

Solving Systems with three variables

New Seats

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Ask your group: If you could be any number what would you be and why?

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Bellwork:

1) The Fort Bakery sells chocolate chip cookies for \$2 each. It costs \$120 to run the over per day. The cost of making one cookie is \$1.40. How many cookies can be sold each day to break even?

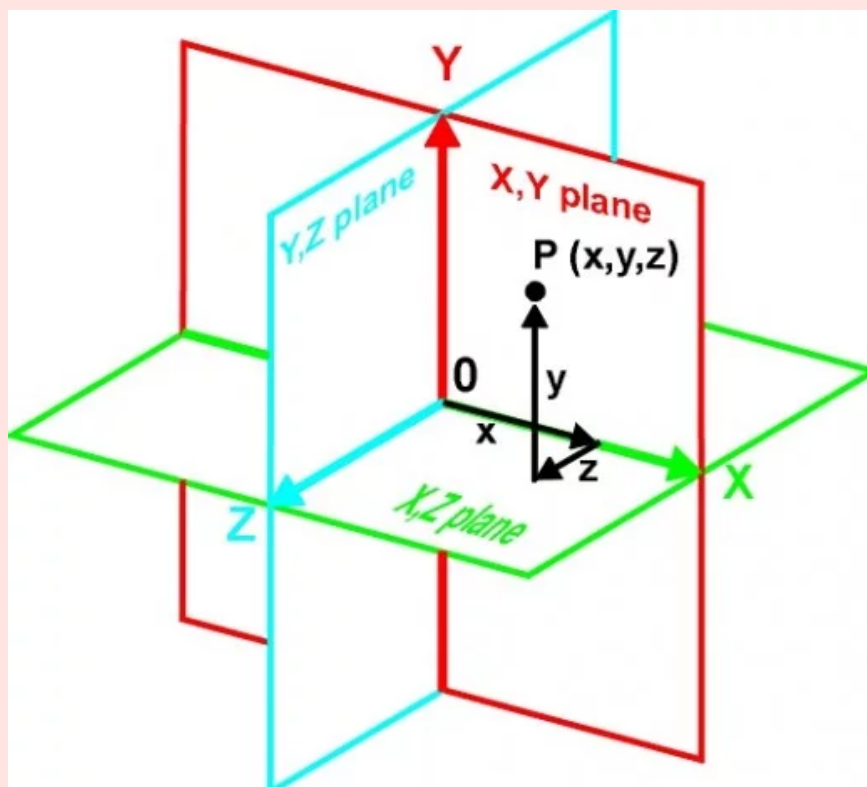
2) Scientists use the formula $A = \pi(R^2 - r^2)$ to determine the area covered by rainfall of a hurricane, where A is area in square miles, R is total radius, and r is radius of the eye of the hurricane. Solve the equation for r .

3) The point $(-2, 2)$ lies on $f(x)$. Find the new point after the transformation to $g(x)$.

$$g(x) = -2f(x) + 3$$

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The three dimensional plane.



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Steps for solving systems with three variables

- 1) Rewrite the system in three variables as a linear system in two variables by using substitution or elimination.
- 2) Solve the new linear system for both of its variable.
- 3) Substitute in and find the rest!
- 4) CHECK YOUR ANSWER!!

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Special Cases

If you end up with a false statement like $3 = 5$ then the system has no solution

If you end up with an identity like $4 = 4$, then the system has infinitely many solutions.

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Example 1: Find the solution to this system of equations.

Solve the system.

$$x + y + z = 5$$

$$2x - y + z = 9$$

$$x - 2y + 3z = 16$$

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Practice

$$\begin{aligned}x - y + z &= -1 \\x + y + 3z &= -3 \\2x - y + 2z &= 0\end{aligned}$$
$$(4, 2, -3)$$

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$$x + 2y - z = -3$$

$$x - y + z = 2$$

$$x - z = 3$$

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Does this system have more than one solution? Justify your answer.

$$\frac{1}{2}x - \frac{3}{8}y + \frac{1}{8}z = -\frac{5}{4}$$

$$\frac{1}{2}x + \frac{1}{4}y + \frac{3}{4}z = 0$$

$$-x + 2y - 5z = 17$$

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You own a bakery and you need to know how many baked goods you will be able to make for a party you are catering. You only have \$300 to spend and you need make 150 baked goods. You can buy the ingredients for cookies for \$2 each, for cupcakes for \$4 each and for cake pops for \$1 each. You need to make twice as many cookies as cupcakes. How many of each baked good do you need to make?

You have five bales of hay. For some reason, instead of being weighed individually, they were weighed in all possible combinations of two: bales 1 and 2, bales 1 and 3, bales 1 and 4, bales 1 and 5, bales 2 and 3, bales 2 and 4, and so on. The weights of each of these combinations were written down and arranged in numerical order, *without keeping track of which weight matched which pair of bales*. The weights in kilograms were 80, 82, 83, 84, 85, 86, 87, 88, 90, and 91. How much does each bale weigh? There may be more than one solution; if so, try to find them all. Also try to solve in as many ways as you can.

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1. $x - y + z = 3$
 $2x + y + z = 8$
 $3x + y - z = 1$

2. $x - y - z = 2$
 $2x + y + z = 8$
 $x + y + z = 6$

3. $x + y + z = 1$
 $2x - y + 2z = -1$
 $-x - 3y + z = 1$

4. $x - y - z = 6$
 $-x + 3y + 2z = -11$
 $3x + 2y + z = 1$

5. $x + y + z = 1$
 $-2x + 2y + 3z = 20$
 $2x - 2y - z = -16$

6. $x + y + z = -3$
 $3x + y - z = 13$
 $3x + y - 2z = 18$

18. $x - 4y + 4z = -1$
 $y - 3z = 5$
 $3x - 4y + 6z = 1$

