.** | $3x - 8 = y$ | | |
| **p.** | | $\frac{1}{2}$ | $\frac{6}{11}$ |
| **q.** | $y = 1\frac{3}{4}x + 4$ | | |
| **r.** | $y = \frac{3x}{4} - 7$ | | |
| **s.** | | $\frac{-2}{3}$ | $-6$ |

# Graphing Lines

| **Ex 1.** Graph the following line: $y = -3x - 4$ | |
|---|---|
| 1 | Begin at the y-intercept |
| 2 | Using the slope, count up for the rise (down if it's negative) and right for the run (left if it's negative) |
| 3 | Join your points. Put arrows at the ends. Label your line. |




## Practice 2 – Graphing Lines

| **2.** Graph the following line: $y = \frac{-2}{3}x + 1$ | **3.** Graph the following line: $y = \frac{1}{2}x$ |
|---|---|
|  |  |
| **4.** Graph the following line: $y = 2x - 5$ | **5.** Graph the following line: $y = -x + 2$ |
|  |  |

# Determining the equation of a line

## *From words*

| **Ex 2** Michael works at a clothing store. In a week, he makes a base salary of $300, plus $13 for each hour he works. Write an equation that models his total weekly earnings. | | |
|---|---|---|
| 1 | Identify the DEPENDENT (y) and INDEPENDENT (x) variables. Define them | |
| 2 | Begin with the point-slope equation of a line | |
| 3 | Identify your RATE OF CHANGE (slope). This is "m" | |
| 4 | Identify your INITIAL VALUE (y-intercept). This is "b" | |
| 5 | Put everything together | |

***Answering secondary questions:***

| a) One week, Michael works 40 hours. How much money does he make? | | |
|---|---|---|
| 6 | Determine if you need to substitute for x or y | |
| 7 | Substitute | |
| 8 | Solve | |
| 9 | Answer in a complete sentence | |

| b) If Michael wants to make $700, how many hours does he have to work? | | |
|---|---|---|
| 6 | Determine if you need to substitute for x or y | |
| 7 | Substitute | |
| 8 | Solve | |
| 9 | Answer in a complete sentence | |

# Practice 3 – Writing an Equation from Words

****For ALL of the following questions, please DEFINE YOUR VARIABLES****

**6.** An airplane 30,000 feet above the ground begins descending at the rate of 2000 feet per minute. Assume the plane continues at the same rate of descent. The plane's height and minutes above the ground are related.
   a. Write an equation to model the situation.
   b. When will the plane hit the ground?

**7.** You are visiting Montreal, and a taxi company charges a flat fee of $3.00 for using the taxi and an additional $0.75 per kilometer.
   a. Write an equation that you could use to find the cost of a taxi ride in Montreal.
   b. What is the cost of a 60km cab ride?

**8.** A plumber charges a fee of $50 to make a house call. He also charges $25 an hour for labour.
   a. Write an equation that you could use to find the amount a plumber charges for a house call based on the number of hours of labour.
   b. If you paid $143.75, how many hours did the plumber work for?

**9.** A mutual fund company charges $50 a year to hold the fund and then an additional 2% (.02) of the profits made for that year.
   a. Write an equation that could be used to determine how much one would pay to the mutual fund company in a year.
   b. If the fund made $30 000 in profits, how much would you pay to the company?

**10.** Kim and Cyndi are starting a business tutoring students in math. In one month, they rent an office that costs them $400 and charge $40 per hour per student.
   a. Write an equation relating number of hours and total earnings.
   b. How many hours do they have to tutor to break even (make $0 in total earnings)

**11.** Lin is tracking the progress of her plant's growth. When she purchases the plant, it is 5cm high, and it grows 1.5cm per day.
   a. Write an equation that models the plant's growth.
   b. How tall is it after 1 week?

**12.** A salesperson receives a base salary of $35 000 and a commission of 10% of the total sales for the year.
   a. Write a linear model that shows the salesperson's total income.
   b. If she makes a total income of $65 000, what were the total sales for the year?

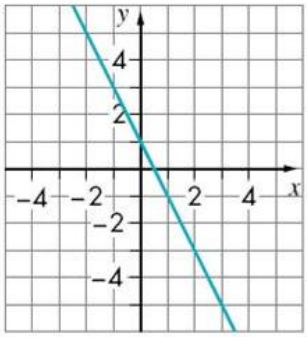
**13.** A plane is taking off at a rate of 1500 feet per minute.
   a. Write a linear equation relating the plane's height to time.
   b. How long does it take the plane to reach a height of 25 000 feet?

