Key Concepts

Simple Interest

Objective Teach students how to compute simple interest, including solving problems involving loans and savings accounts.

Note to the Teacher *Your students will be introduced to the topic of simple interest. Simple interest has wide applications to such things as loans or savings accounts. Mathematically, simple interest extends the idea of percent, and therefore working problems involving interest solidifies students' understanding of percent.*

Computing Simple Interest

Present the basic ideas and definitions regarding simple interest in a discussion with the class. Begin by presenting a scenario where a bank loans Mr. Adams $1,000 for a period of 1 year. At the end of the year, Mr. Adams has to pay back the original $1,000 (which is called the *principal* amount of the loan), plus 5% *interest*. This interest is the *extra* money Mr. Adams must pay the bank in exchange for the bank allowing him to use the money for the year. To compute the amount of interest Mr. Adams will owe the bank at the end of the year, we must compute 5% of the principal loan amount, $1,000.

$$\begin{aligned}\text{interest owed at the end of 1 year} &= 5\% \text{ of } \$1{,}000\\ &= 0.05 \times \$1{,}000\\ &= \$50\end{aligned}$$

So he will owe the bank an extra $50 at the end of one year. The *total amount* Mr. Adams will owe the bank at the end of one year is the sum of the principal, $1,000, plus the accrued interest, $50. That is,

$$\begin{aligned}\text{total amount owed at the end of one year} &= \$1{,}000 + \$50\\ &= \$1{,}050\end{aligned}$$

In the scenario presented above, several new terms were introduced.

- The **principal** is the amount of money originally borrowed (or invested). In this situation, the principal was $1,000. In the simple interest formula, the principal is denoted by the variable p.
- The **annual interest rate** is the percentage of the principal that the borrower will owe after one year in addition to the principal. In this situation, the annual interest rate was 5%. In the simple interest formula, the interest rate is denoted by the variable r.

- The **interest** is the amount the borrower pays for the use of the money. It is the amount in addition to the principal that the borrower owes at the end of the loan period. In the simple interest formula, the interest is denoted by an I.

Simple Interest Formula	The formula for simple interest is $$I = prt,$$ where I is the amount of interest, p is the principal amount, r is the interest rate (expressed as a decimal), and t is the time in years.

Now discuss the following example with your class.

Example 1 **Ms. Brotherton wants to buy a new car. She goes to her bank to borrow some of the money. The bank offers her a simple interest loan of $15,000 at an annual interest rate of 6%. She plans to pay off the loan at the end of 1 year. How much interest will she owe the bank after 1 year? What is the total amount she will owe the bank at the end of 1 year?**

Solution Use the simple interest formula. The principal amount is \$15,000, the interest rate is 6% (6% = 0.06), and the time is 1 year.

$I = prt$

$= \$15{,}000 \times 0.06 \times 1$ *Substitute 15,000 for p, 0.06 for r, and 1 for t.*

$= \$900$ *Use a calculator.*

So, Ms. Brotherton will owe the bank $900 in interest.

The total amount she will owe is the sum of the original loan amount, $15,000, and the interest, $900, which is a total of $15,900.

Now ask your students, "What if Ms. Brotherton had taken 2 years to repay the bank? How much interest would she owe then and what total amount would she have to repay?" Guide the discussion so that the students realize that if she keeps the money for 2 years instead of 1 year, she will owe twice as much interest, $900 × 2 or $1,800. So, the total amount she would owe after the 2-year period of the loan is the principal, $15,000, plus the interest, $1,800, which is a total of $16,800.

Now ask your students to suppose she repaid the loan after just 6 months. Ask, "How much interest would she owe?" Be sure students recognize that 6 months is $\frac{1}{2}$ year. Students should realize that if Ms. Brotherton keeps the money for $\frac{1}{2}$ year, she will only owe $\frac{1}{2}$ as much interest as if she kept the money for 1 year. So she would owe $\frac{1}{2} \times \$900$ or \$450 in interest.

Your students should begin to understand how the simple interest formula $I = prt$ can be used for a variety of time periods, as well as various principal amounts and interest rates. Now do some additional examples on the chalkboard using this formula, and then give more simple interest problems to your students to work on individually or in small groups. Here are two good examples.

Example 2 **Antwon bought a new computer system at an electronics store. The store offered him a choice of two simple interest loans, one for a 6-month time period and the other for an 18-month time period. The annual interest rate for both loans was 18%. If he needs to borrow \$2,000, how much interest would Antwon owe if he chooses the 6-month loan? How much interest would he have to pay if he selects the 18-month loan instead?**

Solution The principal amount p is \$2,000. The annual interest rate is 18%, so $r = 0.18$. Since 6 months is half of a year, use $t = \frac{1}{2}$ in the formula.

$$\begin{aligned} I &= prt \\ &= \$2,000 \times 0.18 \times \frac{1}{2} \\ &= \$180 \end{aligned}$$

If he chooses the 6-month loan, Antwon will have to pay \$180 in interest.

If Antwon chooses the 18-month loan, then he will have to pay 3 times as much interest as he would have to pay for the 6-month loan, or $\$180 \times 3 = \$540$. The same result can be found using the simple interest formula with $t = 1.5$, since 18 months equals 1.5 years.

$$\begin{aligned} I &= prt \\ &= \$2,000 \times 0.18 \times 1.5 \\ &= \$540 \end{aligned}$$

Point out that the simple interest formula is not just used in situations where people borrow money. It is also used in situations where people place their money into an account (such as a bank savings account) that earns interest while the money is in their account.

Example 3 **Natalie put $350 into a savings account on her 14th birthday. Her bank pays 4% annual simple interest on the account. Assuming Natalie does not deposit or withdraw any more money from her account, how much money will she have in the savings account on her 17th birthday?**

Solution We first compute how much interest her money will have earned in the 3-year period from her 14th birthday to her 17th birthday. Remember to express 4% as the decimal 0.04 in the formula.

$$
\begin{aligned}
I &= prt \\
&= \$350 \times 0.04 \times 3 && \textit{Substitute 350 for p, 0.04 for r, and 3 for t.} \\
&= \$42 && \textit{Use a calculator.}
\end{aligned}
$$

The total amount of money Natalie will have in her savings account is the original (principal) amount she deposited plus the interest earned.

$$
\begin{aligned}
\text{total amount} &= p + I \\
&= \$350 + \$42 \\
&= \$392
\end{aligned}
$$

So, Natalie will have $392 in the bank on her 17th birthday.