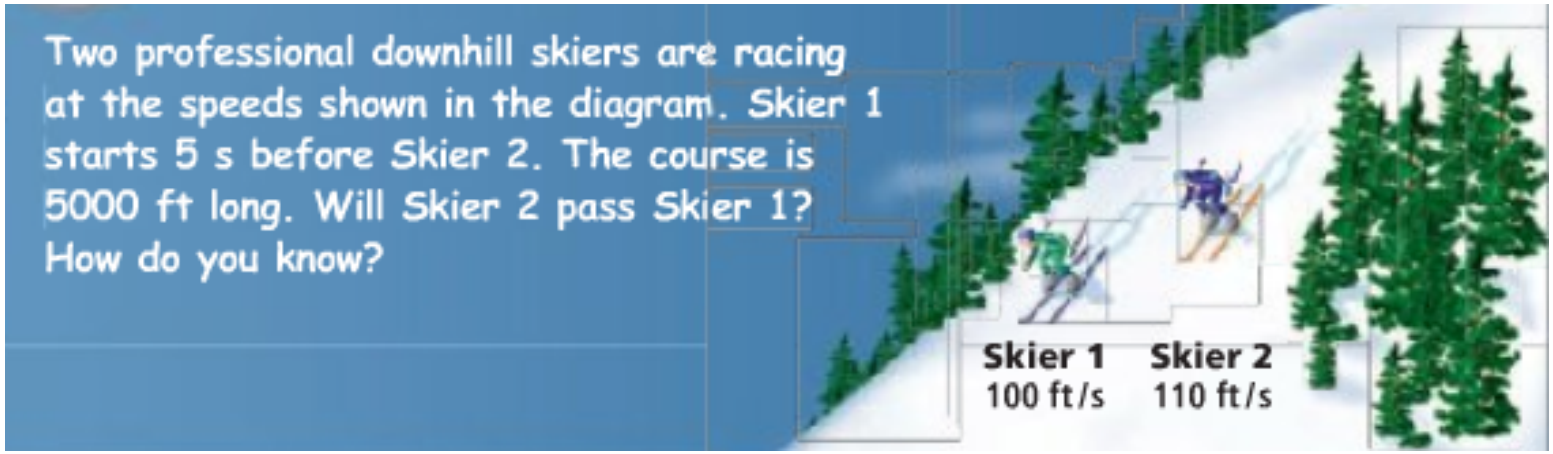
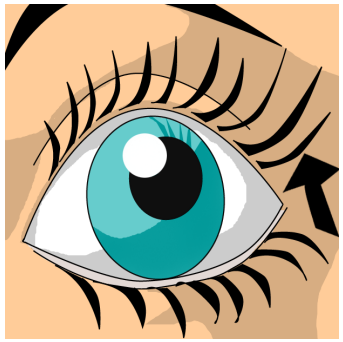
# 6-1: Solving Systems of Linear Equations Using Graphing

# Eye Opener


Two professional downhill skiers are racing at the speeds shown in the diagram. Skier 1 starts 5 s before Skier 2. The course is 5000 ft long. Will Skier 2 pass Skier 1? How do you know?
Skier 1
100 ft/s
Skier 2
110 ft/s



**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.

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.

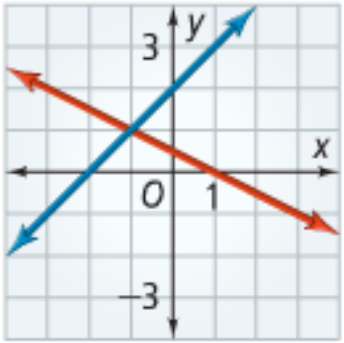
A consistent system that is **dependent** has infinitely many solutions.

