

INVESTMENT and MIXTURE PROBLEMS

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Sample Problems

1. Carlos invested a sum of money at 7%. He invested a second sum, \$200 more than the first sum, at 8%. The annual income from the two investments is \$346. Find the amount he invested at each rate.

The formula we use is

$$\mathbf{PR = I}$$

(Principal) X (Rate) = Interest

P	R	I
x	.07	.07 x
$x + 200$.08	.08($x + 200$)

Step 1 - Write the equation

$$.07x + .08(x + 200) = 346$$

Step 2 - Multiply both sides of the equation by 100 to get rid of the decimals

$$100[.07x + .08(x + 200)] = 100(346)$$

$$100(.07x) + 100(.08)(x + 200) = 100(346)$$

$$7x + 8(x + 200) = 34600$$

Step 3 - Use the *distributive property* to multiply $8(x + 200)$

$$7x + 8x + 1600 = 34600$$

Step 4 - Combine *like terms*

$$15x + 1600 = 34600$$

Step 5 - Subtract 1600 from both sides

$$15x = 33000$$

Step 6 - Divide both sides of the equation by 15 to get the solution for x

$$x = 2200$$

Therefore the solution to the problem is:

\$2,200 was invested at 7% and $(\$2,200 + \$200) = \$2,400$ was invested at 8%

2. Danny invested \$11,000. Part of his money is invested in bonds which yield 8% and the remainder is invested in bonds which yield 10%. His total annual income from these bonds is \$1,020. Find the amount he has invested in each kind of bond.

P	R	I
x	.08	.08 x
$11000 - x$.10	.10($11000 - x$)

Step 1 - Write the equation

$$.08x + .10(11000 - x) = 1020$$

Step 2 - Multiply both sides of the equation by 100 to get rid of the decimals

$$100[.08x + .10(11000 - x)] = 100(1020)$$

$$100(.08x) + 100(.10)(11000 - x) = 100(1020)$$

$$8x + 10(11000 - x) = 102000$$

Step 3 - Use the *distributive property* to multiply $10(11000 - x)$

$$8x + 110000 - 10x = 102000$$

Step 4 - Combine *like terms*

$$-2x + 110000 = 102000$$

Step 5 - Subtract 110000 from both sides

$$-2x = -8000$$

Step 6 - Divide both sides of the equation by -2 to get the solution for x

$$x = 4000$$

Therefore the solution to the problem is:

\$4,000 was invested at 8% and $(\$11000 - \$4000) = \$7,000$ was invested at 10%

3. A chemist has one solution that is 14% salt and another solution which is 18% salt. How many ounces of each must be used to produce 60 ounces that is 15% salt?

The formula we use is

$$A \bullet \% = T$$

(Amount)•(%) = Total amount of each substance

A	%	T
x	.14	$.14x$
$60 - x$.18	$.18(60 - x)$
60	.15	$.15(60)$

Step 1 - Write the equation

$$.14x + .18(60 - x) = .15(60)$$

Step 2 - Multiply both sides of the equation by 100 to get rid of the decimals

$$\begin{aligned} 100[.14x + .18(60 - x)] &= 100(.15)(60) \\ 100(.14x) + 100(.18)(60 - x) &= 15(60) \\ 14x + 18(60 - x) &= 900 \end{aligned}$$

Step 3 - Use the *distributive property* to multiply

$$18(60 - x)$$

$$14x + 1080 - 18x = 900$$

Step 4 - Combine *like terms*

$$-4x + 1080 = 900$$

Step 5 - Subtract 900 from both sides

$$-4x = -180$$

Step 6 - *Divide* both sides of the equation by -2 to get the solution for x

$$x = 45$$

Therefore the *solution* to the problem is:

45 ounces of the 14% solution and $(60 - 45) = 15$ ounces of the 18% solution

4. How many pounds of pure salt must be added to 60 pounds of a 8% solution of salt and water to increase it to a 20% solution?

Note: When a substance is pure we write 100% for the percentage of its content.

A	%	T
60	.08	$.08(60)$
x	1.00	$1.00x$
$(60 + x)$.20	$.20(60 + x)$

Step 1 - Write the equation

$$.08(60) + 1.00x = .20(60 + x)$$

Step 2 - Multiply both sides of the equation by 100 to get rid of the decimals

$$\begin{aligned} 100[.08(60) + 1.00x] &= 100[.20(60 + x)] \\ 100(.08)(60) + 100(1.00x) &= 100(.20)(60 + x) \\ 8(60) + 100x &= 20(60 + x) \end{aligned}$$

Step 3 - Use the *distributive property* to multiply

$$20(60 + x)$$

$$480 + 100x = 1200 + 20x$$

Step 4 - Subtract $20x$ from both sides

$$480 + 80x = 1200$$

Step 5 - Subtract 480 from both sides

$$80x = 720$$

Note: Steps 4 and 5 can be combined into one step

Step 6 - *Divide* both sides of the equation by 80 to get the solution for x

$$x = 9$$

Therefore the *solution* to the problem is that **9** pounds of pure salt must be added to 60 pounds of a 8% solution of salt and water to increase it to a 20% solution.

