## 7.1 Solve Linear Systems by Graphing

Goal • Graph and solve systems of linear equations.

**VOCABULARY**

Systems of linear equations - 2 or more linear equations

Is (2,3) a solution?

Ex. $x + y = 5$
$2x + y = 6$
} linear system

Check (x, y) = (2,3)

$2 + 3 \stackrel{?}{=} 5$
$5 = 5$ ✓

$2(2) + 3 \stackrel{?}{=} 6$
$4 + 3 \stackrel{?}{=} 6$
$7 \neq 6$ X

(2,3) is not a solution.

Solution of a system of linear equations. An ordered pair (x,y) that makes all equations true. The point of intersection.

~~Consistent independent system~~

**SOLVING A LINEAR SYSTEM USING THE GRAPH-AND-CHECK METHOD**

**Step 1** Graph both equations in the same coordinate plane. For ease of graphing, you may want to write each equation in slope-intercept form. $y = mx + b$
standard form - graph using the intercepts.

**Step 2** Estimate the coordinates of the intersection point.

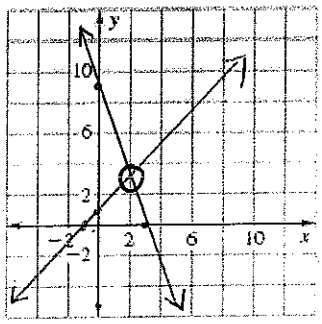
**Step 3** Check the coordinates algebraically by substituting into each equation of the original linear system. ⇐ Mandatory

**Example 1 - *Use the graph-and-check method*** ( Neatness counts)

**Solve the linear system: $3x + y = 9$** **Equation 1**
$x - y = -1$ **Equation 2**

**Solution**

1. Graph both equations. Approach 1




x/y int.

x-int.
$3x + 0 = 9$
$\frac{3x}{3} = \frac{9}{3}$
$x = 3$

| x | y |
|---|---|
| 3 | 0 |
| 0 | 9 |

y-int.
$3(0) + y = 9$
$y = 9$

x-int let $y = 0$
$x - 0 = -1$
$x = -1$

y-int.
$0 - y = -1$
$\frac{-y}{-1} = \frac{-1}{-1}$
$y = 1$

Approach 2

$3x + y = 9$
$-3x \quad -3x$
$y = -3x + 9$

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

| x | y |
|---|---|
| −1 | 0 |
| 0 | 1 |

$y = x + 1$

2. Estimate the point of intersection. The two lines appear to intersect at ( 2 , 3 ).

3. Check whether ( 2 , 3 ) is a solution by substituting 2 for $x$ and 3

for y in each of the original equations.

| Equation 1 | Equation 2 |
|---|---|
| $3x + y = 9$ | $x - y = -1$ |
| $3(2) + 3 \stackrel{?}{=} 9$ | $2 - 3 \stackrel{?}{=} -1$ |
| $6 + 3$ ✓ | ✓ |
| $9 = 9$ | $-1 = -1$ |

Because ( 2 , 3 ) is a solution of each equation in the linear system, it is a

solution of the linear system.

***Checkpoint*** **Solve the linear system by graphing.**

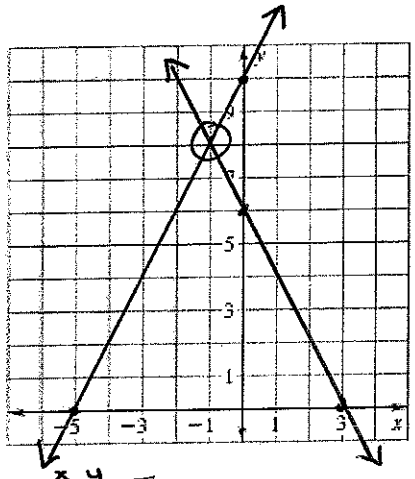
**1.** $2y + 4x = 12$
$2x - y = -10$

(0, 6)
(3, 0)

$2y + 4x = 12$
y-int. let $x = 0$
$\frac{2y}{2} = \frac{12}{2}$
$y = 6$
x-int. let $y = 0$
$\frac{4x}{4} = \frac{12}{4}$
$x = 3$

