



4.2 Note

Bring Ruler !!!!

4.2 Linear Systems

HW P.124 Q5,10 (all)

Many applications of Mathematics involve equations with two or more variables. This section will cover how to graph equations of two variables.

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Coordinate System

(x, y)

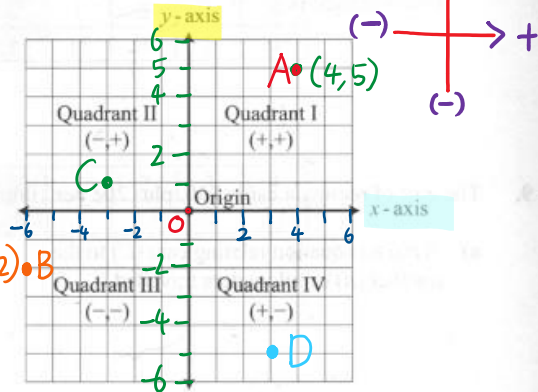
Just as you can represent a real number by points on the real number line, you can represent an **ordered pair** by points in a plane called a rectangular coordinate system.

A (4, 5) $x=4$
 $y=5$

B (-6, -2)

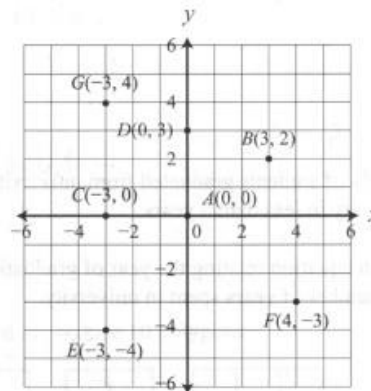
Try C (-3, 1)

Try D (3, -5)



To each ordered pair (x, y) there is a unique point in the plane.

- The ordered pair **A (0, 0)** is located at the origin.
- The ordered pair **B (3, 2)** is located three units to the right, and two units up, from the origin.
- The ordered pair **C (-3, 0)** is located three units to the left of the origin, on the x-axis.
- The ordered pair **D (0, 3)** is located three units up from the origin, on the y-axis.
- The ordered pair **E (-3, -4)** is located three units to the left, and four units down, from the origin.
- The ordered pair **F (4, -3)** is located four units to the right, and three units down, from the origin.
- The ordered pair **G (-3, 4)** is located three units to the left, and four units up, from the origin.



Ordered pairs (4, -3) and (-3, 4) plot different points. That is why they are called ordered pairs, because it makes a difference which number comes first.

Line **P. 127**
Linear Equations

Linear : $y = mx + b$
 (where m is slope and b is y-int.)

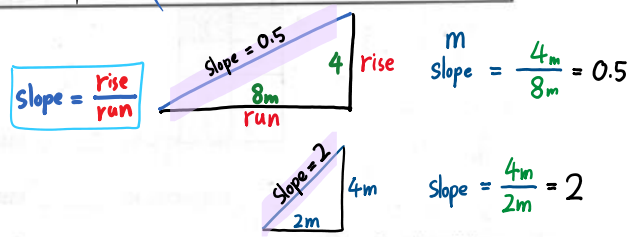
A linear equation means the equation of a straight line.

Slope Intercept Form
 $y = mx + b$
 $m = \text{slope} = \frac{\text{rise}}{\text{run}} = \frac{y_2 - y_1}{x_2 - x_1}$, $b = \text{y-intercept}$

Graphing a Linear Equation

Method 1:

- Step 1: Write the equation in form $y = mx + b$.
- Step 2: Plot the y -intercept, or any known point.
- Step 3: Travel up if slope is positive, or down if slope is negative, by the distance given by the rise. Then travel right a distance given by the run. Mark the new point. Draw a line connecting the new point to the other known point; extend it in both directions, and add arrows to show it goes forever.



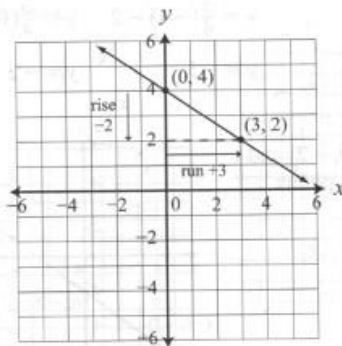
Method 2:

- Step 1: Write the equation in form $y = mx + b$.
- Step 2: Let $x =$ three values that are divisible by the 'run' or denominator of the slope.
- Step 3: Solve for y .
- Step 4: Plot three points from step 2 and draw a line through them.

