

Review Exercise Set 24

Exercise 1: Jeremy is 10 years old than his baby sister, Amy. If the sum of their ages is 66, find their ages.

Exercise 2: Mercedes needs 6 pints of an acid that has a concentration of 40%. However, the only acid solutions available to her have concentrations of 20% and 50%. How much of each must she mix together to get the acid solution that she needs?

Exercise 3: Mila does not want to invest all of her lawsuit settlement (\$40,000) into a single account, so she invests it into three different accounts. She is earning 7% interest on the amount she invested in the first account. She invested \$5,000 less than what is in the first account into a second account earning 5% interest. The remaining balance is invested in the third account earning only 3% interest. If the total annual interest that Mila receives is \$2,300, find the amount in each account.

Exercise 4: A pet store owner is looking to make a 40-pound mixture of birdseed that will cost \$0.76 per pound by combining a generic wild bird seed that costs \$0.59 per pound with blackoil sunflower seeds that cost \$0.89 per pound. How many pounds of each seed must the owner blend together to get the desired mixture?

Review Exercise Set 24 Answer Key

Exercise 1: Jeremy is 10 years older than his baby sister, Amy. If the sum of their ages is 66, find their ages.

Assign variables for each age

x = Jeremy's age

y = Amy's age

Translate the statements into equations for the system of equations

Jeremy is 10 years older than Amy

$$x = 10 + y$$

The sum of their ages is 66

$$x + y = 66$$

Substitute the 1st equation into the 2nd for x and solve for y

$$x + y = 66$$

$$(10 + y) + y = 66$$

$$10 + 2y = 66$$

$$2y = 66 - 10$$

$$2y = 56$$

$$y = 28$$

Substitute the value of y into the 1st equation to find x

$$x = 10 + y$$

$$x = 10 + 28$$

$$x = 38$$

Jeremy is 38 years old and Amy is 28 years old.

Exercise 2: Mercedes needs 6 pints of an acid that has a concentration of 40%. However, the only acid solutions available to her have concentrations of 20% and 50%. How much of each must she mix together to get the acid solution that she needs?

Assign variables for each acid solution

x = amount of the 20% solution

y = amount of the 50% solution

Exercise 2 (Continued):

Use the table below to setup the equations

	Amount (A)	*	Concentration (R)	=	Quantity (Q)
20% Solution	x	*	20	=	20x
50% Solution	y	*	50	=	50y
40% Solution	6	*	40	=	240

$$x + y = 6 \text{ (equation \# 1)}$$

$$20x + 50y = 240$$

$$2x + 5y = 24 \text{ (equation \# 2)}$$

Multiply the 1st equation by -2

$$-2(x + y = 6)$$

$$-2x - 2y = -12$$

Add this new equation to the 2nd equation and solve for y

$$2x + 5y = 24$$

$$\underline{-2x - 2y = -12}$$

$$3y = 12$$

$$y = 4$$

Substitute the value of y into the 1st equation to find x

$$x + y = 6$$

$$x + 4 = 6$$

$$x = 6 - 4$$

$$x = 2$$

Mercedes must mix together 2 pints of the 20% acid solution with 4 pints of the 50% acid solution.

Exercise 3: Mila does not want to invest all of her lawsuit settlement (\$40,000) into a single account, so she invests it into three different accounts. She is earning 7% interest on the amount she invested in the first account. She invested \$5,000 less than what is in the first account into a second account earning 5% interest. The remaining balance is invested in the third account earning only 3% interest. If the total annual interest that Mila receives is \$2,300, find the amount in each account.

Assign variables for each account

x = amount invested in 1st account
 y = amount invested in 2nd account
 z = amount invested in 3rd account

Use the table below to setup the equations

	Principal (P)	*	Rate (R)	*	Time (T)	=	Interest (I)
1st account	x	*	.07	*	1	=	.07x
2nd account	y	*	.05	*	1	=	.05y
3rd account	z	*	.03	*	1	=	.03z
Total	40000						2300

The first equation will come from the principal column. The sum of the amounts deposited into each account must equal the \$40,000 settlement.

