

Systems of Linear Equations

Systems of Trees

ACTIVITY

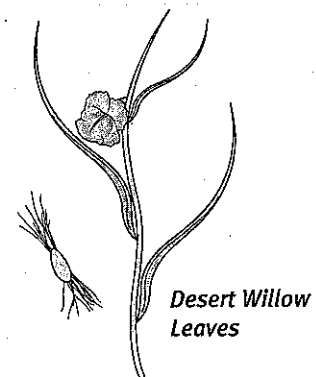
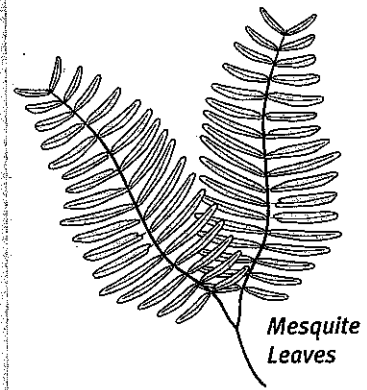
3.7

SUGGESTED LEARNING STRATEGIES: Marking the Text, Summarize/Paraphrase/Retell, Work Backwards, Create Representations, Group Presentation, Quickwrite, Activating Prior Knowledge

Bob decided to plant some trees in his yard. He bought a 10-gallon mesquite tree and a 50-gallon desert willow and planted them in his yard. After one year he was shocked at the growth of both trees, so he measured their heights. The mesquite was 5 ft tall, and the desert willow was 8 ft tall. The next year he measured again and found the mesquite was 6 ft 6 in. tall, and the desert willow was 8 ft 8 in. tall.

My Notes

1. List all the numerical information associated with each tree.
2. What information in the paragraph is not needed to find an equation that will predict the height of the trees in a given year?
3. If the trees grew at a constant rate the first two years, how tall were they when Bob planted them?
4. Let M be the height of the mesquite tree in inches. Find a linear equation that represents the height of the tree in a given year, t .
5. Find a linear equation that represents the height, W , in inches of the desert willow in a given year.
6. Could you use the equations you came up with in Questions 4 and 5 to predict the height at 1.5 years?
7. Is the domain continuous or discrete? Explain your reasoning.
8. What is the domain of the functions M and W ?



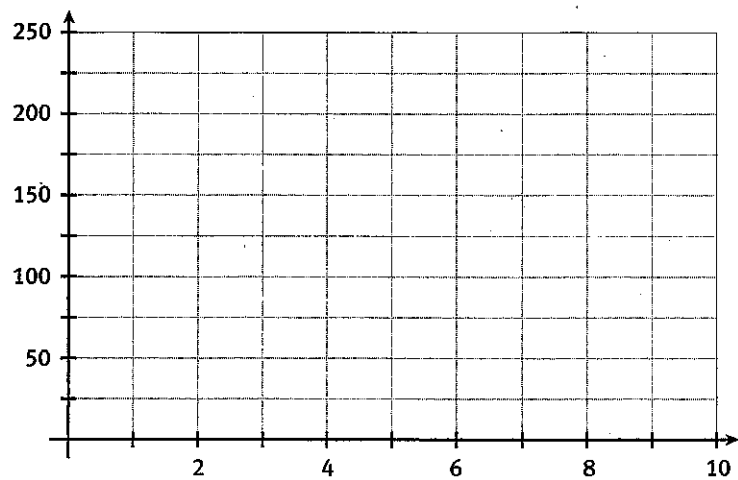
SUGGESTED LEARNING STRATEGIES: Create Representations, Quickwrite, Group Presentation, Think/Pair/Share

My Notes

9. Use the table below to help explain how the height of the mesquite tree compares to the height of the willow over time.

Year	M (inches)	W (inches)

10. Graph each of the equations on the following grid and use the graph to determine in what year the mesquite reaches the same height as the desert willow.



