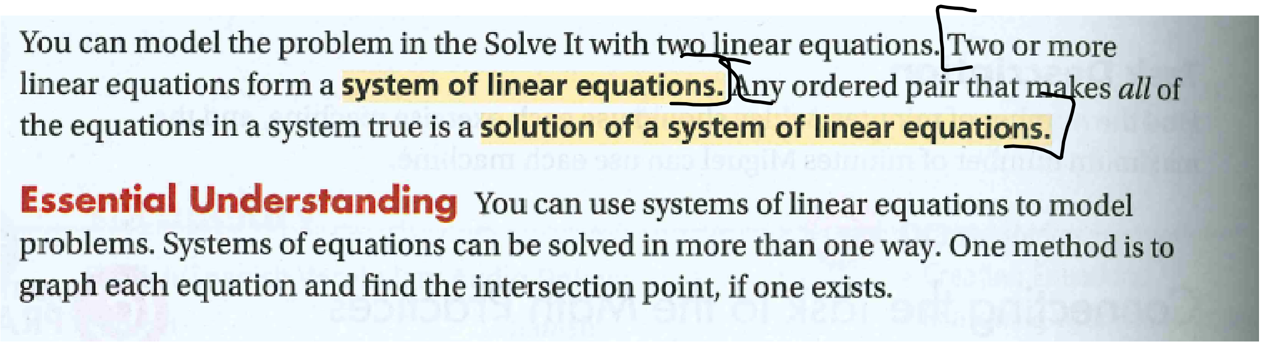
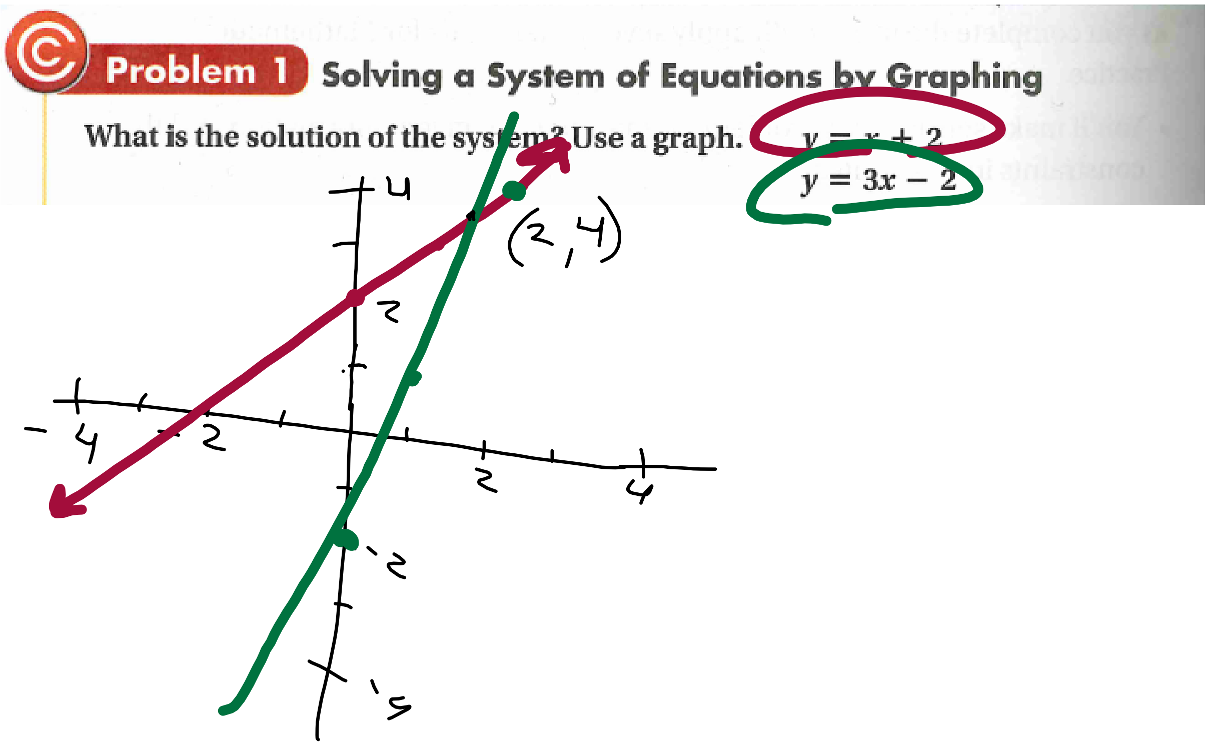


You can model the problem in the Solve It with two linear equations. Two or more linear equations form a **system of linear equations.** Any ordered pair that makes *all* of the equations in a system true is a **solution of a system of linear equations.**

Essential Understanding You can use systems of linear equations to model problems. Systems of equations can be solved in more than one way. One method is to graph each equation and find the intersection point, if one exists.