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

take note

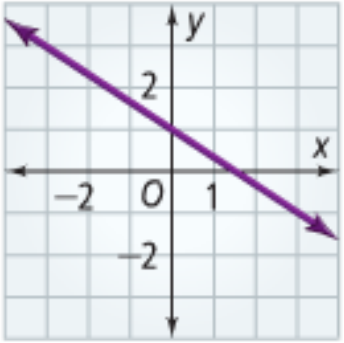
## Concept Summary Systems of Linear Equations

### One solution



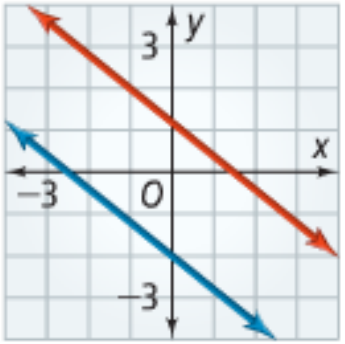

The lines intersect at one point. The lines have different slopes. The equations are consistent and independent.

### 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.

# Solving Systems by Graphing

Pros:

- Very Visual
- Can use Graphing Calculator and "Trace" or "Table" to Solve

Cons:

- Least reliable method for accuracy; requires checking
- Difficult or Impossible to find solution when values are not integers
- Requires graph paper and ruler if doing by hand
- Using graphing calculator requires equations to be in slope-intercept form
- Using graphing calculator takes time scrolling or adjusting table set to find point of intersection

Solve by graphing by hand:

$y = 2x - 3$ and $y = x - 1$

(3, 2)

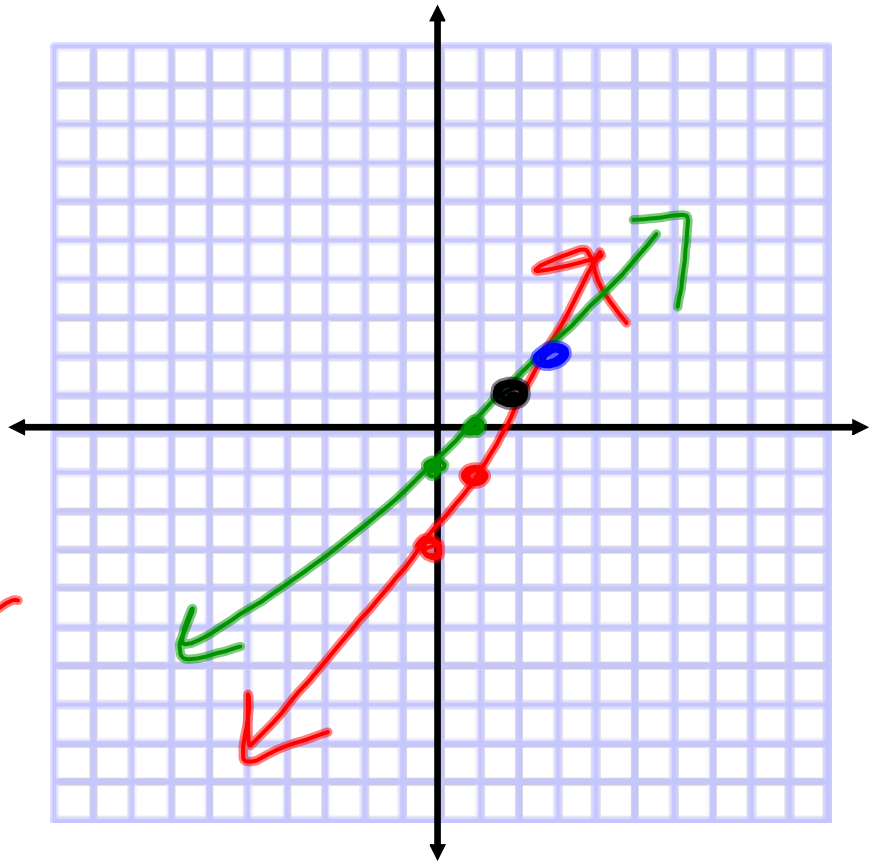
$2 = 2(3) - 3$
$= 6 - 3$
$\neq 3$

$2 = 3 - 1$ ✓

(2, 1)

