

Section 9

Simple Interest

9.1 Explaining Simple Interest Problems

It's easy to recognize a Simple Interest Problem.

- Two amounts of money are invested at different rates of interest for one year.
- The different interest rates are given as percents.
- The amounts of the two investments are *not* given.
- The total amount of interest earned from the two investments *is* given and may be stated in various ways.

Sometimes the problem may state, “total annual interest income”, other times it may state “total yearly interest from both accounts”, “annual simple interest”, “annual income of investments”, and “total earned income”.

There may be still further variations of these phrases. It is not necessary to remember all of them. Just recognize that they all refer to the same thing: How much money is earned after one year from two different amounts invested at different rates.

9.2 The Difference Between The Given Money Amounts

There are always two money amounts given in a Simple Interest Problem. One of these money amounts will be included in the information about the two amounts of money invested.

This given money amount will either be the Total Amount Invested (the two investments added together), or it will be part of the Direct Translation that describes one of the amounts invested.

In either case, this given money amount will be used to name the expressions for the two amounts of money invested. These expressions will be entered into a pre-equation chart.

The other money amount given in the problem will be the total amount of interest earned from both investments. As explained in 9.1, this amount can be stated in many ways. However, in this section, it will be referred to as the Total Interest Earned.

The money amount given for the Total Interest Earned is the exact amount that you will use in the setup of the equation.

9.3 How To Name The Expressions For The Amounts Invested

As in Section 8, there are two methods used to name the expression for each amount invested. One method is to use Direct Translation. If Direct Translation Words are not given, the problem will always give the Total Amount Invested.

This allows you to use the alternate method to name the expressions: One of the amounts invested as the variable x , and other amount invested as the Total Amount Invested minus x .

	1 st Expression	2 nd Expression
Alternate Method To Use	x	Total Amount $- x$
If Total Amount Invested Is 720	x	$720 - x$

9.4 Solving The Problem

Step 1

Read Through The Entire Problem

Look for and make note of the three items you need to set up your chart and your equation:

- The two different rates of interest which are in the form of percents
- Direct Translation with a money amount OR a Total Amount Invested in order to name the expressions for the two amounts invested
- The Total Interest Earned

Step 2

Fill In The Chart Using The Interest Formula

Set up a pre-equation chart like the one below. This will give you the two Interest Terms that you need to use in your equation.

The formula used is “**Interest (I) = principal (p) • rate (r)**”.

- The “rate” is the percentage that is given in the problem.
- The “principal” refers to each amount of money invested.
- The “interest” is the amount earned in one year from the investment. This is determined by multiplying the rate times the principal (amount invested) for each investment.

$$\boxed{r \quad \cdot \quad p \quad = \quad I}$$

Each row in the chart represents one investment.

Enter in the chart the information given in the problem that refers to the rate (percent) and principal (amount invested) of each investment.

The rate is given in the problem, but you will need to name expressions for the two amounts of money invested. Use one of the methods as explained in 9.3.

The Interest earned for each investment is not given in the word problem. You will get the expression to fill in the Interest portion of the chart by using the Interest formula and multiplying together the rate and principal you enter.

These two Interest expressions will be needed to set up the equation.

NOTE: The full formula for interest is " $I = p \cdot r \cdot t$ ". The " t " represents "time". Since the time in Simple Interest Problems is always 1 (for one year), " t " is not used.

HELPFUL HINT

- Remember that you cannot multiply by a percent. Be sure to convert the percent to a decimal before entering it into the rate column of the chart.
- When using Direct Translation to get the expressions for the amounts invested, be careful to match up each amount invested with its corresponding rate. The word "at" is the word to look for in the problem that connects an amount to its matching rate.

Step 3

Set Up An Equation

Not everything from your chart goes into the equation. What you will need is the two Interest Expressions.

The Interest Expressions which represent the interest earned for each investment have already been determined and entered in your chart. Once you have these expressions, your hard work is done. All you need to do is set up the two Interest expressions equal to the "Total Interest Earned", the amount that is given to you in the problem.

$$1^{\text{st}} \text{ Interest} + 2^{\text{nd}} \text{ Interest} = \text{Total Interest Earned}$$

Step 4
Solve the Equation

Using the method taught by your instructor, solve the equation for the variable.

Step 5
Make Sure to Answer the Question Being Asked

In Simple Interest Problems, as in other word problems, you need to make sure exactly what question is being asked. It is possible that the value for the variable x may be your answer. But it may *not* be.