**14.** A 1000ml bucket has a hole and is leaking water at a constant rate of 5ml/s.
   a. Write an equation relating time, and the amount of water left in the bucket
   b. How long will it take until the bucket is empty?

# Determining the equation of a line

***From a graph, when the scale on the x and y axes is the same***

**Ex 3** Determine the equation of the line pictured on the graph shown below.

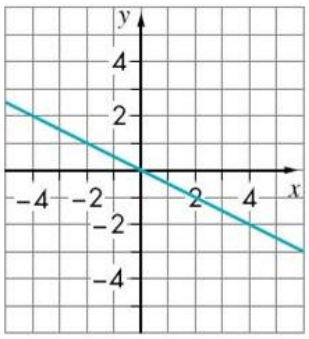



| | | |
|---|---|---|
| 1 | Begin with the point-slope equation of a line | |
| 2 | Identify your RATE OF CHANGE (slope). This is "m" | |
| 3 | Identify your INITIAL VALUE (y-intercept). This is "b" | |
| 4 | Put everything together | |

## Practice 4 – Writing an Equation from a Graph

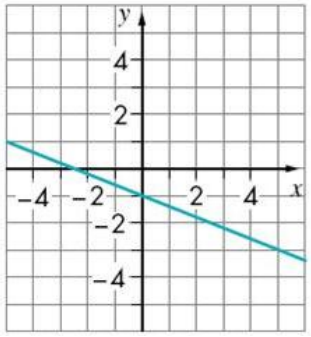
**15.** Determine the equation of each line shown below.

a.



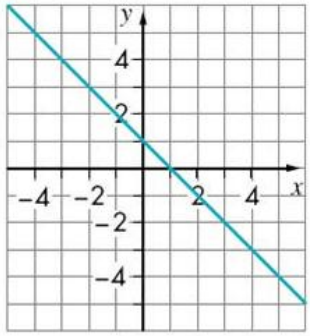

Equation:

b.



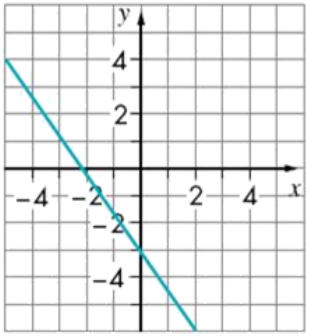

Equation:

c.



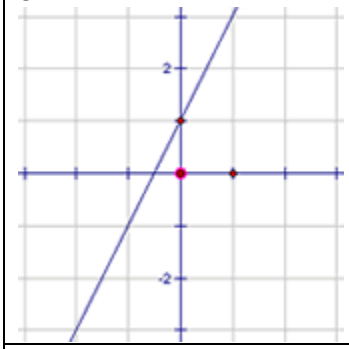

Equation:

d.



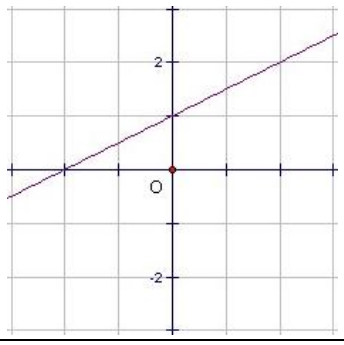

Equation:

e.



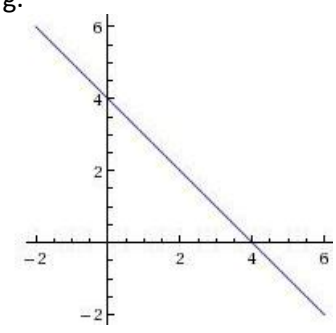

Equation:

f.



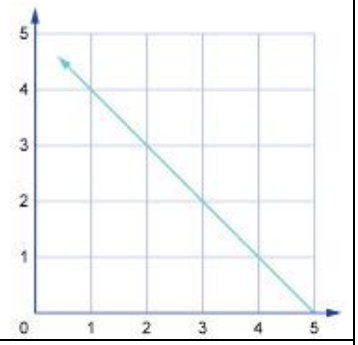

Equation:

g.




Equation:

h.