11. When the mesquite tree and the desert willow are the same height, what is true about the values of W and M ?

Systems of Trees

SUGGESTED LEARNING STRATEGIES: Create Representations, Quickwrite, Shared Reading, Interactive Word Wall, Think/Pair/Share

My Notes

12. Write and solve an equation to find the value of t when the mesquite tree and the desert willow are the same height.
13. What is the meaning of your solution in Question 12?
14. How does the solution you found in Question 12 relate to the table and the graph?

One way to categorize equations M and W is as a **system of linear equations**. The **solution to a system of linear equations** will always be the point where the two lines intersect. The value you determined in Question 12 was the solution to this particular system of linear equations.

Systems of linear equations can be solved in many different ways. One way is numerically.

15. Determine which ordered pair in the set $\{(2,2), (2,3), (2,4), (3,3)\}$ is the solution to the system of linear equations.

$$\begin{cases} y = -x + 5 \\ y = x + 1 \end{cases}$$

16. Create a table of values to find the solution to the following system of equations.

$$\begin{cases} y_1 = -x - 2 \\ y_2 = \frac{2}{3}x + 3 \end{cases}$$

x	y_1	y_2
-6		
-5		
-4		
-3		
-2		
-1		
0		
1		

ACADEMIC VOCABULARY

A **system of linear equations** is a collection of equations which are all considered simultaneously.

The word *linear* indicates that there will only be equations of lines in this collection.

A point, or set of points, is the **solution to a system of equations** in two variables, when it makes both equations true.

WRITING MATH

When working with two or more sets of data in a system of equations, the output variables can be differentiated by writing them with subscripts. For instance, y_1 and y_2 are used in problem 16.

SUGGESTED LEARNING STRATEGIES: Create Representations, Think/Pair/Share

My Notes

17. Create a table of values to find the solution to the following system of equations (use the My Notes space):

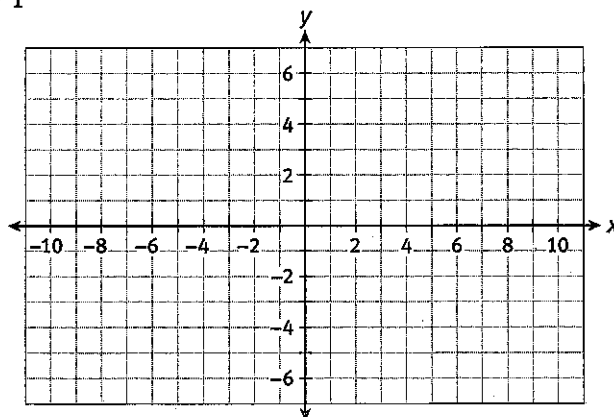
$$\begin{cases} y_1 = 5x + 4 \\ y_2 = 2x + 1 \end{cases}$$

18. What problems came up while solving the systems of equations numerically?

Another way to solve systems of linear equations is by graphing.

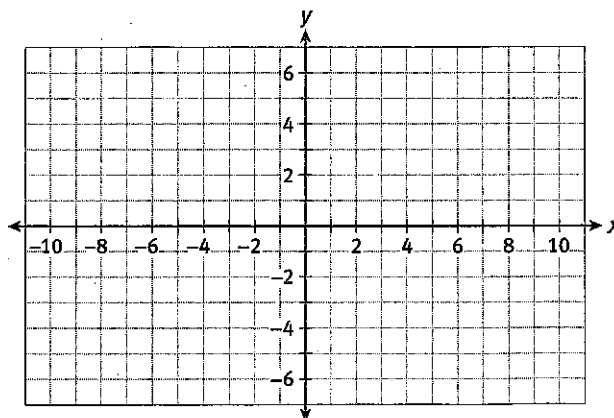
19. Graph the following system of equations and write out the solution.

