**3-4 Study Guide and Intervention**

***Systems of Equations in Three Variables***

**Systems in Three Variables** Use the methods used for solving systems of linear equations in two variables to solve systems of equations in three variables. A system of three equations in three variables can have a unique solution, infinitely many solutions, or no solution. A solution is an **ordered triple.**

**Example: Solve the system of equations. 3*x* + *y* – *z* = –6**

 **2*x* – *y* + 2*z* = 8**

 **4*x* + *y* – 3*z* = –21**

**Step 1** Use elimination to make a system of two equations in two variables.

 3*x* + *y* – *z* = –6 2*x* – *y* + 2*z* = 8

(+) 2*x* – *y* + 2*z* = 8 (+) 4*x* + *y* – 3*z* = –21

**Step 2** Solve the system of two equations.

 5*x* + *z* = 2

(+) 6*x* – *z* = –13

Step 3 Substitute

**Examples**

**Solve each system of equations.**

 **1.** 2*x* + 3*y* – *z* = 0 **2.** 2*x* – *y* + 4*z* = 11 **3.** *x* – 2*y* + *z* = 8

 *x* – 2*y* – 4*z* = 14 *x* + 2*y* – 6*z* = –11 2*x* + *y* – *z* = 0

 3*x* + *y* – 8*z* = 17 3*x* – 2*y* –10*z* = 11 3*x* – 6*y* + 3*z* = 24

**3-4 Study Guide and Intervention** *(continued)*

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**Real-World Problems**

**Example: The Laredo Sports Shop sold 10 balls, 3 bats, and 2 bases for $99 on Monday. On Tuesday they sold
4 balls, 8 bats, and 2 bases for $78. On Wednesday they sold 2 balls, 3 bats, and 1 base for $33.60. What are the prices of 1 ball, 1 bat, and 1 base?**

First define the variables.

*x* = price of 1 ball

*y* = price of 1 bat

*z* = price of 1 base

Translate the information in the problem into three equations.

10*x* + 3*y* + 2*z* = 99

4*x* + 8*y* + 2*z* = 78

2*x* + 3*y* +*z* = 33.60

Subtract the second equation from the first equation to eliminate *z*.

 10*x* + 3*y* + 2*z* = 99

(–) 4*x* + 8*y* + 2*z* = 78

 6*x* – 5*y* = 21

Multiply the third equation by 2 and subtract from the second equation.

 4*x* + 8*y* + 2*z* = 78

(–) 4*x* + 6*y* + 2*z* = 67.20

 2*y* = 10.80

 *y* = 5.40

Substitute 5.40 for *y* in the equation

6*x* – 5*y* = 21.

6*x* –5(5.40) = 21

 6*x* = 48

 *x* = 8

Substitute 8 for *x* and 5.40 for *y* in one of the original equations to solve for *z*.

 10*x* + 3*y* + 2*z* = 99

10(8) + 3(5.40) + 2*z* = 99

 80 + 16.20 + 2*z* = 99

 2*z* = 2.80

 *z* = 1.40

So a ball costs $8, a bat $5.40, and a base $1.40.

**Exercises**

 **1. FITNESS TRAINING** Carly is training for a triathlon. In her training routine each week, she runs 7 times as far as she swims, and she bikes 3 times as far as she runs. One week she trained a total of 232 miles. How far did she run that week?

 **2. ENTERTAINMENT** At the arcade, Ryan, Sara, and Tim played video racing games, pinball, and air hockey. Ryan spent $6 for 6 racing games, 2 pinball games, and 1 game of air hockey. Sara spent $12 for 3 racing games, 4 pinball games, and 5 games of air hockey. Tim spent $12.25 for 2 racing games, 7 pinball games, and 4 games of air hockey. How much did each of the games cost?

 **3. FOOD** A natural food store makes its own brand of trail mix out of dried apples, raisins, and peanuts. One pound of the mixture costs $3.18. It contains twice as much peanuts by weight as apples. One pound of dried apples costs $4.48, a pound of raisins $2.40, and a pound of peanuts $3.44. How many ounces of each ingredient are contained in 1 pound of the trail mix?