Example 1 Graph $y = -\frac{2}{3}x + 4$. **P. 127**

► **Solution:** Method 1: Plot the y -intercept of 4, go down 2, and right 3 units. Mark the new point (3, 2). Draw a straight line through the y -intercept point (0, 4) and the new point (3, 2).

Ex2) Draw



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Method 2: Pick three points divisible by 3:

x	y
0	
3	

Solve for three missing y values:

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

$$y = -\frac{2}{3}(0) + 4 \quad y = -\frac{2}{3}(3) + 4 \quad y = -\frac{2}{3}(-3) + 4$$

x	y
0	
3	
-3	

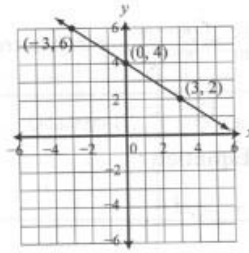
$$y = -\frac{2}{3}x + 4 \quad y = -\frac{2}{3}x + 4 \quad y = -\frac{2}{3}x + 4$$

$$y = -\frac{2}{3}(0) + 4 \quad y = -\frac{2}{3}(3) + 4 \quad y = -\frac{2}{3}(-3) + 4$$

$$y = 4 \quad y = 2 \quad y = 6$$

Plot the three points (0, 4), (3, 2) and (-3, 6) and draw a line through the points.

x	y
0	4
3	2
-3	6

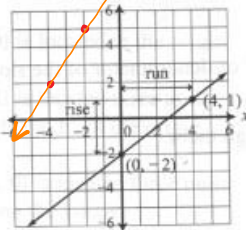


$$y = mx + b$$

slope y-int

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

Solution: P. 128 Plot the y-intercept of -2, go up 3 units and right 4 units. Mark the new point (4, 1). Draw a straight line through the y-intercept point (0, -2), and the new point (4, 1).



Method 2: Pick three points divisible by 3:

x	y
-4	
0	
-4	

Solve for three missing y values:

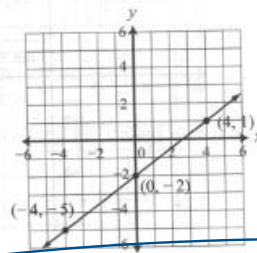
$$y = \frac{3}{4}x - 2 \quad y = \frac{3}{4}x - 2 \quad y = \frac{3}{4}x - 2$$

$$y = \frac{3}{4}(-4) - 2 \quad y = \frac{3}{4}(0) - 2 \quad y = \frac{3}{4}(4) - 2$$

$$y = -5 \quad y = -2 \quad y = 1$$

Plot the three points (-4, -5), (0, -2) and (4, 1) and draw a line through the points.

x	y
-4	-5
0	-2
-4	1



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HW P. 129 Q3-5, 8 all

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4.2 Exercise Set

- Fill in the blanks using $<$, or $>$.
 - If a point (x, y) is in quadrant I, then x $\underline{\quad}$ 0, and y $\underline{\quad}$ 0.
 - If a point (x, y) is in quadrant II, then x $\underline{\quad}$ 0, and y $\underline{\quad}$ 0.
 - If a point (x, y) is in quadrant III, then x $\underline{\quad}$ 0, and y $\underline{\quad}$ 0.
 - If a point (x, y) is in quadrant IV, then x $\underline{\quad}$ 0, and y $\underline{\quad}$ 0.

2. Fill in the blanks.

2. Fill in the blanks.

a) If $xy > 0$, then the point (x, y) is either in quadrant _____ or quadrant _____.

b) If $xy < 0$, then the point (x, y) is either in quadrant _____ or quadrant _____.