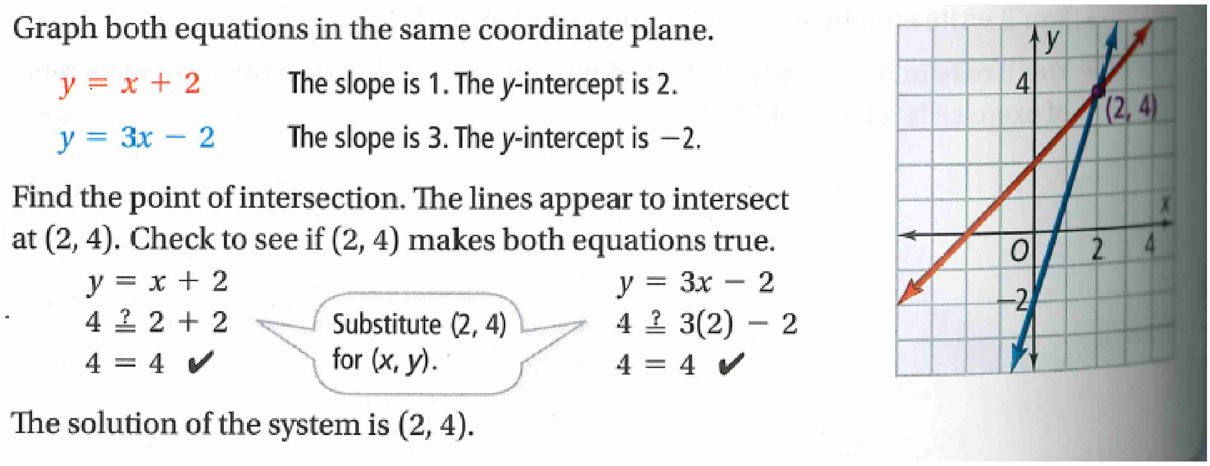
Problem 1 Solving a System of Equations by Graphing

What is the solution of the system? Use a graph.

$y = x + 2$

$y = 3x - 2$

(2, 4)



Graph both equations in the same coordinate plane.

$y = x + 2$ The slope is 1. The y-intercept is 2.

$y = 3x - 2$ The slope is 3. The y-intercept is -2.

Find the point of intersection. The lines appear to intersect at (2, 4). Check to see if (2, 4) makes both equations true.