Check solution: $1 = 2 - 1$ ✓

$1 = 2(2) - 3$
$= 4 - 3 = 1$ ✓



**Activity**

**Solve the system using a graph.**

Solve by graphing calculator: $y = 2x - 3$ and $y = x - 1$

**Step 1** Enter the equations in the y= screen.

**Step 2** Graph the equations. Use a standard graphing window.

**Step 3** Use the calc feature. Choose **INTERSECT** to find the point where the lines intersect.

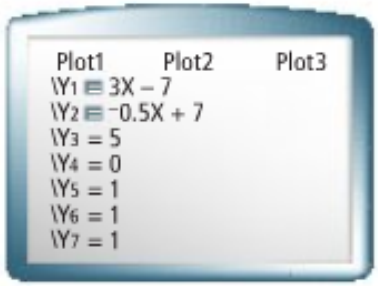
**Activity**

**Solve the system using a table.**

Solve by graphing calculator: $y = 2x - 3$ and $y = x - 1$

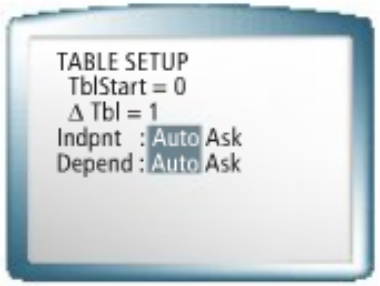
**Step 1**

Enter the equations in the y= screen.



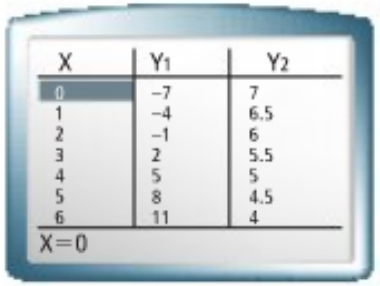

**Step 2**

Use the tblset function. Set TblStart to 0 and △Tbl to 1.




**Step 3**

Press table to show the table on the screen.



| X | Y1 | Y2 |
|---|---|---|
| 0 | −7 | 7 |
| 1 | −4 | 6.5 |
| 2 | −1 | 6 |
| 3 | 2 | 5.5 |
| 4 | 5 | 5 |
| 5 | 8 | 4.5 |
| 6 | 11 | 4 |

X=0

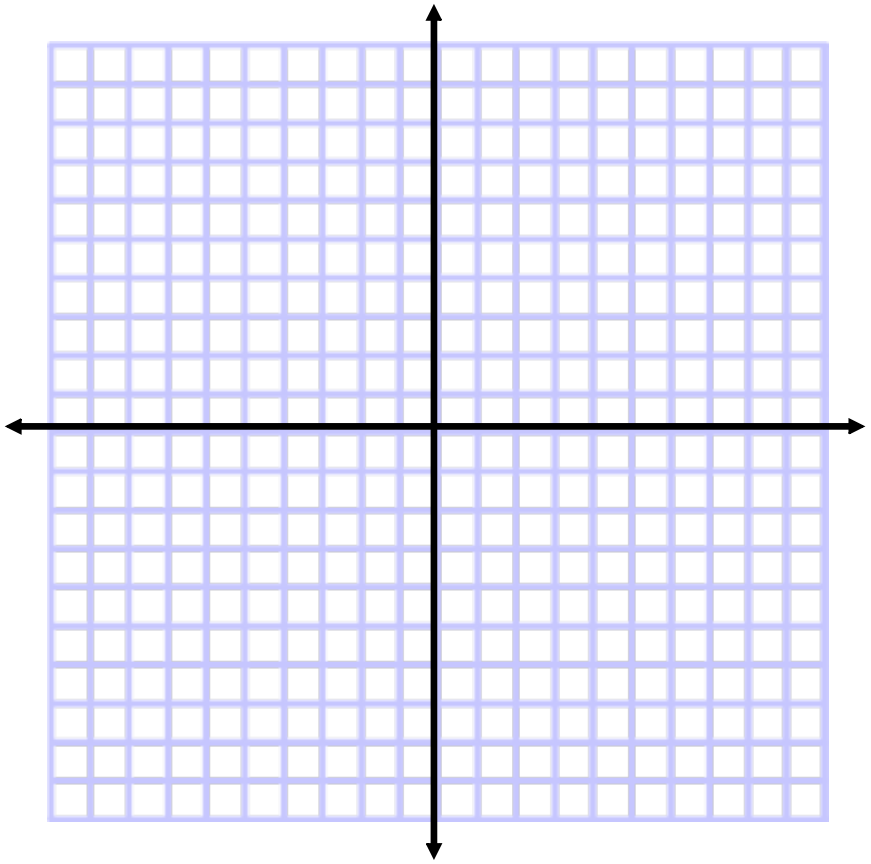
Which $x$-value gives the same value for $Y_1$ and $Y_2$?