For example, the value for x may be the amount of money invested at 6%, and the question wants to know the amount of money invested at 8%. To get the correct answer, look at your pre-equation chart and find the expression for the amount invested that corresponds to the 8% rate. Substitute the solution for x into that expression to get the correct answer.

EXAMPLES

EXAMPLE 1 Zach Thomas has some money invested at 5%, and \$5000 more than that amount invested at 9%. His total annual interest income is \$1430. Find the amount invested at 9%.

SOLUTION*Step 1 Read The Problem*

- The two rates of interest are 5% and 9%.
- Direct Translation and a money amount are given in the problem.
- These will be used to name the expressions for the two amounts of money invested.
- The Total Interest Earned is \$1430.

Step 2 Set Up And Fill In A Chart

- Write in the investment percentage in the Investment Column.
- Fill in the 1st row of the Rate Column with “.05”, the decimal equivalent of 5%.
- Fill in the 2nd row of the Rate Column with “.09”, the decimal equivalent of 9%.
- Use Direct Translation to write expressions for the amount of each investment.
- Fill in 1st row of the Principal Column with “ x ” to represent the amount at 5%.
- Fill in 2nd row of the Principal Column with “ $x + 5000$ ” to represent the amount at 9%.
- For each investment, multiply the Rate times the Principal to get its Interest Expression.

Investment	Rate	Principal (Amount)	Interest
Amount at 5%	.05	x	$.05(x)$
Amount at 9%	.09	$x + 5000$	$.09(x + 5000)$

Step 3 Set Up The Equation

- Use the two Interest expressions from your chart. They are $.05(x)$ and $.09(x + 5000)$.
- The Total Interest Earned is always given in the problem. In this example, it is \$1430.
- Set up equation as Interest Expression + Interest Expression = Total Interest Earned.

$$.05(x) + .09(x + 5000) = 1430$$

Step 4 *Solve The Equation*

- The solution to the equation is

$$x = 7000$$

Step 5 *Answer The Question Asked*

- You have the solution to the equation, but it is NOT the answer to the question.
- x is the amount invested at 5%; the problem asks for the amount invested at 9%.
- You need to use the expression for the 9% investment you named in the chart in Step 2.
- Get the answer by substituting the solution for x (which is 7000) into that expression.

$$\begin{aligned}\text{Amount at 9\%} &= x + 5000 \\ \text{Amount at 9\%} &= 7000 + 5000 \\ \text{Amount at 9\%} &= 12,000\end{aligned}$$

Answer: The amount invested at 9% is \$12,000.



EXAMPLE 2 Whitney invested part of her \$25,000 advance in a savings account at 7% annual simple interest and the rest in a mutual fund at 8% annual simple interest. If her total yearly interest from both accounts was \$1900, find the amount invested at each rate.

SOLUTIONStep 1 *Read The Problem*

- The two rates of interest are 7% and 8%.
- The Total Amount Invested is given in the problem. It is \$25,000.
- This will be used to name the expressions of the individual amounts of money invested.
- The Total Interest Earned is \$1900.

Step 2 *Set Up And Fill In A Chart*

- Write in the investment percentage in the Investment Column.
- Fill in the 1st row of the Rate Column with “.07”, the decimal equivalent of 7%.
- Fill in the 2nd row of the Rate Column with “.08”, the decimal equivalent of 8%.
- Use the Total Amount method to write expressions for the amount of each investment.
- Fill in 1st row of the Principal Column with “ x ” to represent the amount at 7%.
- Fill in 2nd row of the Principal Column with “ $25,000 - x$ ” to represent the amount at 8%.
- For each investment, multiply the Rate times the Principal to get its Interest Expression.

Investment	Rate	• Principal (Amount)	= Interest
Amount at 7%	.07	x	$.07(x)$
Amount at 8%	.08	$25,000 - x$	$.08(25,000 - x)$

Step 3 *Set Up The Equation*

- Use the two Interest expressions from your chart. They are $.07(x)$ and $.08(25,000 - x)$.
- The Total Interest Earned is always given in the problem. In this example, it is \$1900.
- Set up your equation as Interest Expression + Interest Expression = Total Interest Earned.

$$.07(x) + .08(25,000 - x) = 1900$$

Step 4 *Solve The Equation*

- The solution to the equation is

$$x = 10,000$$

Step 5 *Answer The Question Asked*

- You have the solution to the equation, but it is not the complete answer to the question.
- x is the amount invested at 7%; the problem also asks for the amount invested at 8%.
- You need to use the expression for the 8% investment you named in the chart in Step 2.
- Get the answer by substituting the solution for x (which is 10,000) into that expression.

