Section 9.2: Simple Interest

■Simple Interest
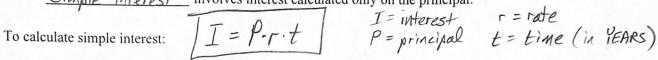
- $\underline{Interest}$ is the dollar amount that we get paid for lending money or pay for borrowing money.
- The amount of money that we deposit or borrow is called the $\underline{principal}$.
- The amount of interest depends on the principal, the interest $\underline{rate}$, which is given as a percent and varies from bank to bank, and the length of time which the money is deposited.
- $\underline{Simple\ interest}$ involves interest calculated only on the principal.

To calculate simple interest:

$$\boxed{I = P \cdot r \cdot t}$$

$I = $ interest $r = $ rate
$P = $ principal $t = $ time (in YEARS)

(The rate r, is expressed as a $\underline{decimal}$ when calculating simple interest.) ← Given as %, convert to decimal

Example 1: A student took out a simple interest loan for $1800 for two years, at a rate of 8% to purchase a new car. Find the interest of the loan. $P = 1800$ $t = 2$ $r = .08$

$$I = Prt$$
$$I = (1800)(.08)(2) \quad \rightarrow \text{The interest is } \$288.$$
$$I = 288$$

Example 2: Fred made an investment for 5 years at a rate of 6%, and ending up earning $120 in interest. How much was the investment for? Also, at the end of 5 years, what was the future value of his investment?

$t = 5$ $\quad I = Prt$
$r = .06$ $\quad 120 = P(.06)(5)$
$I = 120$ $\quad \dfrac{120}{.3} = \dfrac{.3P}{.3} \Rightarrow \boxed{P = \$400}$ original investment

$\rightarrow P + I$
$400 + 120 = \boxed{\$520}$
Future value (TOTAL)

■Future Value: Principal Plus Interest

The $\underline{future\ value}$ $\boxed{A}$ of P dollars at simple interest rate r (as a decimal) for t years is given by

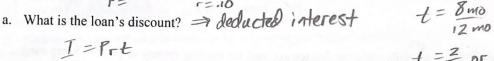- P is also known as the loan's $\underline{present\ value}$.

$$\boxed{A = P + I}$$

Example 3: A loan of $1060 has been made at a simple interest rate of 6.5% for three **months**. Find the loan's future value. $P = \$\underline{1060}$ $r = \underline{.065}$ $t = \underline{.25}$ (in terms of years)

$A = P + I$
$\quad I = Prt$
$\quad I = 1060(.065)(.25)$
$\quad \boxed{I = 17.23}$

$\{ A = P + I$
$\{ A = 1060 + 17.23$
$\{ \boxed{A = 1077.23}$

$t = \dfrac{3\ months}{12\ months}$
$t = \frac{1}{4}$ or .25

Example 4: You borrow $2500 from a friend and promise to pay back $2655 in six months. What simple interest rate will you pay? Find $\boxed{r}$

$P = 2500$
$A = 2655$
$t = \dfrac{6\ mo}{12\ mo} = \frac{1}{2}$

$A = P + I$
$2655 = 2500 + I$
$\underline{-2500 \quad -2500}$
$\$155 = I$

$I = Prt$
$155 = 2500 \cdot r \left(\frac{1}{2}\right)$
$\dfrac{155}{1250} = \dfrac{1250r}{1250} \Rightarrow r = .124 = \boxed{12.4\%}$

■ **Discounted Loans**

- Some lenders collect the interest from the amount of the loan at the time that the loan is made. This is called a _discounted loan_.
- The interest that is deducted from the loan is the _discount_.

Example 5: You borrow $10,000 on a 10% discounted loan for a period of 8 months.

$P =$ $r = .10$ $t = \dfrac{8 \, mo}{12 \, mo}$

a. What is the loan's discount? $\Rightarrow$ deducted interest

$t = \dfrac{2}{3}$ or $.\overline{6}$

$$I = Prt$$
$$I = (10000)(.10)\left(\tfrac{2}{3}\right) = {}^{\#}666.67$$

b. Determine the net amount of money you receive.

$$10000 - 666.67 = 9333.33$$

c. What is the loan's actual interest rate? Since you actually only received 9333.33, use that as the principal.

$$I = Prt$$

Solve for r:

$$666.67 = (9333.33)(r)\left(\tfrac{2}{3}\right)$$
$$666.67 = 6222.22 \, r$$
$$\frac{666.67}{6222.22} = \frac{6222.22}{6222.22}$$

$$\boxed{r \approx .107 \approx 10.7\%}$$

A discounted loan is NOT a better deal!

Example 6: Christina needs to borrow $3000, and she has two different options from her lender. Which option allows her to pay the least interest?

Option A: The length of the loan is 4 years, at an interest rate of 6.8%.
Option B: The length of the loan is 3.5 years, at an interest rate of 8.2%.

A: $I = Prt$

$$I = 3000(.068)4$$
$$I = {}^{\#}816$$

B: $I = Prt$

$$I = 3000(.082)(3.5)$$
$$I = {}^{\#}861$$

$\boxed{\text{Option A}}$ has less interest.