$y = x + 2$

$4 \overset{?}{=} 2 + 2$

$4 = 4$ ✓

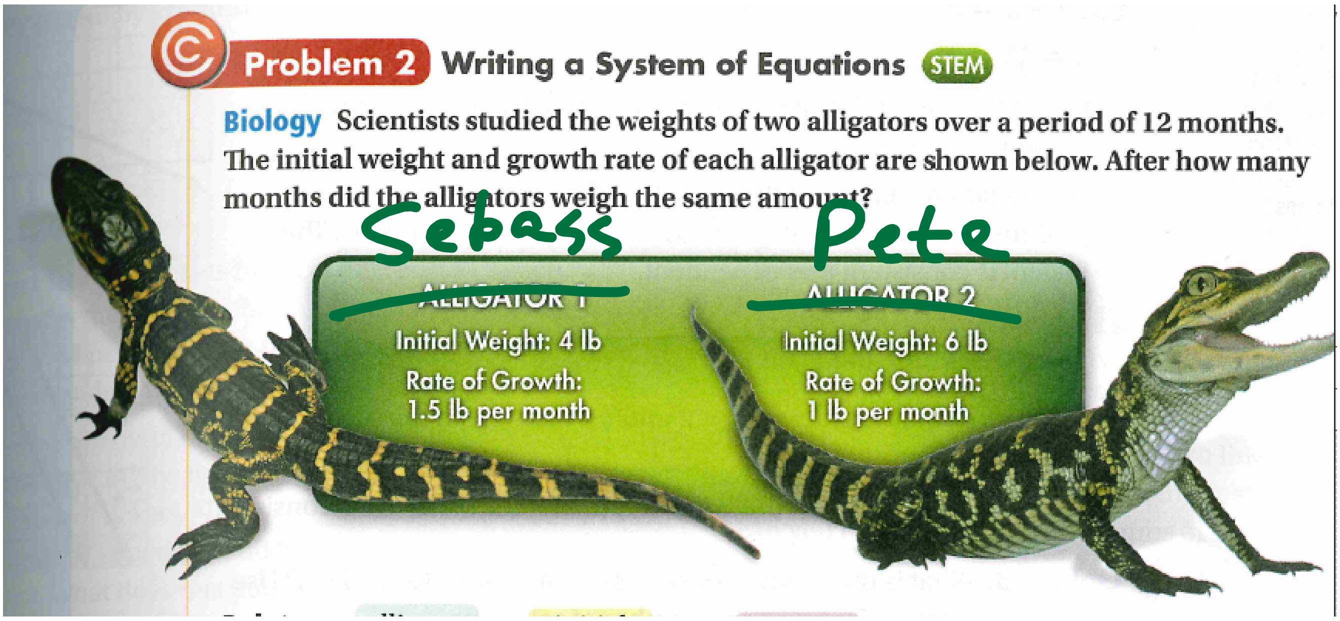
Substitute (2, 4) for (x, y).

$y = 3x - 2$

$4 \overset{?}{=} 3(2) - 2$

$4 = 4$ ✓

The solution of the system is (2, 4).



Problem 2 Writing a System of Equations STEM

Biology Scientists studied the weights of two alligators over a period of 12 months. The initial weight and growth rate of each alligator are shown below. After how many months did the alligators weigh the same amount?

Sebass

~~ALLIGATOR 1~~

Initial Weight: 4 lb

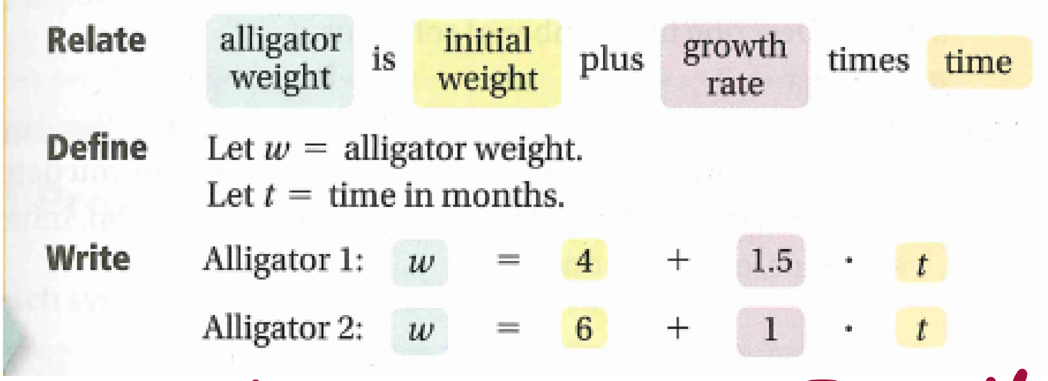
Rate of Growth:
1.5 lb per month

Pete

~~ALLIGATOR 2~~

Initial Weight: 6 lb

Rate of Growth:
1 lb per month

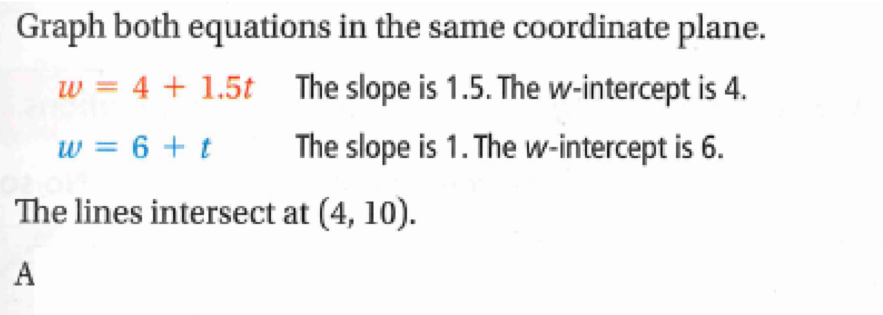


Relate alligator weight is initial weight plus growth rate times time

Define Let w = alligator weight.
Let t = time in months.