\$10,0	$\begin{aligned} \text{Amount at 8\%} &= 25,000 - x \\ \text{Amount at 8\%} &= 25,000 - 10,000 \\ \text{Amount at 8\%} &= 15,000 \end{aligned}$
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Answer: The amount invested at 7% is

The amount invested at 8% is \$15,000.



Simple Interest: Exercise Set

1. Clay Aiken has an annual interest income of \$3390 from two investments. He has \$10,000 more invested at 8% than he has invested at 6%. Find the amount invested at 6%.
2. Frank Gore has some money invested at 5%, and \$5000 more than that amount invested at 9%. His total annual interest income is \$1430. Find the amount invested at 5%.
3. Cristian Vega received an inheritance. He invested some of the inheritance at 9% and \$3500 more than that amount at 10%. If he earns \$1490 in annual interest from the two investments, find the amount he invested at 9%.
4. Marilyn Milian earns a \$17,000 bonus from her company. She invests part of the money at 9% and the balance at 11%. If the annual interest for the two investments is \$1670, find the amount invested at each rate.
5. Larry Coker has \$1000 more invested at 9% than he has invested at 11%. If the annual income for the investments is \$1290, how much he has invested at each rate?
6. Ken Dorsey received a \$100,000 signing bonus. He invested some of the money in a Mutual Fund at 8% and the rest of the money in Savings Bonds at 5%. If his total yearly interest earned was \$6800, how much did Ken Dorsey invest in the Mutual Fund at 8%?
7. Hillary B. Smith invested her holiday bonus check of \$5,000 into two different savings accounts. She invested some at 3% and the rest at 7%. If her total yearly interest was \$290, how much did she invest at 3%?
8. The CEO of Hammer Industries invested \$75,000 in stocks and bonds. The stocks had an interest rate of 11% and the bonds had an interest rate of 6%. If her total earned income for one year was \$6750, how much was invested at 11%?
9. Blair invested some money at 9% annual simple interest and \$250 more than that amount at 10% annual simple interest. If her total yearly interest was \$101, how much was invested at each rate?
10. Hilda invested \$15,000 from which she earns an annual income of \$1620. She invested part of the money in a money market at 9% and the rest of the money in a mutual fund at a rate of 12%. How much did Hilda invest in the money market?
11. Sergei has an account with his bank that pays 3% interest, and an account with his credit union that pays 5%. He has \$1000 more invested at 5% than twice the amount he has invested at 3%. If his interest earned was \$245 last year, how much did Sergei have invested in his bank account at 3%?

12. Vernon Duke invests some money in a savings account at 6% simple interest and 600 more than that amount in stocks at 11% simple interest. If his yearly interest income was \$185, how much did he have invested at each rate?
13. Missy Elliott invests some money in bonds at 8.5% simple interest and \$2000 more than twice that amount in a retirement account at 10% simple interest. If her total annual income is \$1625, how much did she invest in bonds 8.5%?
14. Erika Slezak invests some money in stocks at 7.5% simple interest and \$1000 less than twice that amount in savings bonds at 9.5%. If her yearly income earned is \$2025, how much did she invest in savings bonds at 9.5%?
15. Brooke and Jeff received a total of \$12,000 in wedding gifts. They invested some in her savings account at 6.5% simple interest and the rest in his savings account at 4.5% simple interest. If they received an annual income of \$680, how much did they invest in each account?
16. Phil McGraw invested a total of \$70,000 in two different money markets. One yielded 11.5% simple interest and the other yielded 15.5% simple interest. If he earned an annual income of \$10,050, how much was invested in the money market that yielded 11.5%?
17. Fatima invested some money at 6% and \$500 more than that amount at 8%. If the total income earned was \$320, how much did she invest at each rate?
18. Karena has an annual interest income of \$1380. She has \$6000 more invested at 11% than she does at 7%. Find the amounts Karena invested at each rate.
19. Matchbox Twenty got an advance of \$80,000 after signing with Sony Records. They invested some of this money at 8% and the rest at 10%. If their yearly earned income was \$7300, how much did Matchbox Twenty invest at 10%.
20. Emanuel invested a total amount of \$8000 into two separate mutual funds. One fund yields 5% while the other yields 7%. If the income earned in one year on the two investments is \$510, how much did Emanuel invest at 5%?