

EXAMPLE**Write and Solve a System of Equations****4**

SPORTS There are 49,000 seats in a sports stadium. Tickets for the seats in the upper level sell for \$25, the ones in the middle level cost \$30, and the ones in the bottom level are \$35 each. The number of seats in the middle and bottom levels together equals the number of seats in the upper level. When all of the seats are sold for an event, the total revenue is \$1,419,500. How many seats are there in each level?

Explore Read the problem and define the .

u = number of seats in the upper level

m = number of seats in the middle level

b = number of seats in the bottom level

Plan There are seats.

$$u + m + b = 49,000$$

When all the seats are sold, the revenue is .

Seats cost , , and .

$$25u + 30m + 35b = 1,419,500$$

The number of seats in the middle and bottom levels together equal the number of seats in the upper level.

$$m + b = \boxed{}$$

Solve Substitute $m + b$ for u in each of the first two equations.

$$u + m + b = 49,000$$

$$\left(\boxed{}\right) + m + b = 49,000 \quad \text{Replace } u \text{ with } \boxed{}.$$

$$\boxed{} + \boxed{} = 49,000 \quad \text{Simplify.}$$

$$m + b = 24,500 \quad \text{Divide by 2.}$$

$$25u + 30m + 35b = 1,419,500$$

$$25\left(\boxed{}\right) + 30m + 35b = 1,419,500 \quad \text{Replace } u \text{ with } m + b.$$

$$\boxed{} - 30m - 35b = 1,419,500 \quad \text{Distributive Property}$$

$$\boxed{} + \boxed{} = 1,419,500$$

Now, solve the system of two equations in two variables

$$\begin{array}{l} m + b = 24,500 \xrightarrow{(\times 55)} \boxed{} + \boxed{} = \boxed{} \\ 55m + 60b = 1,419,500 \quad \underline{(-)55m + 60b = 1,419,500} \\ \boxed{} = \boxed{} \\ b = 14,400 \end{array}$$

Substitute 14,400 for b in the one of the equations with two variables and solve for m .

$$\begin{array}{l} m + b = 24,500 \quad \text{Equation with two variables} \\ m + \boxed{} = 24,500 \quad b = 14,400 \\ m = 10,100 \quad \text{Subtract } \boxed{} \text{ from each side.} \end{array}$$

Substitute 14,400 for b and 10,100 for m in one of the original equation with three variables.

$$\begin{array}{l} m + b = u \quad \text{Equation with three variables} \\ \boxed{} + \boxed{} = u \quad m = 10,100, b = 14,400 \\ \boxed{} = u \quad \text{Add.} \end{array}$$

There are upper level, middle level, and bottom level seats.

Check Check to see if all the criteria are met.

There are seats in the stadium.

$$24,500 + 10,100 + 14,400 = 49,000 \quad \checkmark$$

The number of seats in the middle and bottom levels equals the number of seats in the upper level.

$$10,100 + 14,400 = 24,500 \quad \checkmark$$

When all of the seats are sold, the revenue is

.

$$\begin{aligned} 24,500(\$25) + 10,100(\$30) + 14,400(\$35) \\ = 1,419,500 \quad \checkmark \end{aligned}$$