3. Without plotting, determine which quadrant the points are found in.

a) $(4, -2)$ _____

b) $(6, 3)$ _____

c) $(-1, 3)$ _____

d) $(-2, -\frac{3}{2})$ _____

4. Plot the points on the grid provided.

A $(-3, 1)$

B $(-4, -2)$

C $(-5, 0)$
Stay

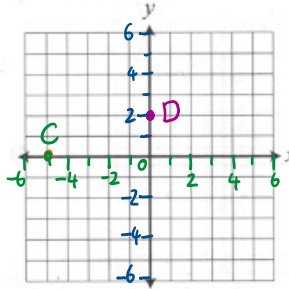
D $(0, 2)$

E $(3, -5)$

F $(4, 3)$

G $(4, 0)$

H $(0, -4)$



5. Find the coordinates of each point.

A (,)

B (,)

C $(5, \emptyset)$

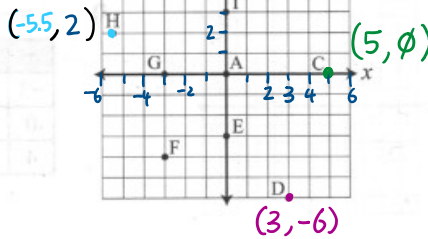
D $(3, -6)$

E (,)

F (,)

G (,)

H $(-5.5, 2)$



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6. Determine whether the given ordered pair is a solution of the equation.

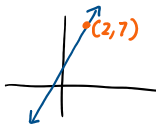
Is the pt. on the Line?

a) $(2, 7)$; $y = 3x + 1$

$$7 = 3(2) + 1$$

$$7 = 6 + 1$$

$$7 = 7 \quad \checkmark \quad \text{Yes}$$

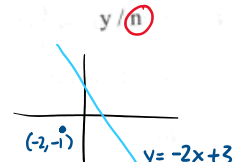


b) $(-2, -1)$; $y = -2x + 3$

$$-1 = -2(-2) + 3$$

$$-1 = 4 + 3$$

$$-1 \neq 7 \quad \text{No}$$



P130 c) $(6, 5)$; $y = \frac{2}{3}x + 1$

$$5 = \frac{2}{3}(6) + 1$$

$$5 = 4 + 1$$

$$5 = 5 \quad \checkmark \quad \text{Yes}$$

d) $(-8, 1)$; $y = -\frac{3}{4}x - 5$

$$1 = -\frac{3}{4}(-8) - 5$$

e) $(3, 0)$; $2x - 3y = 6$

f) $(3, 0)$; $2x + 3y = 6$

7. Determine the missing ordered pair values for the given equations.

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

b) $y = 3x - 6$

pt:

x	y
0	

x	y
0	-
	n

pt1
pt2
pt.3

x	y
0	
	0
4	

x	y
0	-
	0
4	6

Ext c) $y = -\frac{3}{4}x - \frac{5}{2}$

x	y
0	
	0
-6	

d) $y = \frac{8}{3}x - 8$

③

x	y
0	
	0
	4

e) $y = -2x$

x	y
0	
	0
-3	

f) $y = -2$

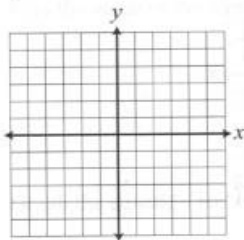
x	y
-3	
0	
4	

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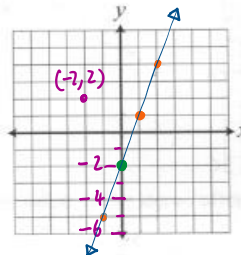
8. Graph the equation and identify the y-intercept

HW **P131** $y = mX + b$
Slope m y-int b

a) $y = x + 1$



b) $y = 3x - 2$ y-int = -2 ← start



slope = $3 = \frac{3}{1}$ rise ↓, run ←

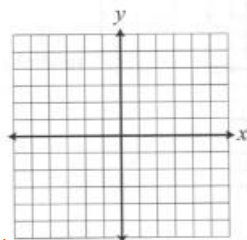
3 up, 1 right

3 down, 1 left

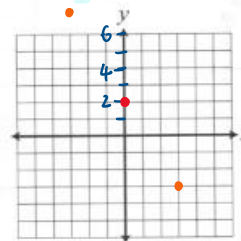
is (2, 4) on the line? ✓

is (-2, 2) on the line? X

c) $y = -2x + 1$



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



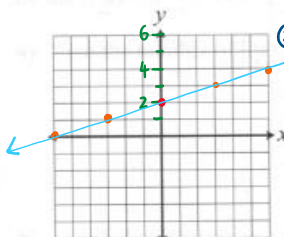
slope = $-\frac{5}{3} = \frac{-5}{3}$ rise, run

Down 5 Right 3 ✓

Up 5 Left 3 ✓

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



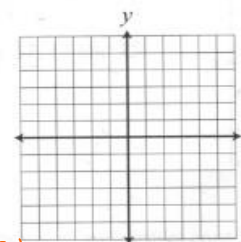
① get y-int = 2 starting pt.

