Chapter 7, Lesson 4

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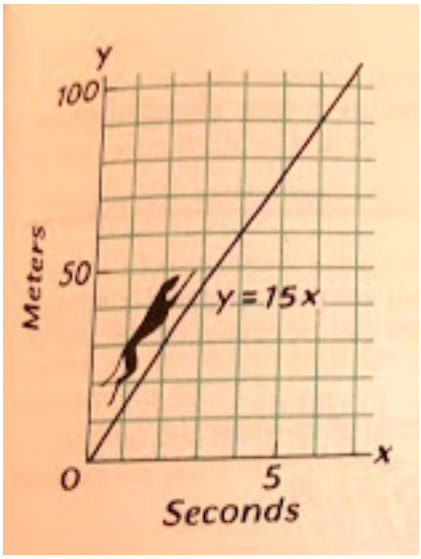
Suppose that a greyhound spots a cat 30 meters away. If the greyhound runs toward the cat at a speed of 15 meters per second and the cat runs away at a speed of 10 meters per second, how long will it take the greyhound to catch up with the cat?

speed of greyhound = 15 m/s
speed of cat = 10 m/s

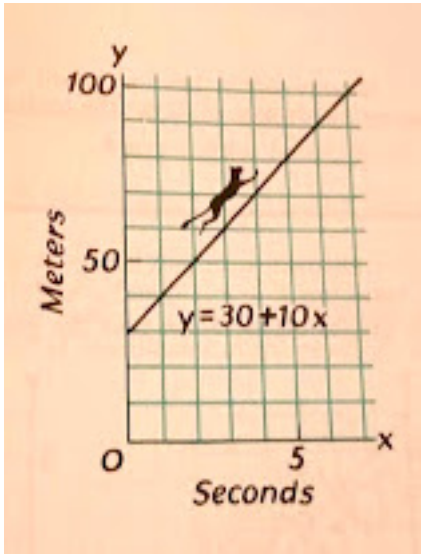
time (seconds)	0	1	2	3	…
distance (dog)	0	15	30	45	…
distance (cat)	30	40	50	60	…

x = time (s) y = distance (m)

Greyhound



Cat



$$y = 15x$$
$$\underline{-1(y = 10x + 30)}$$

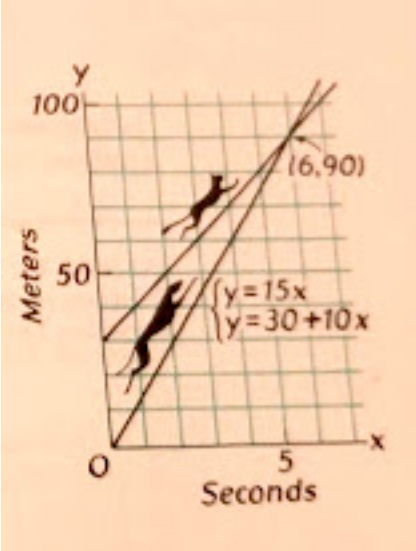
$$y = 15x$$
$$\underline{-y = -10x - 30}$$

$$0 = 5x - 30$$
$$+30 \qquad +30$$

$$\frac{30 = 5x}{5}$$

$6 = x$ so it will take 6 seconds.

The graphical way to solve the problem is to put both equations on the same graph. The solution is where the two lines intersect: (6,90).



Example 1
Solve the following simultaneous equations by graphing.