Equation:

# Determining the equation of a line

## *From two points*

You may be given your two points, or they may come from a table of values or a graph

| **Ex 4** Determine the equation of a line that goes through point A (3,4) and point B (–5,0) | | |
|---|---|---|
| 1 | Use the two points and the slope formula to find the slope | |
| 2 | Replace “m” with the slope in “y=mx + b” | |
| 3 | Pick one of your points and substitute it in for “x” and “y” to solve for “b” | |
| 4 | Take your “m” and “b”, and put them into “y=mx + b” form | |

| **Ex 5** Nat hires a cleaning service. For 4 hours of cleaning, they charge $112. For 6 hours of cleaning, they charge $144. Determine the equation of a line that relates total cost to number of hours. | | |
|---|---|---|
| 1 | Identify the DEPENDENT (y) and INDEPENDENT (x) variables. Define them | |
| 2 | Interpret the information given as ordered pairs.<br>Use the two points and the slope formula to find the slope | |
| 3 | Replace “m” with the slope in “y=mx + b” | |
| 4 | Pick one of your points and substitute it in for “x” and “y” to solve for “b” | |
| 5 | Take your “m” and “b”, and put them into “y=mx + b” form | |

# Practice 5 – Writing an Equation from two points

**16.** For each of the following pairs of points, find the equation of the line that passes through them:

a. (1, -4) and (3, 2)
b. (–5, 2) and (7, –1)
c. (–2, 5) and (3, –5)
d. (1, -1) and (8, 1)
e. (0, 5) and (45, –18)
f. (278, 109) and (26, –210)
g. (–2.7, –8.3) and (–4.9, 0)
h. (95, –32) and (–23, 145)

**17.** Determine the equation of the line represented by each table below

a.

| x | y |
|---|---|
| –3 | 8 |
| –2 | 5 |
| –1 | 2 |
| 0 | –1 |
| 1 | –4 |
| 2 | –7 |
| 3 | –10 |

b.

| x | y |
|---|---|
| 0 | –8 |
| 1 | –6 |
| 2 | –4 |
| 3 | –2 |
| 4 | 0 |
| 5 | 2 |
| 6 | 4 |

c.

| x | y |
|---|---|
| 10 | 72 |
| 20 | 87 |
| 30 | 102 |
| 40 | 117 |
| 50 | 132 |
| 60 | 147 |
| 70 | 162 |

d.

| x | y |
|---|---|
| 0 | 1000 |
| –500 | 965.5 |
| –1000 | 931 |
| –1500 | 896.5 |
| –2000 | 862 |
| –2500 | 827.5 |
| –3000 | 793 |

**18.** Determine the equation of the line represented by each situation:

a. Chris is draining water out of his pool. After 2h, he has 108 600L left. After 5h, he has 106 350L left. Write an equation relating the volume of water and time. When will the pool be empty?

b. Esfand works at a clothing store. He makes a flat salary, plus an hourly rate. He makes $860 when he works a 20h week. When he works 45h, he makes $1310. Write an equation relating total earnings to number of hours. Using your equation, determine how much he will make if he works a 40h week.

c. Dom is taking a road trip and keeping track of the kilometres travelled, as well as the amount of gas he's left with. After 120km, he has 35.4L of gas left. After 380km, he has 14.6L of gas left. Write an equation relating number of kilometres travelled to total gas in the tank. Using your equation determine how much gas he started with.

d. A plane is descending to land. After 5 minutes, it is at 15 000 feet. It hits the ground after 12.5 minutes. Create an equation to model this situation. How high was the plane when it began its descent?

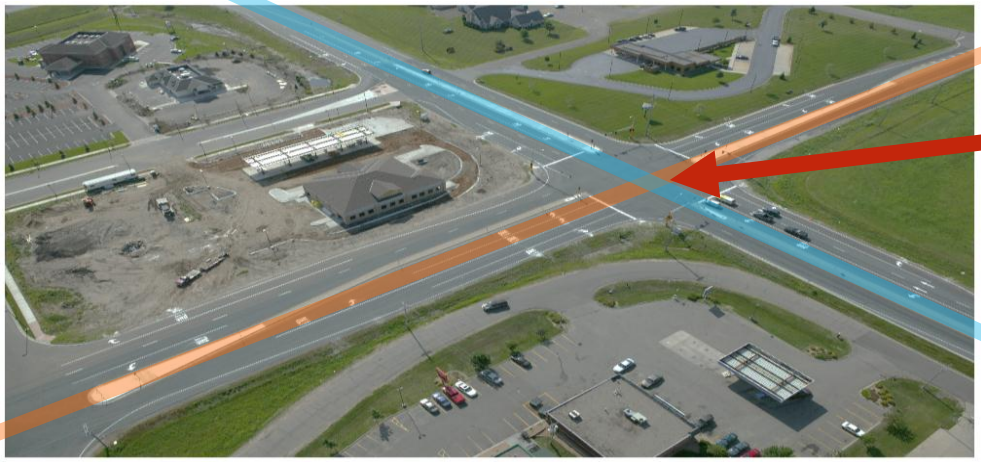
e. A company is tracking its sales over the years. The company began tracking its sales in 1995. By 2005, its sales were $328 500. In 2012, its sales were $243 600. Assuming a constant rate of decline, create an equation relating sales to years. What were the sales in 1995? When will the company go broke ($0 in sales)?