Write Alligator 1: $w = 4 + 1.5 \cdot t$
Alligator 2: $w = 6 + 1 \cdot t$

Sebass : $w = 1.5t + 4$
Pete : $w = t + 6$



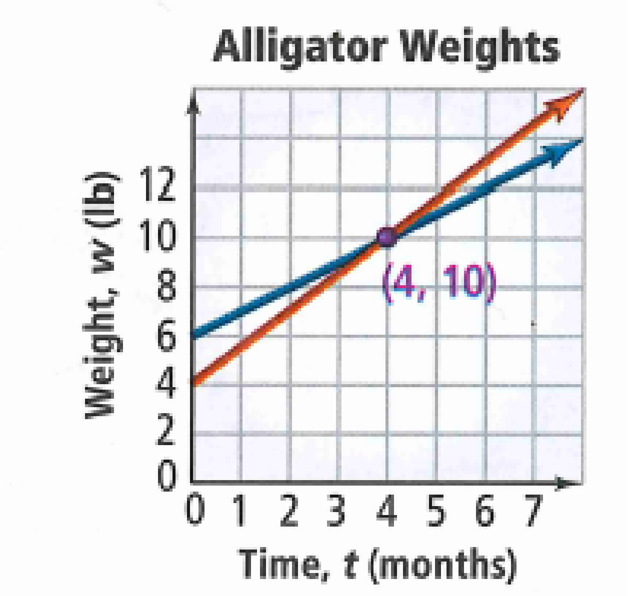
Graph both equations in the same coordinate plane.

$w = 4 + 1.5t$ The slope is 1.5. The w-intercept is 4.

$w = 6 + t$ The slope is 1. The w-intercept is 6.

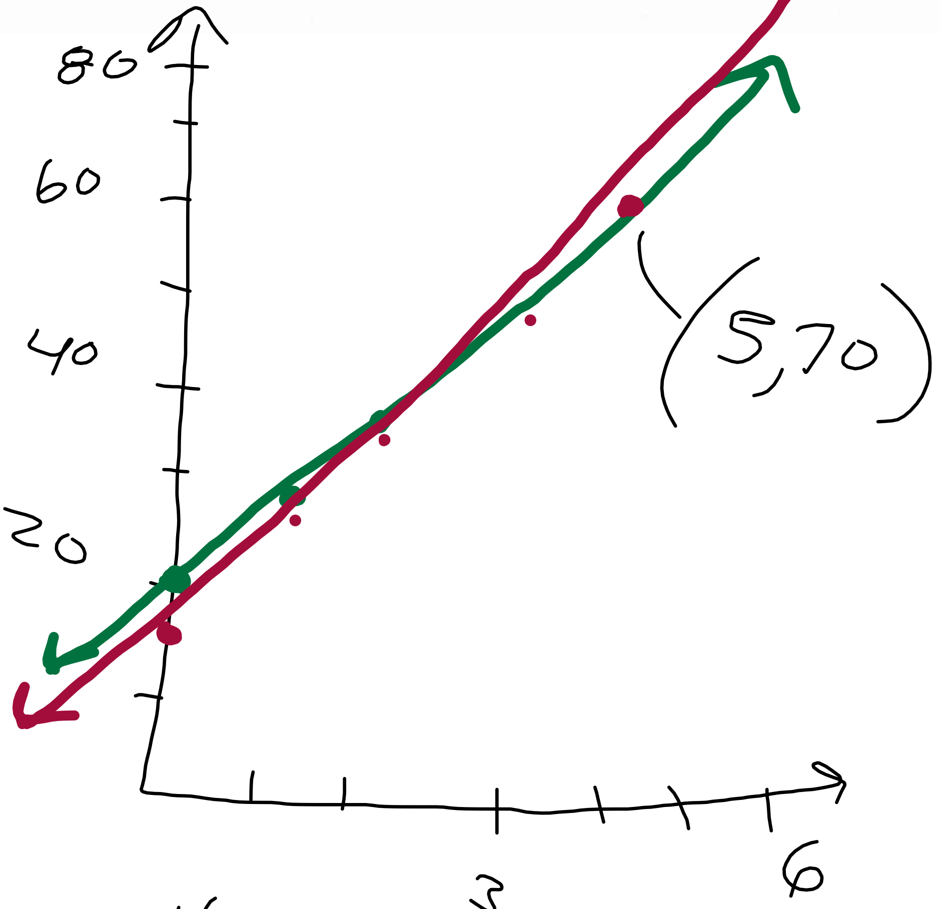
The lines intersect at (4, 10).