(0, 10)
(−5, 0)

$2x - y = -10$
y-int. let $x = 0$
$\frac{-1y}{-1} = \frac{-10}{-1}$
$y = 10$
x-int. $y = 0$
$\frac{2x}{2} = \frac{-10}{2}$
$x = -5$



x y
(−1, 8)

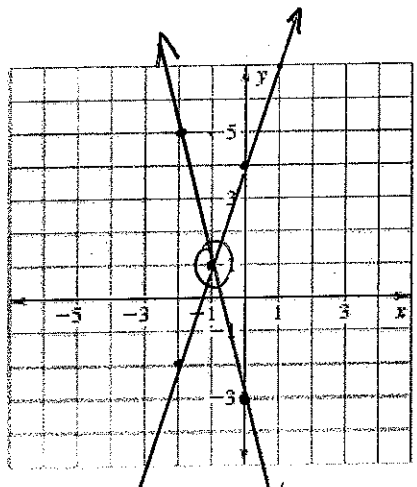
$2(8) + 4(-1) \stackrel{?}{=} 12$
$16 - 4 \stackrel{?}{=} 12$
$12 = 12$ ✓

$2(-1) - 8 \stackrel{?}{=} -10$
$-2 - 8 = -10$
$-10 = -10$ ✓

**2.** $2y = 6x + 8$
$4x + y = -3$
$-4x \quad -4x$

$\frac{2y}{2} = \frac{6x}{2} + \frac{8}{2}$
$y = 3x + 4$

$y = -4x - 3$
$\frac{-4}{1} = \frac{4}{-1}$



(−1, 1) Check...

**Example 2** - A business rents in-line skates and bicycles. During one day, the business has a total of 25 rentals and collects $450 for the rentals. It costs $15/day to rent the skates and $30/day to rent a bicycle. Find the number of pairs of skates rented and the number of bicycles rented. (Write and solve a linear system to solve this problem.)

$20+5 \stackrel{?}{=} 25$

$25 = 25$ ✓

$15(20)+30(5) \stackrel{?}{=} 450$

$300+150 = 450$

$450 = 450$ ✓

$x$ = # of skate rentals

$y$ = # of bikes rented

$x+y=25$

$15x+30y=450$

x-int. let $y=0$

$15x = 450$

$x = 30$ (30,0)

y-int. let $x=0$

$30y = 450$

$y = 15$ (0,15)

$x+y=25$

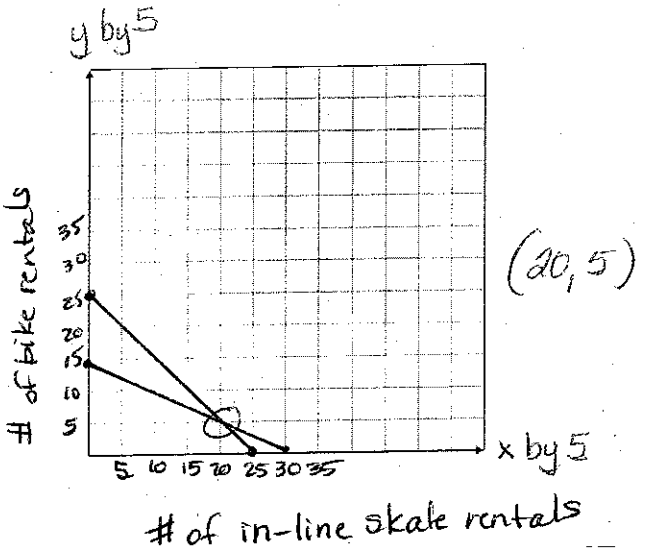
x-int $y=0$ (25,0)

$x=25$

y-int. $x=0$ (0,25)

$y=25$

The business rented 20 in-line skates and 5 bicycles.




**Example 3 – Solve the linear system by graphing. Check your solution.**

$\frac{1}{5}x - \frac{2}{5}y = \frac{-8}{5}$

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

(did not do in class)