$$x + y + z = 40000 \text{ (equation \#1)}$$

The next equation will come from the interest column. The total of the interest earned on each individual account must equal the total annual interest of \$2,300. We can multiply the equation by 100 to get rid of the decimals.

$$\begin{aligned} .07x + .05y + .03z &= 2300 \\ 100(.07x + .05y + .03z) &= 23000 \\ 7x + 5y + 3z &= 230000 \text{ (equation \#2)} \end{aligned}$$

The third equation will come from the statement that the amount invested in the second account was \$5,000 less than what was invested in the first account.

$$y = x - 5000 \text{ (equation \#3)}$$

System of equations

$$\begin{aligned} x + y + z &= 40000 \\ 7x + 5y + 3z &= 230000 \\ y &= x - 5000 \end{aligned}$$

Exercise 3 (Continued):

Substitute the 3rd equation into the first two equations to eliminate y and reduce the equations to only two variables.

$$\begin{aligned}x + y + z &= 40000 \\x + (x - 5000) + z &= 40000 \\2x - 5000 + z &= 40000 \\2x + z &= 40000 + 5000 \\2x + z &= 45000 \text{ (equation \#4)}\end{aligned}$$

$$\begin{aligned}7x + 5y + 3z &= 230000 \\7x + 5(x - 5000) + 3z &= 230000 \\7x + 5x - 25000 + 3z &= 230000 \\12x + 3z &= 230000 + 25000 \\12x + 3z &= 255000 \text{ (equation \#5)}\end{aligned}$$

Multiply the 4th equation by -3 and add to the 5th equation to solve for x

$$\begin{aligned}-3(2x + z = 45000) \\-6x - 3z &= -135000 \\ \\12x + 3z &= 255000 \\ \underline{-6x - 3z = -135000} \\6x &= 120000 \\x &= 20000\end{aligned}$$

Substitute the value of x into the 4th or 5th equation to find z

$$\begin{aligned}2x + z &= 45000 \\2(20000) + z &= 45000 \\40000 + z &= 45000 \\z &= 45000 - 40000 \\z &= 5000\end{aligned}$$

Substitute the value of x into the 3rd equation to find y

$$\begin{aligned}y &= x - 5000 \\y &= 20000 - 5000 \\y &= 15000\end{aligned}$$

Mila invested \$20,000 in the 1st account, \$15,000 in the 2nd account, and \$5,000 in the 3rd account.

Exercise 4: A pet store owner is looking to make a 40-pound mixture of birdseed that will cost \$0.76 per pound by combining a generic wild bird seed that costs \$0.59 per pound with black oil sunflower seeds that cost \$0.89 per pound. How many pounds of each seed must the owner blend together to get the desired mixture?

Assign variables for each seed

x = amount of generic wild bird seed
 y = amount of black oil sunflower seed

Use the table below to setup the equations

	Amount (A)	*	Cost/pound (C)	=	Value (V)
generic seed	x	*	0.59	=	$0.59x$
sunflower	y	*	0.89	=	$0.89y$
mixture	40	*	0.76	=	30.4

The equations will come from the amount and value columns. The equation from the value column can be multiplied by 100 to get rid of the decimals.

$$x + y = 40 \text{ (equation \#1)}$$

$$0.59x + 0.89y = 30.4$$

$$100(0.59x + 0.89y = 30.4)$$

$$59x + 89y = 3040 \text{ (equation \# 2)}$$

System of equations

$$x + y = 40$$

$$59x + 89y = 3040$$

Multiply the 1st equation by -59 and add it to the 2nd equation to find y

$$-59(x + y = 40)$$

$$-59x - 59y = -2360$$

$$59x + 89y = 3040$$

$$\underline{-59x - 59y = -2360}$$

$$30y = 680$$

$$y = \frac{680}{30}$$

$$y = 22\frac{2}{3}$$

Exercise 4 (Continued):

Substitute the value of y into the 1st equation to find x

$$x + y = 40$$

$$x + 22\frac{2}{3} = 40$$

$$x = 40 - 22\frac{2}{3}$$

$$x = 17\frac{1}{3}$$

The pet store owner needs to use $17\frac{1}{3}$ pounds of the generic wild bird seed and $22\frac{2}{3}$ pounds of the black oil sunflower seed to make the desired mixture.