$x + y = 6$
$y = 2x$

Graph by Finding Intercepts

y-intercept $x = 0$

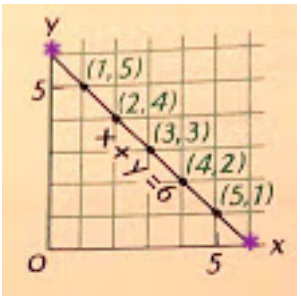
$0 + y = 6$
$y = 6$
(0,6)

x-intercept $y = 0$

$x + 0 = 6$

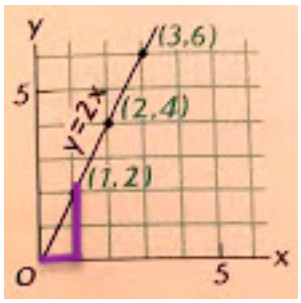
$x = 6$

(6,0)



Graph by Slope-Intercept

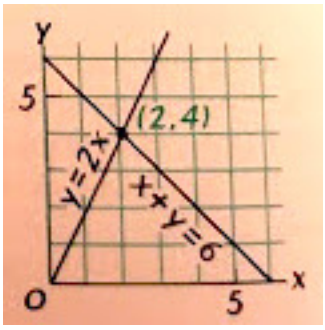
$y = mx + b$



$y = 2x$

$m = 2$ —> $rise = 2$ $run = 1$

$b = 0$ —> (0,0)



Solution is where the two lines intersect: (2,4). You can check by plugging in x and y.

$y = 2x$

$4 = 2 \cdot 2$

$x + y = 6$

$2 + 4 = 6$

Example 2
Solve the following simultaneous equations by graphing.

$$x + 4y = 8$$

$$y = \frac{1}{2}x + 5$$

Graph by Finding Intercepts

y-intercept $x = 0$

$0 + 4y = 8$
$y = 2$
(0,2)

x-intercept $y = 0$

$x + 0 = 8$
$x = 8$
(8,0)

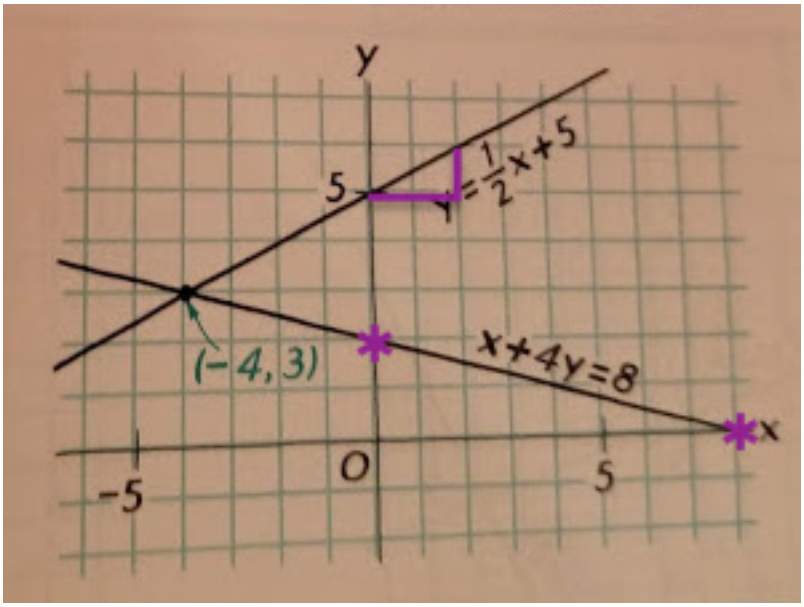
Graph by Slope-Intercept

$\underline{y = mx + b}$

$$y = \frac{1}{2}x + 5$$

$$m = \frac{1}{2} \quad \text{—> } rise = 1 \quad run = 2$$

$b = 5$ —> (0,5)



Solution is where the two lines intersect: (−4,3). You can check by plugging in x and y.

$$-4 + 4 \cdot 3 = 8 \qquad 3 = \frac{1}{2} \cdot -4 + 5$$

$$-4 + 12 = 8 \qquad 3 = -2 + 5$$

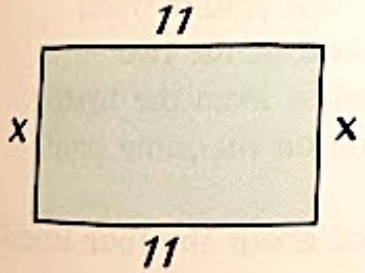
$$8 = 8 \qquad 3 = 3$$

Homework

Set I

1. Solve each of the following equations for the variable indicated.
   a) For x: $y = ax + b$
   b) For x: $ax + by = c$
   c) For y: $ax + by = c$

2. Find the length of this rectangle's sides labeled x



   a) if its perimeter is 36.
   b) if its area is $x + 36$.