f. Sierra is performing an experiment where she the measures the temperature of a cup of water while it heats up. After 3 minutes, the temperature is 5°C. After 10 minutes, the temperature is 45°C. Create an equation relating time to temperature. What was the temperature of the water when the experiment began?

g. Natalie is renting a limo for an event. For 2h of service, the limo company charges $1499. For 6h of service, the limo company charges $1947. Write an equation relating time to cost. How much will it cost to rent the limo for 5h?

# Solving a Linear System

If you have a **linear system**, or a system of linear equations, that means you have **two or more** linear equations. **Solving** a linear system means **finding the point where the lines intersect** (cross). The **solution** (or point of intersection) is a **point that lies on both lines**.




## *Solving systems of linear equations by graphing*

**Ex 6** Isabella is looking to join a gym in order to take fitness classes. Here are the two fitness plans she is comparing:

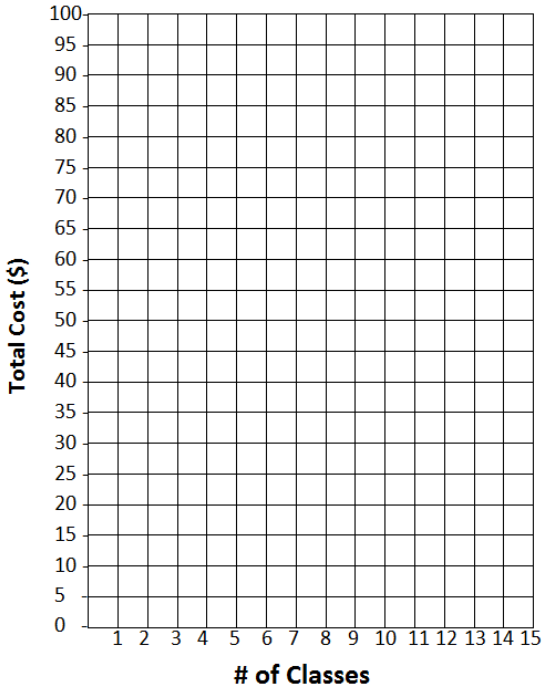
**Body by Ms. Will** does not charge a membership fee, and charges $10 per fitness class.

This can be represented by the equation **y = 10x**

**Chahine's Total Fitness** charges a $40 membership fee, and $5 per fitness class.

This can be represented by the equation **y = 5x + 40**

***Let x represent number of classes***
***Let y represent total cost***




**a)** Graph BOTH equations on the grid. Find the point of intersection. What does it mean?

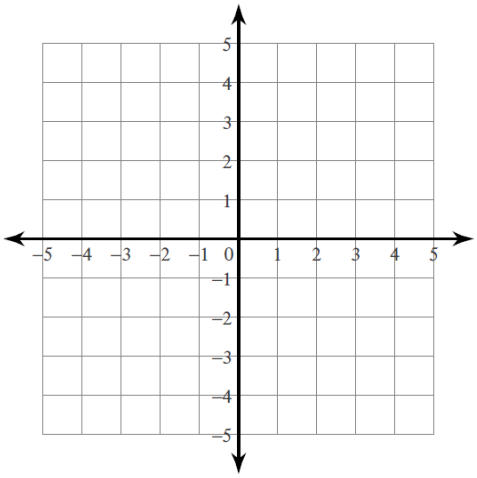
**b)** What recommendation would you make if Isabella thinks she will take about 6 classes?

