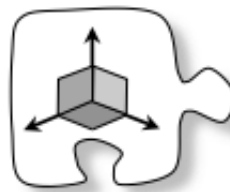


6.1.3 What can I discover about 3-D systems?

Systems of Three-Variable Equations



You know a lot about systems of two-variable equations, their solutions, and their graphs. Today you will investigate systems of three-variable equations.

6-30. THREE-DIMENSIONAL SYSTEM INVESTIGATION

Consider the following systems of equations:

System I

$$20x + 12y + 15z = 60$$

$$20x + 12y + 15z = 120$$

System II

$$20x + 15y + 12z = 60$$

$$10x + 30y + 12z = 60$$

Your Task: With your team, find out as much as you can about each of these systems of equations, their graphs, and their solutions. Be sure to record all of your work carefully and be prepared to share your summary statements with the class. Explore using [3-D Graph](#) (CPM).

Discussion Points

What does the graph of a three-variable equation look like?

What does it mean to be a solution to a system of equations?

What does a solution to a three-variable system of equations look like on a graph?

Is there always a solution to a system of equations?

Further Guidance

6-31. Using isometric dot paper, graph both equations in *System I* from problem 6-30 on a single three-dimensional coordinate system. Use different colors to help identify each graph.

- Describe the graph of the system in as much detail as you can.
- Looking at the graph, can you tell what the solution to this system is? Explain.

6-32. Using isometric dot paper, graph both equations in *System II* from problem 6-30 on a single three-dimensional coordinate system. Use different colors to help identify each graph.

- Describe the graph of the system in as much detail as you can.
- Looking at the graph, can you tell what the solution to this system is? Explain.

6-33. Now compare the graphs of the two systems. How are they similar? How are they different?

Further Guidance
section ends here.

6-34. Look closely at your graph of *System II*. Can you see the intersection of the two planes clearly? If not, make a new set of axes and graph the systems carefully.

- What does the intersection of two planes look like?
- Work with your team to find the coordinates of as many points as you can that lie in both planes. Show your work and describe your strategies. Be prepared to share your ideas with the class.
- Can you add a third equation to the system that will share the same intersection with the original two graphs?



6-35. On isometric dot paper, graph the system of equations below. What shape is the intersection? Use color to show the intersection clearly on your graph. [Help \(Html5\)](#) \Leftrightarrow [Help \(Java\)](#)

$$10x + 6y + 5z = 30$$

$$6x + 15y + 5z = 30$$

6-36. Verify that $2^7 = 128$. Is it true that $\log 2^7 = \log 128$? [Help \(Html5\)](#) \Leftrightarrow [Help \(Java\)](#)

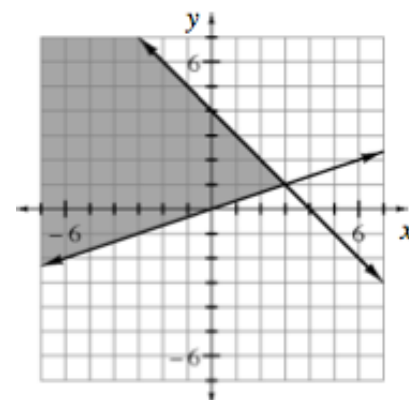
6-37. If $24 = y$, is it true that $\log 24 = \log y$? **Justify** your answer. [Help \(Html5\)](#) \Leftrightarrow [Help \(Java\)](#)

6-38. Write the system of inequalities that would give the graph at right. [Help \(Html5\)](#) \Leftrightarrow [Help \(Java\)](#)

6-39. Simplify each of the following expressions. [Help \(Html5\)](#) \Leftrightarrow [Help \(Java\)](#)

a. $\frac{2x^3 + 5x^2 - 3x}{4x^3 - 4x^2 + x}$

b. $\frac{3x^2 - 5x - 2}{2x^2 - 11x + 15} \cdot \frac{2x^2 - 5x}{3x^3 - 5x^2 - 2x}$



6-40. Solve $\sqrt{3x+1} - x = -3$ and check your solution. [Help \(Html5\)](#) \Leftrightarrow [Help \(Java\)](#)

- a. You should have gotten two values for x when you solved. Did you? If not, rework the problem.
- b. Did you check *both* solutions? What happened?

6-41. Solve each of the following equations. [Help \(Html5\)](#) \Leftrightarrow [Help \(Java\)](#)

- a. $(x + 4)(2x - 5) = 0$
- b. $(x + 4)(x^2 - 5x + 6) = 0$
- c. $3x(x + 1)(2x - 7)(3x + 4)^2(x - 13)(x + 7) = 0$
- d. Describe how to solve an equation made up of any number of factors all multiplied to equal zero.

6-42. Determine if each of the following functions is odd, even, or neither. [Help \(Html5\)](#) \Leftrightarrow [Help \(Java\)](#)

- a. $f(x) = 3x^3 + 2$
- b. $y = x^6 + x^4$

6-43. Solve for x , y , and z : $(2^x)(3^y)(5^z) = (2^3)(3^{x-2})(5^{2x-3y})$. [Help \(Html5\)](#) \Leftrightarrow [Help \(Java\)](#)