Plant A is 6 cm tall and growing at a rate of 4 cm/day. Plant B is 10 cm tall and grawing at a rate of 2 cm/day. After how many days will the plants be the same height. What will their height be at that time?

$y = 4a + 6$

$y = 10 + 2a$

$(2, 14)$



Solve by graphing: $2x + y = 1$ and $8x = -4y - 4$

$-2x$

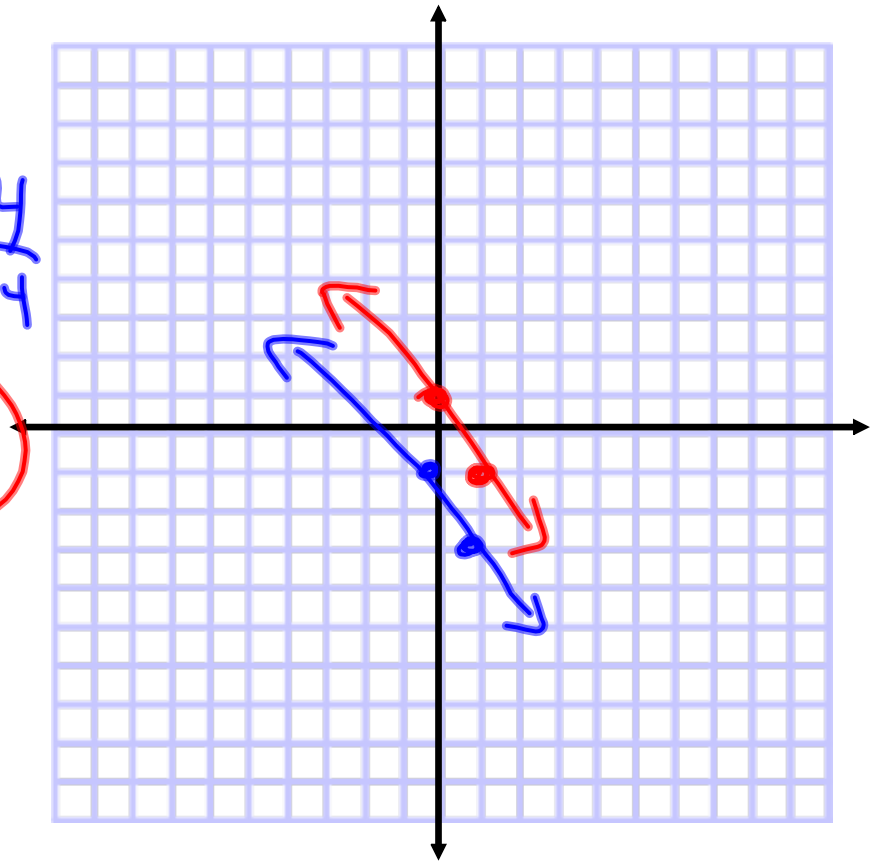
$y = -2x + 1$

$-8x \quad +4y$

$\frac{4y}{4} = \frac{-8x}{4} - \frac{4}{4}$