A

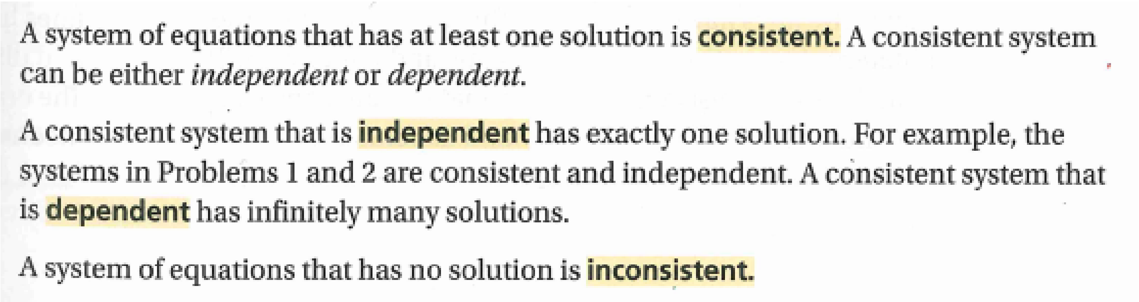


On the 4th month both Alligators weigh 10lbs.

One satellite radio service charges $10 per month plus an activation fee of $20. A second service charges $11 per month plus an activation fee of $15. In what month was the cost of the service the same?



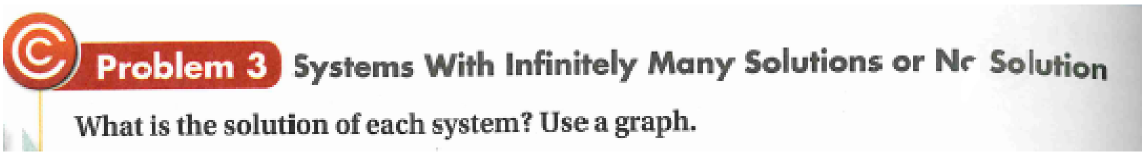
On the 5th month they both cost $70.



A system of equations that has at least one solution is **consistent.** A consistent system can be either *independent* or *dependent*.

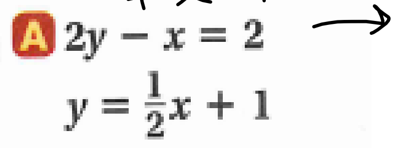
A consistent system that is **independent** has exactly one solution. For example, the systems in Problems 1 and 2 are consistent and independent. A consistent system that is **dependent** has infinitely many solutions.

A system of equations that has no solution is **inconsistent.**



Problem 3 Systems With Infinitely Many Solutions or No Solution

What is the solution of each system? Use a graph.

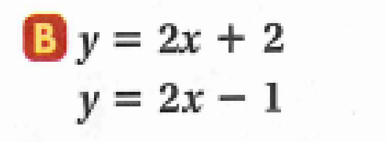


$$\overset{+x}{2y - x} = \overset{+x}{2} \longrightarrow \frac{2y}{2} = \frac{2+x}{2}$$