② Slope = $\frac{1}{3}$ rise ↓, run ←

Up 1 3 right

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

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



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

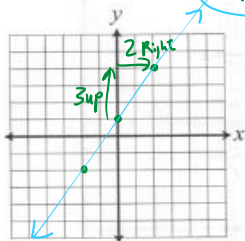
m = 3 rise ↓, up 3

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h) $y = -\frac{1}{2}(x - 4) = -\frac{1}{2}x + 2$ m, y-int

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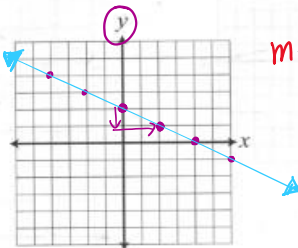
(g) $y = \frac{3}{2}x + 1$



$m = \frac{3 \text{ rise } \uparrow}{2 \text{ run } \leftrightarrow}$ Up 3 Right 2

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(h) $y = -\frac{1}{2}(x-4) = -\frac{1}{2}x + 2$



$m = \frac{-1 \text{ rise}}{2 \text{ run}}$ 1 Down 2 Right

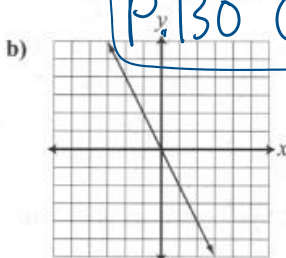
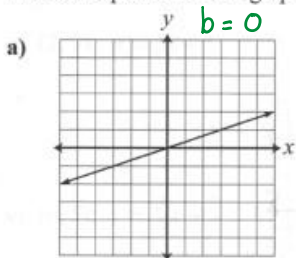
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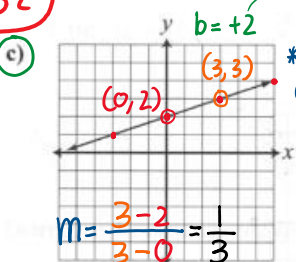
$y = mx + b$

FW
P.130 Q6, 9 (all)

9. Write an equation for the graph.

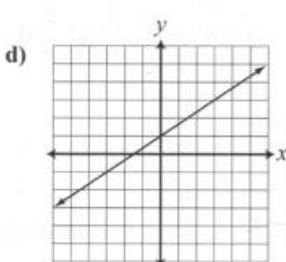


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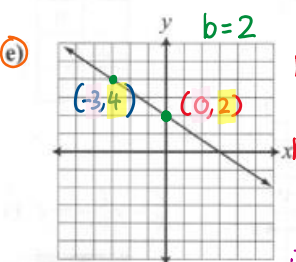


$y = mx + b$
* To get slope m :
① pick 2 good pts.
(0, 2) and (3, 3)
 $x_1 \ y_1 \quad x_2 \ y_2$
 $m = \frac{y_1 - y_2}{x_1 - x_2} = \frac{2 - 3}{0 - 3}$
 $m = \frac{-1}{-3} = \frac{1}{3}$

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

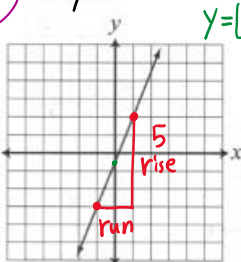


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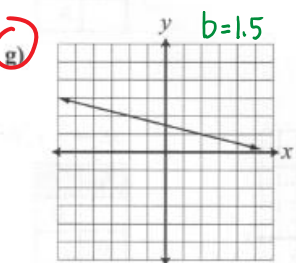


$m = \frac{y_1 - y_2}{x_1 - x_2}$
 $m = \frac{4 - 2}{-3 - 0} = \frac{2}{-3}$ slope
 $y = mx + b$
 $y = -\frac{2}{3}x + 2$

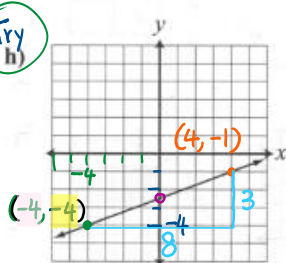
$y = mx + b$
 $y = -0.5$



$m = \frac{\text{rise}}{\text{run}} = \frac{+5}{2}$
 $y = \frac{5}{2}x - 0.5$
 $\frac{5x}{2}$