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INVESTMENT PROBLEMS

1. Steve invested a sum of money at 4%. He invested twice as much at 5%. The total annual income from these investments was \$210. Find the amount he invested at each rate.
2. Ken invested a sum of money at 4%. He invested a second sum, \$250 more than the first sum, at 6%. If his total annual income was \$90, how much did he invest at each rate?
3. Mark invested a sum of money at 3%. He invested a second sum, \$150 less than the first sum, at 6%. The total annual income was \$54. Find the amount invested at each rate.
4. Mr. Jones invested a sum of money in 6% bonds. He invested \$400 more than this sum in 4% bonds. If his total annual income was \$116, how much did he invest in each kind of bond?
5. Juan invested a sum of money at 6%. He invested a second sum, which exceeded twice the first sum by \$1000, at 10%. His total annual income was \$620. Find the amount he invested at each rate.
6. Bob invested \$4000, part at 5% and the remainder at 3%. The total annual income from both investments was \$152. Find the amount invested at each rate.
7. Frank invested \$25,000, part at 4% and the remainder at 7%. The total income he received at the end of the year was \$1,450. How much did he invest at each rate?
8. A sum of \$3500 is invested in two parts. One part brings a return of 5% and the other a return of 8%. The total annual return is \$250. Find the amount invested at each rate.
9. Janice has invested \$7,500 in two parts, one part at 6% and the other at 10%. Find the amount invested at each rate if the total yearly income is \$590.
10. Mr. Sims invested \$8000. Part of his money is invested in bonds which yield 4% and the remainder is invested in bonds which yield 5%. His total annual income from these bonds is \$380. Find the amount he has invested in each kind of bond.
11. Mr. Marcus invested a sum of money at 6%. He invested \$200 more than this sum at 4%. If the annual incomes from both investments were the same, find the amount invested at each rate.
12. Mike invested \$7200, part at 4% and the remainder at 5%. If the annual incomes from both investments were equal, find the amount invested at each rate.
13. Mr. Austin has invested \$18,000 in two parts. One part is invested at 8% and the other at 10%. The annual income from the 10% investment is \$360 more than the annual income from the 8% investment. Find the amount invested at each rate.
14. The sum of \$4000 is invested, part at 4% and the rest at 6%. The annual income from the 6% investment is \$10 less than the annual income from the 4% investment. Find the amount invested at each rate.
15. Joe bought two bonds for \$15,000. One bond pays 6% interest and the other pays 8% interest. The annual interest from the 8% bond exceeds the annual interest from the 6% bond by \$500. Find the cost of each bond.

Answers:

1. \$1,500 @ 4%, \$3,000 @ 5%	6. \$1,600 @ 5%, \$2,400 @ 3%	11. \$400 @ 6%, \$600 @ 4%
2. \$750 @ 4%, \$1,000 @ 6%	7. \$10,000 @ 4%, 15,000 @ 7%	12. \$4,000 @ 4%, \$3,200 @ 5%
3. \$700 @ 3%, \$550 @ 6%	8. \$1,000 @ 5%, \$2,500 @ 8%	13. \$8,000 @ 8%, \$10,000 @ 10%
4. \$1,000 @ 6%, \$1,400 @ 4%	9. \$4,000 @ 6%, \$3,500 @ 10%	14. \$2,500 @ 4%, \$1,500 @ 6%
5. \$2,000 @ 6%, \$5,000 @ 10%	10. \$2,000 @ 4%, \$6,000 @ 5%	15. \$5,000 @ 6%; \$10,000 @ 8%

MIXTURE PROBLEMS

1. A chemist has one solution that is 30% salt and another solution that is 60% salt. How many ounces of each must she use to produce 60 ounces of a solution that is 50% pure salt?
2. A farmer has some cream that is 24% butterfat and some cream that is 18% butterfat. How many quarts of each must she use to produce 90 quarts of cream that is 22% butterfat?
3. How many pints of a solution that is 30% alcohol must be mixed with 21 pints of a solution that is 80% alcohol to produce a mixture that is 60% alcohol?
4. How many ounces of a silver alloy that is 30% silver must be mixed with 18 ounces of a silver alloy that is 12% silver to produce a new alloy that is 18% silver?
5. How many quarts of a solution that is 75% acid must be mixed with 16 quarts of a solution that is 30% acid to produce a solution that is 55% acid?
6. How many pounds of pure salt must be added to 60 pounds of a 4% solution of salt and water to increase it to a 10% solution?
7. An alloy of copper and tin is 20% copper. How many pounds of copper must be added to 80 pounds of the alloy in order that the resulting alloy be 50% copper?
8. A certain grade of metal that is a mixture of tin and copper contains 16% tin. How much tin must be added to 820 pounds of the metal to make a mixture that is 18% tin?
9. How much pure acid must be added to 30 ounces of an acid solution which is 40% acid in order to produce a solution which is 50% acid?
10. Of 24 pounds of salt water, 8% is salt. Of another mixture, 4% is salt. How many pounds of the second mixture should be added to the first mixture in order to get a mixture that is 5% salt?
11. One solution is 20% salt and another solution is 13% salt. How many ounces of each solution must be used to produce 35 ounces of a solution that is 15% salt?
12. A certain alloy of copper and silver weighs 50 pounds and is 10% silver. How much silver must be added to produce a metal that is 25% silver?

Answers:

1. 20 oz. @ 30%, 40 oz. @ 60%	5. 20 qts.	9. 6 oz.
2. 60 qts. @ 24%, 30 qts. @ 18%	6. 4 lbs.	10. 72 lbs.
3. 14 pts.	7. 48 lbs.	11. 10 oz. of 20% solution 25 oz. of 13% solution
4. 9 oz.	8. 20 lbs.	12. 10 lbs.