LESSON MAKER PRO

Three Unknowns, Solved

Use elimination to solve systems with three variables.

HIGH SCHOOL · MA.912.AR.9.9

MA.912.AR.9.9 "Given a mathematical or real-world context, solve a system of three-variable linear equations algebraically."

NAME _____ DATE _____

ELIMINATE, THEN SOLVE

Use elimination to remove the same variable from two pairs of equations. Solve the resulting two-variable system, then substitute back to find the third variable and check all three equations.

WORKED EXAMPLE

Solve the system: x + y + z = 41 x - y + z = 19 x + y - z = 13

1. Subtract the second equation from the first: 2y = 22.
2. Divide by 2: y = 11.
3. Subtract the third equation from the first: 2z = 28, so z = 14.
4. Substitute into the first equation: x = 16.

Answer: x = 16, y = 11, z = 14

PRACTICE 6 problems

1 Solve the system algebraically: x + y + z = 46 x - y + z = 20 x + y - z = 16

ANSWER _____

2 Solve the system algebraically: x + y + z = 58 x - y + z = 34 x + y - z = 24

ANSWER _____

3 Solve the system algebraically: 2x + y + z = 52 x + 2y + z = 59 x + y + 2z = 65

ANSWER _____

4 Solve the system algebraically: 3x + y - z = 15 x + 3y + z = 25 x - y + 3z = 23

ANSWER _____

5 Solve the system algebraically: 2x - y + z = 20 x + 2y - z = 4 x + y + 2z = 28

ANSWER _____

6 Solve the system algebraically: x + y + z = 18 2x - y + z = 17 x + 2y - z = 8

ANSWER _____

APPLY IT Show your work

1 At a school esports fundraiser, a game pass costs p dollars, a snack voucher costs s dollars, and a raffle ticket costs r dollars. Three game passes, two snack vouchers, and one raffle ticket cost $25. Two game passes, one snack voucher, and two raffle tickets cost $25. One game pass, three snack vouchers, and two raffle tickets cost $27. Write and solve a system to find each price.

WORK SPACE

ANSWER _____

2 At a pop-up school store, a cap costs c dollars, a shirt costs h dollars, and a sticker pack costs s dollars. Two caps, one shirt, and three sticker packs cost $35. One cap, three shirts, and two sticker packs cost $40. Three caps, two shirts, and one sticker pack cost $39. Write and solve a system to find each price.

WORK SPACE

ANSWER _____

CHALLENGE One step up

Without graphing, solve the system. Then explain why your elimination work shows that the system has only one solution. $4x - 2y + z = 11$ $3x + y - 2z = 5$ $2x + 3y + 4z = 24$

WORK SPACE AND ANSWER

ANSWER KEY

Three Unknowns, Solved

HIGH SCHOOL · MA.912.AR.9.9

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Solve the system algebraically: x + y + z = 46 x - y + z = 20 x + y - z = 16	**x = 18, y = 13, z = 15**
2	Solve the system algebraically: x + y + z = 58 x - y + z = 34 x + y - z = 24	**x = 29, y = 12, z = 17**
3	Solve the system algebraically: 2x + y + z = 52 x + 2y + z = 59 x + y + 2z = 65	**x = 8, y = 15, z = 21**
4	Solve the system algebraically: 3x + y - z = 15 x + 3y + z = 25 x - y + 3z = 23	**x = 6, y = 4, z = 7**
5	Solve the system algebraically: 2x - y + z = 20 x + 2y - z = 4 x + y + 2z = 28	**x = 7, y = 3, z = 9**
6	Solve the system algebraically: x + y + z = 18 2x - y + z = 17 x + 2y - z = 8	**x = 7, y = 4, z = 7**

PART 2 · APPLY IT

1. **p = $4, s = $3, r = $7** Use the three purchase totals to write 3p + 2s + r = 25, 2p + s + 2r = 25, and p + 3s + 2r = 27. Eliminate variables until one price is found, then substitute back.
2. **c = $6, h = $8, s = $5** Write 2c + h + 3s = 35, c + 3h + 2s = 40, and 3c + 2h + s = 39. Eliminate one variable from two pairs of equations, solve the resulting two-variable system, and substitute back.

CHALLENGE

x = 3, y = 2, z = 3.

Accept any algebraically equivalent elimination or substitution method. For word problems, accept prices written with or without dollar signs when the variable values are correct.