Try (h)



$m = \frac{y_1 - y_2}{x_1 - x_2}$
 $m = \frac{-4 - (-1)}{-4 - 4}$ or
 $m = \frac{-4 + 1}{-8} = \frac{-3}{-8}$

$b = -2.5$ $m = \frac{3}{8}$
 $y\text{-int}$
 $V = mx + b$
Ans: $V = \frac{3}{8}x - 2.5$

$$b = -2.5 \quad m = \frac{3}{8}$$

y-int

$$y = mx + b$$

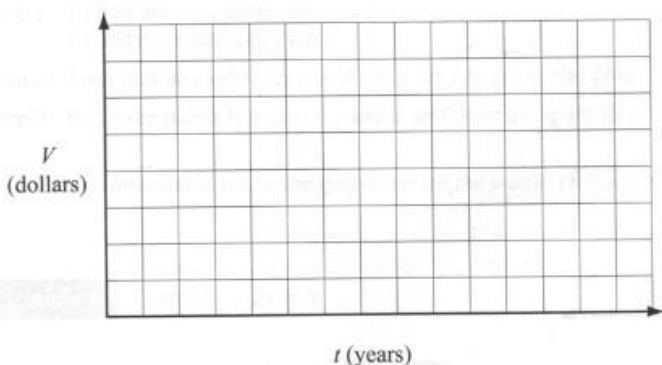
Ans: $y = \frac{3}{8}x - 2.5$

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10. The value (V) in dollars of a stereo bought is given by the equation $V = -100t + 600$ where t is the number of years since first buying the stereo.
- a) Find the value of the stereo after zero, two and four years.

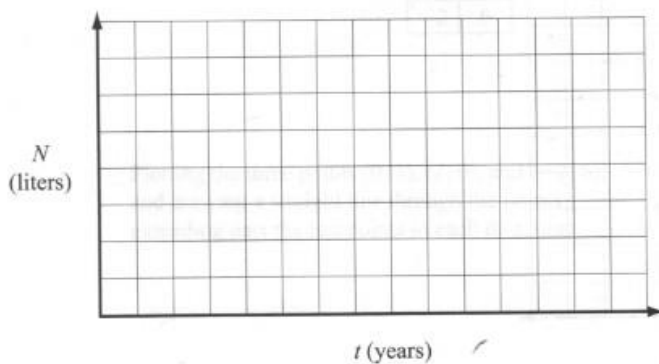
- b) Graph the equation and then use the graph to estimate the value of the stereo after $3\frac{1}{2}$ years.



11. The number of liters (N) of soft drinks consumed each year by the average Canadian teenager is approximated by the equation $N = 0.4t + 20$, where t is the age.

- a) Find the number of liters of soft drinks consumed at age 13, 14 and 15.

- b) Graph the equation and use the graph to estimate the amount of soft drinks consumed by a 19 year old.

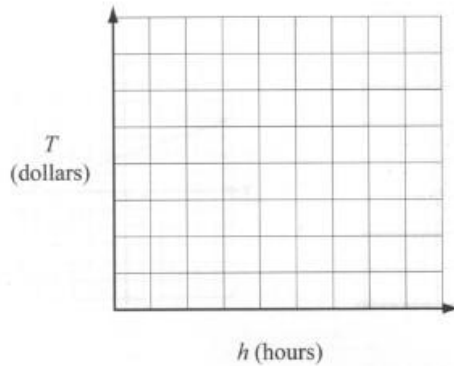


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12. The cost (T) in dollars of dues and fees at a health spa is $T = 80h + 100$, where h is the number of hours spent with a personal trainer.

a) Find the cost for a member who uses two, four or eight hours with a personal trainer.

b) Graph the equation and then use the graph to estimate the cost of dues and fees for six hours of a personal trainer.



13. The temperature in degrees celsius (T) in Victoria, BC on July 1, 2008 could be approximated by $T = -1.2h + 20$, where h is the number of hours since 5:00 pm.

a) Find the temperature at 3:00 pm, 7:00 pm and 9:00 pm.

b) Graph the equation and use the graph to estimate the temperature at 1:00 pm.