$y = -2x - 1$

None



Solve by Graphing: $2x + 4y = 8$ and $1/2x + y = 2$

$y = mx + b$

$2x + 4y = 8$

$2x + 4y = 8 \cdot 2x$

$-2x$

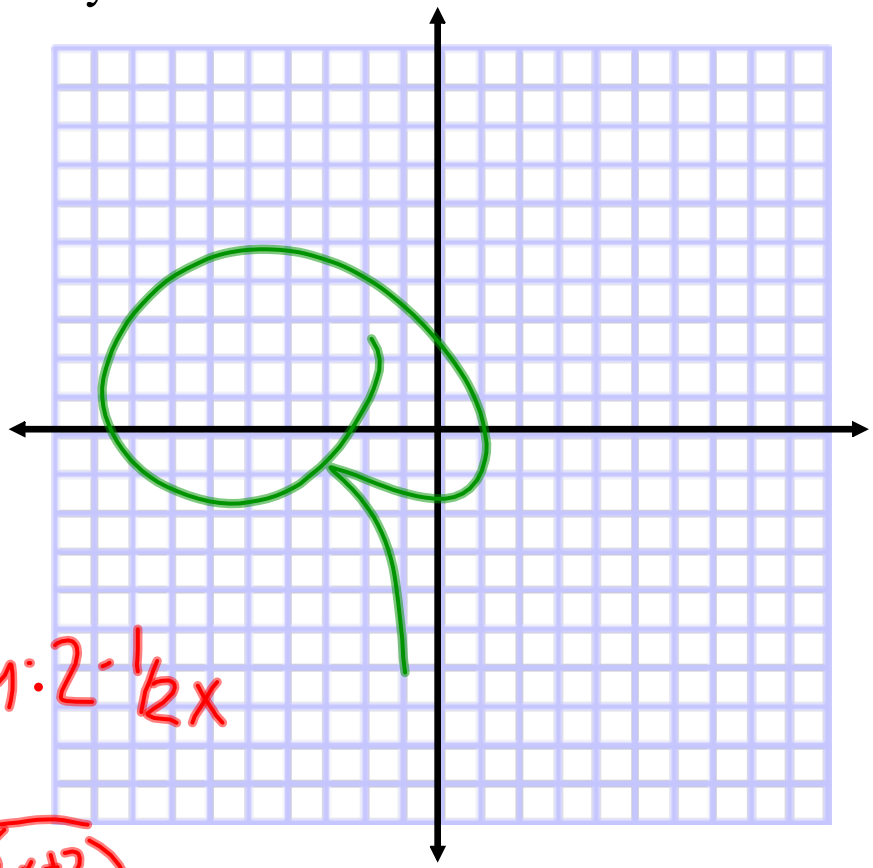
$4y = \frac{8}{4} - \frac{2x}{4}$

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

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

$\cdot 1/2x$

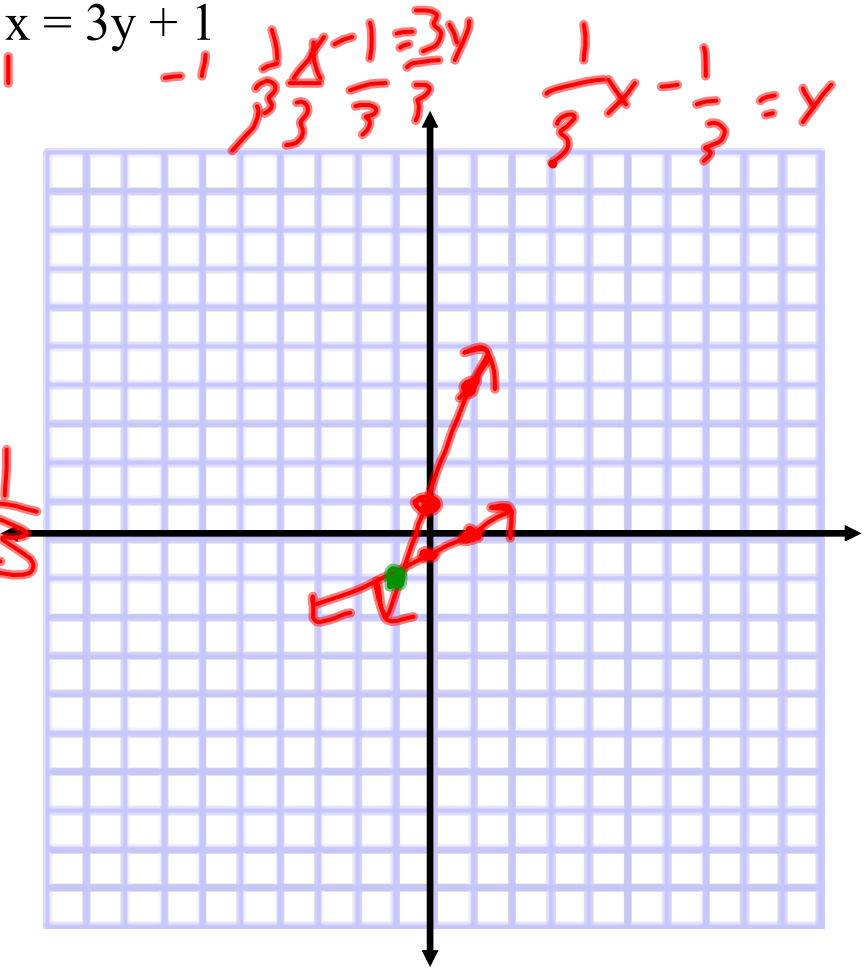
$y = -\frac{1}{2}x + 2$