$$\begin{cases} y = 2x - 4 \\ y = -\frac{1}{2}x + 1 \end{cases}$$



20. Graph the following system of equations and write out the solution.

$$\begin{cases} y = 3x - 4 \\ y = 3x + 2 \end{cases}$$

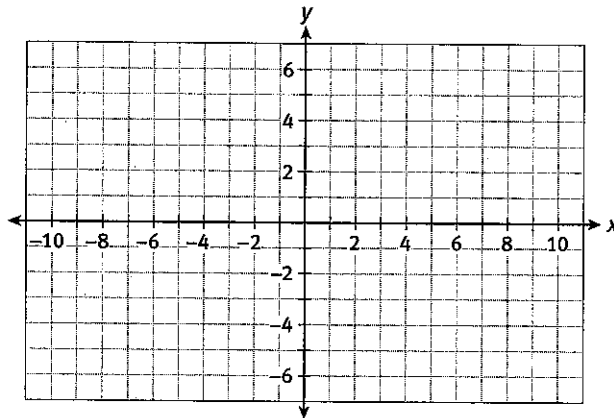


SUGGESTED LEARNING STRATEGIES: Think/Pair/Share, Quickwrite, Interactive Word Wall, Note Taking

My Notes

21. Graph the following system of equations and write out the solution.

$$\begin{cases} y = \frac{1}{3}x + 2 \\ y = -x - 3 \end{cases}$$



22. What problems came up while solving the systems of equations graphically?

You can also solve a system of linear equations algebraically by using the **transitive property of equality**.

EXAMPLE 1

Solve the following system of equations algebraically. $\begin{cases} y = 4x - 1 \\ y = -x + 4 \end{cases}$

Step 1: Set the equations equal to each other. $4x - 1 = -x + 4$

$$4x - 1 = -x + 4$$

$$+x \quad +x$$

Step 2: Solve for x .

$$5x - 1 = 4$$

$$+1 \quad +1$$

$$5x = 5$$

$$x = 1$$

Step 3: Substitute x into one of the original equations, and solve for y .

$$y = 4(1) - 1$$

$$y = 3$$

Step 4: Check your solution using the other equation.

$$3 \stackrel{?}{=} -1 + 4$$

$$3 = 3$$

Solution: Write the solution as an ordered pair.

The lines intersect at the point (1,3).

MATH TERMS

The transitive property of equality states:

If $a = b$ and $b = c$, then $a = c$.

ACTIVITY 3.7 Systems of Linear Equations**Systems of Trees****SUGGESTED LEARNING STRATEGIES:** Create Representations

My Notes

TRY THESE A

Solve the following systems of linear equations algebraically.

a.
$$\begin{cases} y = -x - 1 \\ y = -5x - 17 \end{cases}$$

b.
$$\begin{cases} y = \frac{1}{2}x + 4 \\ y = -\frac{3}{2}x - 4 \end{cases}$$

c.
$$\begin{cases} 2x - 3y = -1 \\ y = x - 1 \end{cases}$$

d.
$$\begin{cases} 4x + y = 6 \\ -5x - y = 21 \end{cases}$$

CHECK YOUR UNDERSTANDING

Write your answers on notebook paper.
Show your work.

Determine what information is needed to solve the following problem. Do not solve the problem.

- A boat on a river traveled 16 miles in 20 minutes going downstream. The boat can hold 15 gallons of gas. It takes 30 minutes for the boat to travel back upstream to where it started. Find the speed of the current.
- Determine which of the following points $\{(1, -2), (-1, 2), (1, 2), (-1, -2)\}$ are solutions to the system of equations.

$$\begin{cases} 3x - y = 5 \\ x + 4y = -7 \end{cases}$$
- Create a table of values to find the solution to the system of equations.

$$\begin{cases} y = 5x - 3 \\ y = 2x - 6 \end{cases}$$

Solve the systems of equations graphically.

4.
$$\begin{cases} y = x + 2 \\ y = 2x + 3 \end{cases}$$

5.
$$\begin{cases} 2x - 3y = 0 \\ x + 3y = 9 \end{cases}$$

Solve the following systems algebraically.

6.
$$\begin{cases} y = -x + 5 \\ y = x + 3 \end{cases}$$

7.
$$\begin{cases} x + y = 8 \\ y = -x + 4 \end{cases}$$

8.
$$\begin{cases} x - 6y = -3 \\ 2x + 3y = 9 \end{cases}$$

- MATHEMATICAL** Which method(s) you have learned for solving systems of equations do you prefer? Explain why.