**c)** What recommendation would you make if Isabella thinks she will take 10 or more classes?

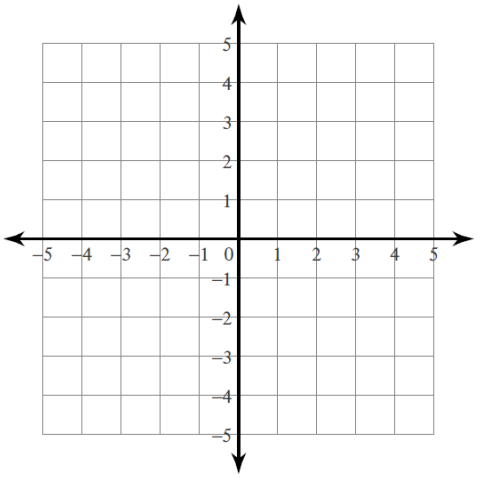
# Practice 6 – Solving a System of Equations by Graphing

**19.** For each of the following systems of equations, find the solution by graphing.

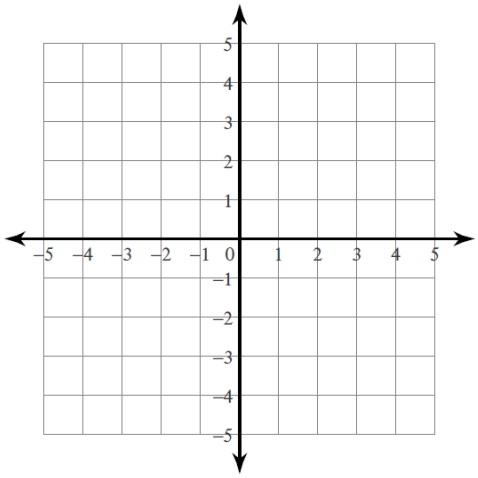
a. $y = -3x + 4$ and $y = 3x - 2$



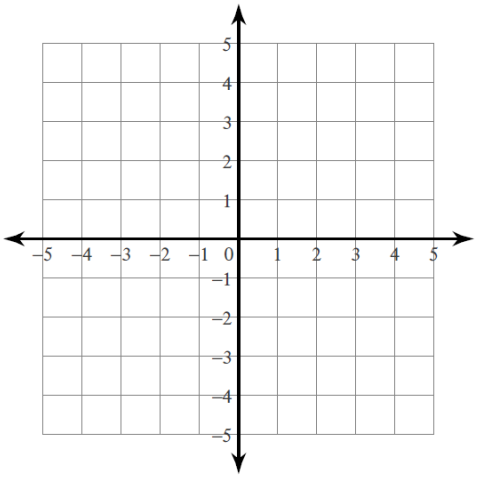
b. $y = x + 2$ and $y = \frac{-1}{2}x - 4$



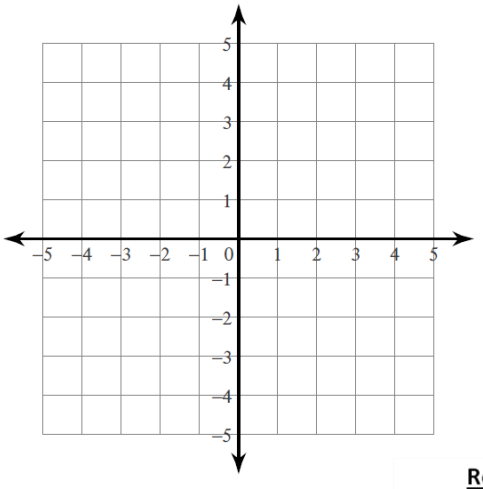
c. $y = -\frac{1}{4}x + 4$ and $y = \frac{3}{2}x - \frac{1}{2}$



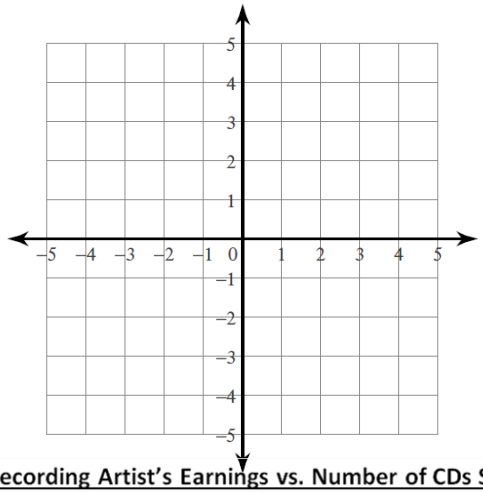
d. $y = x - \frac{1}{2}$ and $y = 3x - 4.5$