Solve by Graphing: $y = 3x + 1$ and $x = 3y + 1$

$x = 3y + 1 \rightarrow y = \frac{1}{3}x - \frac{1}{3}$

$(-.5, -.5)$



Is (-1, 5) a solution for the system: $x + y = 4$ and $x = -1$

(x, y) ✓

$-1 + 5 = 4$ ✓

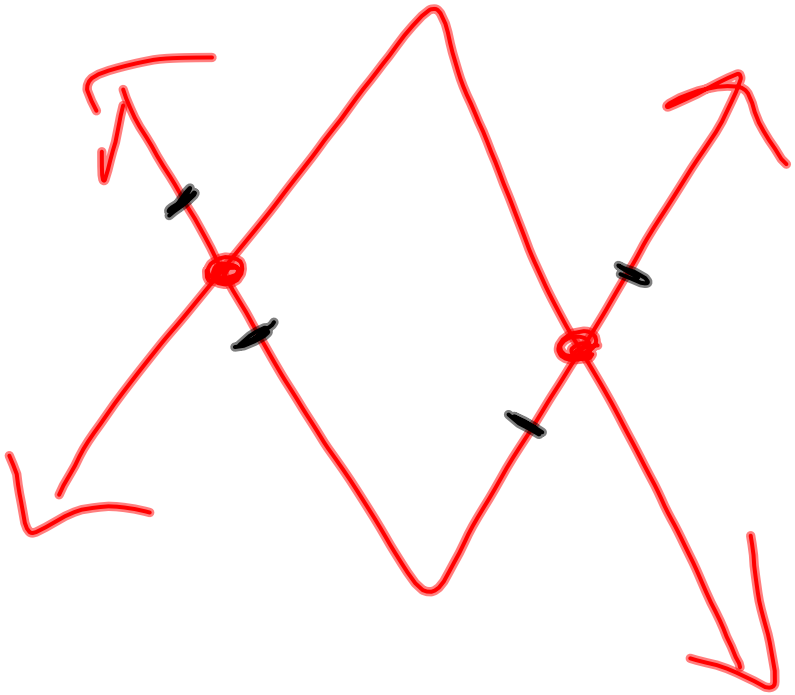
Yes

$$3y - 7 = -2|x+3| + 5$$

$+7$ $+7$

$$\div 3 \qquad 12 \div 3$$

$$y = -\tfrac{2}{3}|x+3| + 4$$



Is (3, 4) a solution for

$x + y = 7$

$x - y = -1$

$y = -x + 7$

$x + 1 = y$