   Check your answers.

3. The British eat more candy than do any other people in the world: about eight ounces per person per week.

About how many ounces of candy

a) do five people in Britain eat in four weeks?

b) do x people in Britain eat in y weeks?

How many weeks would it take

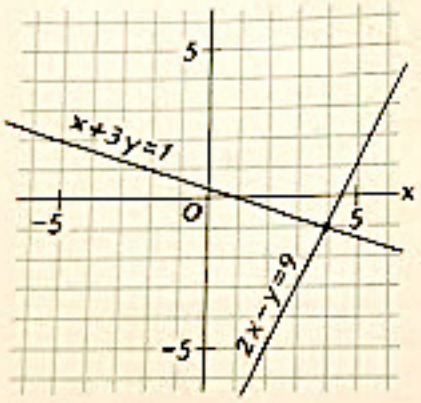
c) five people to eat 1,000 ounces of candy?

d) x people to eat z ounces of candy?

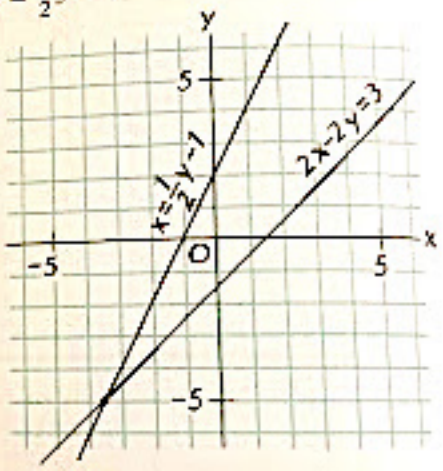
Set II

Use the graphs of the following pairs of simultaneous equations to find their solutions. Check each answer by showing that it makes both equations true.

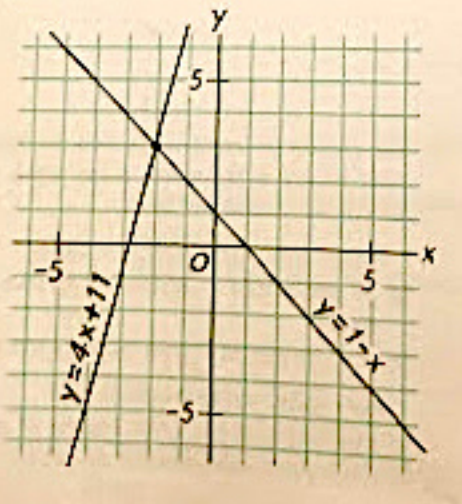
4. $x + 3y = 1$
   $2x - y = 9$



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



5. $y = 4x + 11$
$y = 1 - x$



7. This exercise is about the simultaneous equations

$$x + 3y = 3$$
$$x + y = 5$$

a) Graph the two equations on one pair of axes.
b) Write the equation that results from adding the two equations.
c) Graph that equation on the same pair of axes.
d) Write the equation that results from subtracting the second of the two simultaneous equations from the first.
e) Graph that equation on the same pair of axes.
f) What do you notice about the four lines?

8. This exercise is about the simultaneous equations

$$2x + y = 8$$
$$2x - y = 4$$

Follow the instructions given in exercise 7 and answer the question asked in part f.

Find solutions to each of the following pairs of simultaneous equations by graphing them.

Check each solution by seeing if it makes each equation in the pair true.

9. $y = 2x$
$x + y = 3$

10. $y = x + 4$
$x + y = -2$

11. $3x - 2y = 6$
$y = -\frac{1}{2}x - 3$

12. $y = 7 - x$
$x - y = 2$