

3.1: Simple Interest

Simple interest is generally only used on short-term loans (1 year or less).

Principal: Amount of money on which interest is earned.

Interest: Cost to borrow money.

Simple Interest:

$$I = Prt$$

where

P = principal

r = annual simple interest rate (written as a decimal)

t = time in years

The future value, A , (the amount of money after simple interest accrues) is given by

$$A = P + I$$

$$A = P + Prt$$

$$= P(1 + rt)$$

Example 1: Your car needs repairs, but you are short on cash. Uncle Albert has agreed to loan you \$500, but you have to pay it back with interest. How much will you owe Uncle Albert after 5 months at 9% simple interest?

$$P = \$500$$

$$r = 0.09$$

$$t = 5 \text{ months} \left(\frac{1 \text{ yr}}{12 \text{ months}} \right) = \frac{5}{12} \text{ years}$$

$$I = Prt = \$500(0.09)\left(\frac{5}{12}\right) = \$18.75$$

$$A = P + I = \$500 + \$18.75 = \boxed{\$518.75}$$

the 9% interest rate is assumed to be an annual interest rate.

Could also use

$$A = P(1 + rt)$$
$$= \$500\left(1 + 0.09\left(\frac{5}{12}\right)\right)$$
$$= \$518.75$$

Example 2: How much should you invest so that you will receive \$1000 after 10 months at 10% simple interest?

$$A = P + I$$

$$= P + Prt$$

$$= P(1 + rt)$$

$$\$1000 = P\left(1 + 0.10\left(\frac{10}{12}\right)\right)$$

$$\$1000 \approx P(1.0833)$$

$$\frac{\$1000}{1.0833} \approx P \Rightarrow P = 923.0769231$$
$$\approx \boxed{\$923.08}$$

$$t = 10 \text{ months} \left(\frac{1 \text{ year}}{12 \text{ months}} \right)$$

$$= \frac{10}{12} \text{ year}$$

$$r = 0.10$$

$$A = \$1000$$

Example 3: You put \$10,000 into a short-term simple interest account for 180 days. After that time, the bank pays you \$10,150. What was the interest rate?

Use a 365-day year.

$$A = P(1 + rt)$$

$$\$10,150 = \$10,000 \left(1 + r \left(\frac{180}{365} \right) \right) \quad \begin{array}{l} A = \$10,150 \\ P = \$10,000 \\ r = ? \end{array}$$

$$\frac{\$10,150}{\$10,000} = 1 + r \left(\frac{180}{365} \right)$$

$$1.015 = 1 + r \left(\frac{180}{365} \right)$$

$$0.015 = r \left(\frac{180}{365} \right)$$

$$\frac{0.015}{\left(\frac{180}{365} \right)} = r$$

$$r = 0.015 \left(\frac{365}{180} \right) \approx 0.0304166667$$

$$\approx 0.0304 \Rightarrow r \approx 3.04\%$$

$$\text{OR } I = Prt$$

$$I = \$10,150 - \$10,000 = \$150$$

$$P = \$10,000$$

$$r = ?$$

$$t = \frac{180}{365} \text{ yrs}$$

$$I = Prt$$

$$\$150 = \$10,000 \left(r \right) \left(\frac{180}{365} \right)$$

$$\frac{\$150}{\$10,000 \left(\frac{180}{365} \right)} = r$$

3.04% is the interest rate.

Example 4: You are due to receive a tax refund of \$1685. IRS guidelines state that you should receive your refund 21 days after electronically filing your tax return. Instead of waiting, you utilize a "rapid refund" tax service. In addition to the tax preparation fee, which starts at \$59 for the simplest tax return, you must also pay \$40 to receive your refund in a refund transfer account set up by the tax preparation service. This allows you to access your refund amount immediately, less deductions and fees. While this is technically a tax product rather than a loan, you can calculate the annual interest rate that corresponds to a loan that has the same length of time, principal, and payback amount. What is this equivalent interest rate?