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

$$y = 1 + \tfrac{1}{2}x$$

Consistent & Dependent

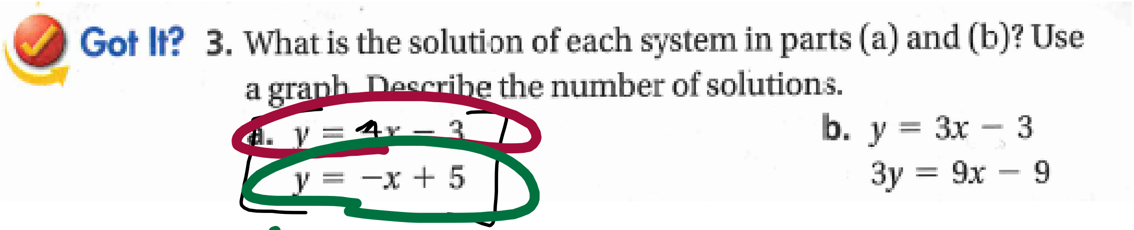


B $y = 2x + 2$

$y = 2x - 1$

Inconsistent

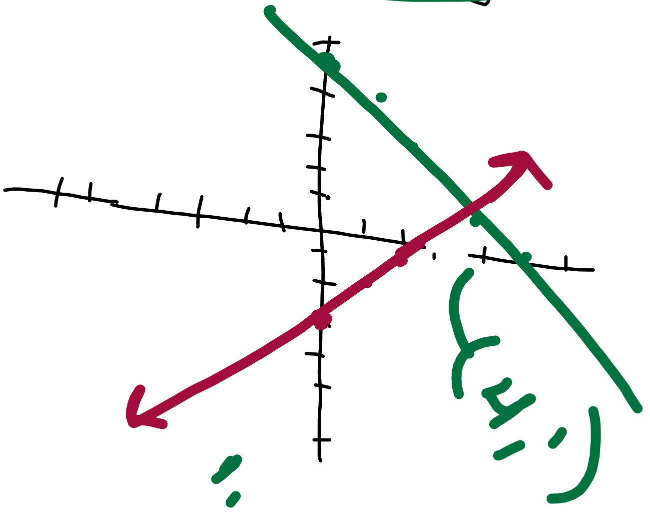
No solution

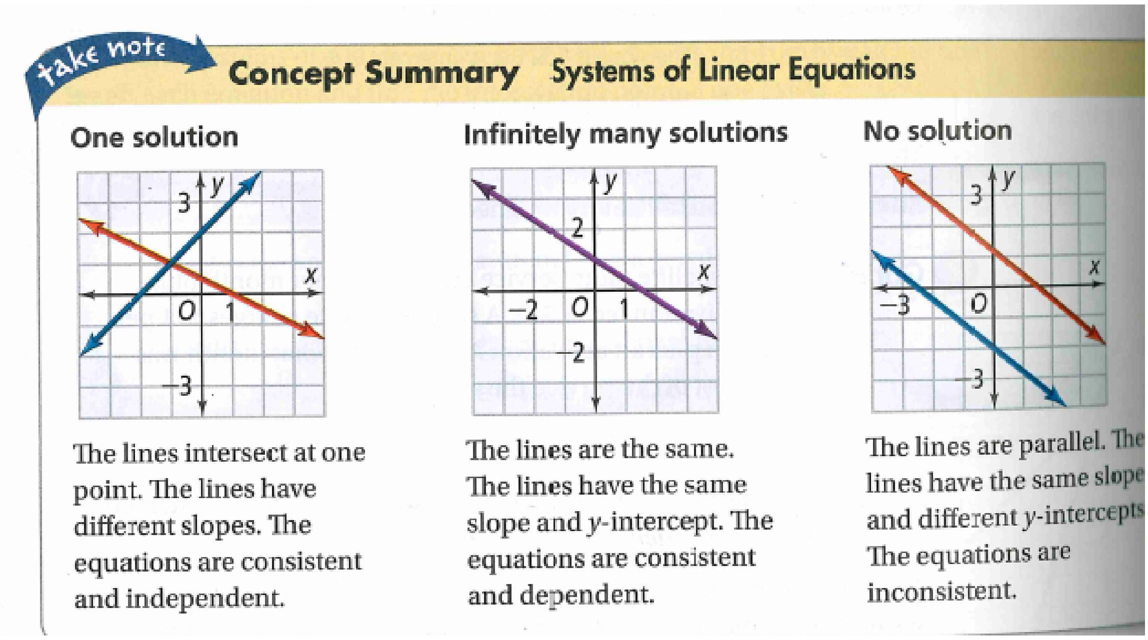


Got It? **3.** What is the solution of each system in parts (a) and (b)? Use a graph. Describe the number of solutions.

a. $y = 1x - 3$
$y = -x + 5$

b. $y = 3x - 3$
$3y = 9x - 9$





Concept Summary Systems of Linear Equations

One solution

The lines intersect at one point. The lines have different slopes. The equations are consistent and independent.

Infinitely many solutions

The lines are the same. The lines have the same slope and y-intercept. The equations are consistent and dependent.

No solution

The lines are parallel. The lines have the same slope and different y-intercepts. The equations are inconsistent.

Lesson Check 5.1