e. $y = -x - 3$ and $y = 7x + 3$



f. $y = -\frac{3}{2}x + \frac{1}{2}$ and $y = \frac{3}{4}x - 3$



**20.** A recording artist is offered two deals for her CD release:

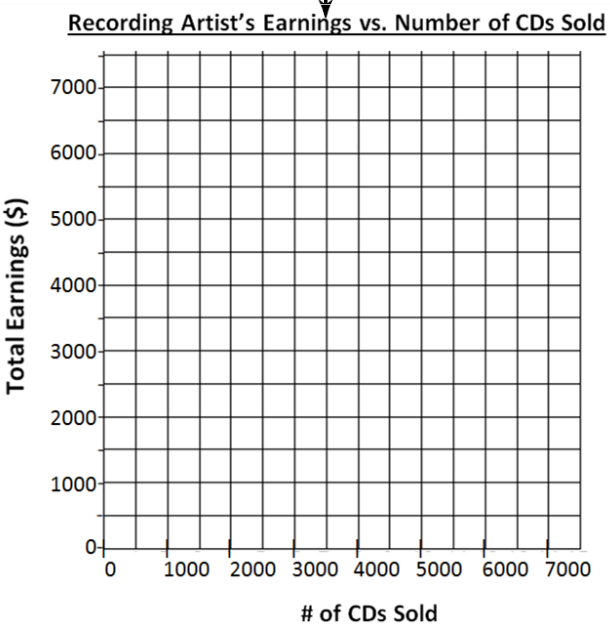
Plan A – Royalty only: \$1 per CD sold

Plan B – Partial royalty: \$2000 plus \$0.50 per CD sold.

a. Graph both linear relations on the same grid.

b. Find the solution of the linear system, and explain what it means.

c. What recommendations would you make for this artist? Give two different recommendations for different amounts of CDs sold.



# Solving a Linear System

## *Solving systems of linear equations algebraically*

**Ex 7** Isabella is looking to join a gym in order to take fitness classes. Here are the two fitness plans she is comparing:

**Body by Ms. Will** does not charge a membership fee, and charges $10 per fitness class.

This can be represented by the equation **y = 10x**

**Chahine's Total Fitness** charges a $40 membership fee, and $5 per fitness class.

This can be represented by the equation **y = 5x + 40**

***Let x represent number of classes***
***Let y represent total cost***

**Recall** from when we graphed these lines that the solution to this linear system was **(8,80)**

***We can get the same answer WITHOUT graphing.***

**How it works:** We know that the solution to a system of equations gives us a point where the x and y are the same for BOTH equations. First, let's prove that.

**Ex 7a)** For both gyms, find the cost for 8 classes:

| **Body by Ms. Will:** | **Chahine's Total Fitness:** |
|---|---|
| **y = 10x** | **y = 5x + 40** |
| Therefore, the point **(  ,  )** lies on this graph | Therefore, the point **(  ,  )** lies on this graph |

Since **(  ,  )** lies on both graphs, we know it is the point of intersection

**Ex 7b)** Now, let's find the point of intersection without graphing.

If the "y" for both gyms are the same, we can say: **y = y**

If **y = 10x**, AND **y = 5x + 40**, then we can say that: **10x = 5x + 40**

**Now we have ONE equation with ONE type of variable, so we can solve for x.**

**10x = 5x + 40**

Now let's try another example:

| **Ex 8** Find the point of intersection between $\boldsymbol{y = 95.70x + 1200}$ and $\boldsymbol{y = -63.50x - 140}$ | | | |
|---|---|---|---|
| 1 | Make sure that both equations are in "y = mx + b" form | | |
| 2 | Set both equations equal to each other | | |
| 3 | Solve for x | | |
| 4 | Substitute x into either one of the two equations to find y | | |
| 5 | End with a point or a therefore statement | | |
| **Optional** | Check that this is the point of intersection by substituting your x and y values into EACH original equation, and performing a LS = RS check | LS = RS Check<br>$\boldsymbol{y = 95.70x + 1200}$ | LS = RS Check<br>$\boldsymbol{y = -63.50x - 140}$ |

## Practice 7 – Solving a System of Equations Algebraically

**21.** For each of the following systems of equations, find the point of intersection algebraically.

a. $y = 23.8x - 12$ and $y = -3x + 43$

b. $y = \frac{1}{3}x - 7$ and $y = \frac{-2}{3}x + 13$

c. $y = 8x + \frac{3}{5}$ and $y = 9x - \frac{2}{5}$

d. $y = \frac{1}{3}x + \frac{1}{2}$ and $y = \frac{1}{6}x - \frac{2}{3}$

e. $y = 1900x - 320$ and $y = -1270x + 13000$

f. $y = -3.4x + 45.2$ and $y = 294.1x - 184.2$