

6-7

Applying Simple and Compound Interest


California Standards

NS1.7 Solve problems that involve discounts, markups, commissions, and profit and compute simple and compound interest.

Vocabulary

simple interest
principal
rate of interest
compound interest

Why learn this? You can calculate the amount of money a bank pays you in interest using the simple interest formula.

When you deposit money into a bank, the bank pays you interest. When you borrow money from a bank, you pay interest to the bank.

Simple interest is money paid only on the principal.

Rate of interest is the percent charged or earned.

Principal is the amount of money borrowed or invested.

Time that the money is borrowed or invested (in years)

$$I = P \cdot r \cdot t$$

EXAMPLE 1 Finding Interest and Total Payment on a Loan

Tristan borrowed \$14,500 from a bank and promised to pay them back over 5 years at an annual simple interest rate of 7%. How much interest will he pay if he pays off the entire loan at the end of the fifth year? What is the total amount he will repay?

First, find the interest he will pay.

$$I = P \cdot r \cdot t \quad \text{Use the formula.}$$

$$I = 14,500 \cdot 0.07 \cdot 5 \quad \text{Substitute. Use 0.07 for 7\%.}$$

$$I = 5075 \quad \text{Solve for } I.$$

Tristan will pay \$5075 in interest.

The total amount A to be repaid is the principal P plus the interest I .

$$P + I = A \quad \text{principal + interest = total amount}$$

$$14,500 + 5075 = A \quad \text{Substitute.}$$

$$19,575 = A \quad \text{Solve for } A.$$

Tristan will repay a total of \$19,575 on his loan.

EXAMPLE 2 Determining the Amount of Investment Time

Isaiah invested \$3500 in a mutual fund at a yearly rate of 6%. He earned \$945 in interest. For how long was the money invested?

$$I = P \cdot r \cdot t \quad \text{Use the formula.}$$

$$945 = 3500 \cdot 0.06 \cdot t \quad \text{Substitute. Use 0.06 for 6\%.}$$

$$945 = 210t \quad \text{Simplify.}$$

$$4.5 = t \quad \text{Solve for } t.$$

The money was invested for 4.5 years, or 4 years and 6 months.

EXAMPLE 3 Computing Total Savings

Nadia's aunt deposited \$3000 into a savings account as a college fund for Nadia. How much will be in this account after 5 years if the account earns a yearly simple interest rate of 3.5%?

$$I = P \cdot r \cdot t \quad \text{Use the formula.}$$

$$I = 3000 \cdot 0.035 \cdot 5 \quad \text{Substitute. Use 0.035 for 3.5\%.}$$

$$I = 525 \quad \text{Solve for } I.$$

The interest is \$525.

Now you can find the total.

$$P + I = A \quad \text{Use the formula.}$$

$$3000 + 525 = A \quad \text{Substitute.}$$

$$3525 = A \quad \text{Solve for } A.$$

Nadia will have \$3525 in her savings account after 5 years.

EXAMPLE 4 Finding the Rate of Interest

To pay for her college expenses, Hannah borrows \$7000. She plans to repay the loan in 5 years at simple interest. If Hannah repays a total of \$9187.50, what is the interest rate?

$$P + I = A \quad \text{Use the formula.}$$

$$7000 + I = 9187.5 \quad \text{Substitute.}$$

$$\begin{array}{r} -7000 \\ \hline \end{array} \quad \begin{array}{r} -7000 \\ \hline \end{array} \quad \text{Subtract 7000 from both sides.}$$

$$I = 2187.5 \quad \text{Simplify.}$$

She paid \$2187.50 in interest. Use the amount of interest to find the interest rate.

$$I = P \cdot r \cdot t \quad \text{Use the formula.}$$

$$2187.5 = 7000 \cdot r \cdot 5 \quad \text{Substitute.}$$

$$2187.5 = 35,000r \quad \text{Simplify.}$$

$$\frac{2187.5}{35,000} = \frac{35,000r}{35,000} \quad \text{Divide both sides by 35,000.}$$

$$0.0625 = r \quad \text{Simplify.}$$

The simple annual rate is 6.25%, or $6\frac{1}{4}\%$.

For more on the compound interest formula, see page 302.

Compound interest is interest paid not only on the principal, but also on the interest that has already been earned. The formula for compound interest is below.

$$A = P \left(1 + \frac{r}{n} \right)^{nt}$$

A is the final dollar value, P is the principal, r is the rate of interest, t is the number of years, and n is the number of *compounding periods* per year.

The table shows some common compounding periods and how many times per year interest is paid for them.

Compounding Periods	Times per year (n)
Annually	1
Semi-annually	2
Quarterly	4
Monthly	12

EXAMPLE 5 Applying Compound Interest

Danielle invested \$1500 in a savings account that pays 3% interest compounded quarterly. Find the value of the investment after 9 years.

$$\begin{aligned}
 A &= P\left(1 + \frac{r}{n}\right)^{nt} && \text{Use the compound interest formula.} \\
 &= 1500\left(1 + \frac{0.03}{4}\right)^{4(9)} && \text{Substitute.} \\
 &= 1500(1 + 0.0075)^{36} && \text{Simplify.} \\
 &= 1500(1.0075)^{36} && \text{Add inside the parentheses.} \\
 &\approx 1500(1.308645) && \text{Find } (1.0075)^{36} \text{ and round.} \\
 &\approx 1962.97 && \text{Multiply and round to the nearest cent.}
 \end{aligned}$$

After 9 years, the investment will be worth about \$1962.97.

Think and Discuss

- Tell** what value should be used for t when referring to 6 months.
- Demonstrate** that doubling the time while halving the interest rate results in the same amount of simple interest.

6-7 Exercises



California Standards Practice

NS1.7



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GUIDED PRACTICE

- See Example 1
- Nick borrowed \$7150, to be repaid after 5 years at an annual simple interest rate of 6.25%. How much interest will be due after 5 years? How much will Nick have to repay?
- See Example 2
- Mr. Williams invested \$4000 in a bond with a yearly interest rate of 4%. His total interest on the investment was \$800. What was the length of the investment?