

# 1324-BZBS14e\_Notes-3-1-simple-interest

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1324-BZBS14e\_Notes-3-1-simple-interest

### 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

Ex: 8% interest  
 $\Rightarrow r = 0.08$

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

$$\begin{aligned} A &= P + I \\ A &= P + Prt \\ &= P(1 + rt) \end{aligned}$$

**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?

$$\begin{aligned} I &= Prt \\ &= \$500(0.09)\left(\frac{5}{12} \text{ yr}\right) \\ &= \$18.75 \\ A &= P + I = \$500 + \$18.75 \\ &= \$518.75 \end{aligned}$$

You will pay Albert back \$518.75.

$$\begin{aligned} P &= \$500 \\ r &= 0.09 \\ t &= \frac{5 \text{ months}}{1} \left( \frac{1 \text{ year}}{12 \text{ months}} \right) = \frac{5}{12} \text{ year} \\ I &= ? \end{aligned}$$

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

$$\begin{aligned} A &= P + Prt \\ A &= P(1 + rt) \\ \$1000 &= P\left(1 + 0.10\left(\frac{10}{12}\right)\right) \\ P &\approx \$923.0769231 \end{aligned}$$

You should invest \$923.08.

$$\begin{aligned} A &= \$1000 \\ P &= ? \\ r &= 0.10 \\ t &= 10 \text{ months} \left( \frac{1 \text{ yr}}{12 \text{ months}} \right) = \frac{10}{12} \text{ yr} \end{aligned}$$

Do not round until the end!

**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?

Assume a 365-day year.

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

$$I = Prt$$

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

$$I = \$150$$

$$P = \$10,000$$

$$r = ?$$

$$t = 180 \text{ days} \left( \frac{1 \text{ yr}}{365 \text{ days}} \right)$$

$$= \frac{180}{365} \text{ yr}$$

$$r \approx 0.03041667 \Rightarrow 3.04\%$$

Interest rate is 3.04%.

OR

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

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

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

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

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

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

$$r \approx 0.03041667$$

$$P = \$10,000$$

$$A = \$10,150$$

$$r = ?$$

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

**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?