

One safe investment pays 8% per year, and a more risky investment pays 12% per year. How much must be invested in each account if the investor of \$100,000 would like a return of \$9000 per year.

To solve this problem and other story problems, follow the steps below.

Write Out The Variables

Start by writing out what the variables. Since we are trying to find the amounts invested in each investment, there must be two variables. Let

x: the amount invested at 8% per year in dollars

y: the amount invested at 12% per year in dollars

Make sure you write out a complete description – don't simply say x is 8 and y is 12. This will make solving the problem much harder.

Find The Relationship Between The Variables

The variables are related by two pieces of information:

The total amount invested is \$100,000

The total return is \$9000

This information will ultimately allow us to write two equations. Since the variables describe the amounts invested in each account, it should be clear that

$$\text{The total amount invested is } \$100,000 \Rightarrow x + y = 100,000$$

to write out an equation for the total return, we need to find the return from each investment. Since the first investment returns 8% of the amount invested, it earns 8% of x or $.08x$. The second investment returns 12% of the amount invested or 12% of y. Thus the equation for the total return is

$$.08x + .12y = 9000$$

With these two equations, we have the systems of linear equations,

$$\begin{aligned} x + y &= 100,000 \\ .08x + .12y &= 9000 \end{aligned}$$

Solve The System

This system is easily solved by elimination or substitution.

Substitution: To solve using substitution, solve for a variable in one of the equations. In this system, it is easiest to solve for either x or y in the first equation. We'll solve for y to give

$$y = 100,000 - x$$

Now use replace the y in the second equation with $100,000 - x$ to yield

$$.08x + .12(100,000 - x) = 9000$$

Now that the equation contains the variable x only, we can solve for x by simplifying the equation and solving for x :

$$\begin{aligned} .08x + 12,000 - .12x &= 9000 \\ -.04x + 12,000 &= 9000 \\ -.04x &= -3000 \\ x &= \frac{-3000}{-.04} = 75,000 \end{aligned}$$

Now that we know x , we can find y using $y = 100,000 - x$ to get

$$y = 100,000 - 75,000 = 25,000$$

This means that \$75,000 must be invested at 8% per year and \$25,000 must be invested at 12%.

Elimination: In elimination, we multiply the equations by numbers so that when we add the equations, a variable is eliminated. If we choose to eliminate the terms with x , we multiply the first equation by $-.08$:

$$\begin{array}{rcl} x + y = 100,000 & \xrightarrow{\times(-.08)} & -.08x - .08y = -8000 \\ .08x + .12y = 9000 & \rightarrow & .08x + .12y = 9000 \end{array}$$

Adding these equations give

$$.04y = 1000$$

Dividing both sides by $.04$ gives $y = 25,000$. Substituting this value into the first equation leads to

$$x + 25,000 = 100,000$$

So $x = 75,000$. This means that \$75,000 must be invested at 8% per year and \$25,000 must be invested at 12% per year.