

1.1 – Simple Interest

Simple Interest – The amount of interest earned on an investment or paid on a loan based on the original amount (the principal) and the simple interest rate.

Term (t) – The contracted duration of an investment or loan (the time, usually in years).

Interest (I) – The amount of money earned on an investment or paid on a loan.

Fixed Interest Rate (r) – An interest rate that is guaranteed not to change during the term of an investment or loan. (always written as a decimal for calculations)

Principal (P) – The original amount of money invested or loaned.

Maturity – The contracted end date of an investment or loan, at the end of the term.

FUTURE VALUE (FV or A) The amount that an investment will be worth after a specified period of time.

Example 1: Marty invested in a \$2500 guaranteed investment certificate (GIC) at 2.5% simple interest, paid annually (she can only withdraw the money at the end of each year), with a term of 10 years.

a) How much interest will accumulate over one year?

Find 2.5% of \$2500
= 10%

$$0.025 \times 2500 = \$62.50$$

In one year Marty will earn \$62.50

b) How much interest will accumulate over the term of Marty's investment?

\$62.50 per year for 10 years

$$62.50 \times 10 = \$625$$

In 10 years Marty will have earned \$625

c) What is the **future value** of his investment at maturity?

Future Value = Principal + Interest Earned

$$FV = \$2500 + \$625 = \$3125$$

d) Can you write a formula that will calculate the amount of Simple Interest earned over the term of an investment?

Amount Interest = Interest Rate (as decimal) x Principal x Term

$$I = Prt$$

e) How would an interest rate of 3.4% change the **future value** of Marty's investment?

0.034

$$I = 2500(0.034)(10)$$

$$I = 850$$

$$FV = 2500 + 850$$

$$= \$3350$$

Marty will have an extra

SIMPLE INTERST: Total Interest Earned = (Principle Amount)(Interest Rate)(Term – in years)

$$I = Prt$$

As a decimal

Rate of Return – The ratio of money earned (or lost) on an investment relative to the amount of money invested, usually expressed as a decimal or a percent.

$$\frac{\text{Amount of Interest}}{\text{Principal}} \times 100$$

Example 2: Ingrid invested her summer earnings of \$5000 at 8% simple interest, paid annually. She intends to use the money in a few years to take a holiday with a friend.

a) How long will it take for the future value of the investment to grow to \$8000?

Find the Amount of Interest earned: $8000 - 5000 = 3000$

$$\begin{aligned} I &= 3000 \\ r &= 0.08 \\ t &=? \\ P &= 5000 \end{aligned}$$

$$\begin{aligned} I &= Prt \\ 3000 &= 5000(0.08)t \\ \frac{3000}{400} &= \frac{400t}{400} \\ 7.5 &= t \end{aligned}$$

But since interest is only paid annually she can't take it out until end of year 8.

$$\therefore 8 \text{ years}$$

b) What is Ingrid's rate of return?

$$\text{Rate of Return} = \frac{\text{Interest}}{\text{Principal}} \times 100 = \frac{3200}{5000} \times 100$$

Interest after 8 years:

$$I = 5000(0.08)(8) = \$3200$$

$$= 64\%$$

c) How would each situation below change the length of time needed for the future value of Ingrid's investment to grow to \$8000 under simple interest conditions?

1. If Ingrid invested a principal of only \$4000 at 8%, paid quarterly

$$\begin{aligned} I &= 4000 \\ P &= 4000 \\ r &= 0.08 \\ t &=? \end{aligned}$$

$$\begin{aligned} 4000 &= 4000(0.08)t \\ \frac{4000}{320} &= \frac{320t}{320} \\ t &= 12.5 \end{aligned}$$

so can take it out 4 times a year

$$\therefore 12.5 \text{ years}$$

2. If 8% interest on principal of \$5000 was paid semi-annually

$$\begin{aligned} I &= 3000 \\ P &= 5000 \\ r &= 0.08 \\ t &=? \end{aligned}$$

$$\begin{aligned} 3000 &= 5000(0.08)t \\ \frac{3000}{400} &= \frac{400t}{400} \\ 7.5 &= t \end{aligned}$$

But can take money out after 7.5 years

$$\therefore 7.5 \text{ years}$$

Example 3: Grant invested \$25 000 in a simple interest Canada Savings Bond (CSB) that paid interest annually.

a) If the future value of the CSB is \$29 375 at the end of 5 years, what interest rate does the CSB earn?

Find the Interest Earned: $29375 - 25000 = \$4375$

$$I = 4375$$

$$P = 25000$$

$$r = ?$$

$$t = 5$$

$$I = Prt$$

$$4375 = 25000 r 5$$

$$\frac{4375}{125000} = \frac{125000r}{125000}$$

$$0.035 = r$$

Interest rate
= 3.5%

b) Grant cashed in the bond after 4.5 years because a house he had been admiring came up for sale and he needed a down payment. How much money did he have for the down payment? (Remember that interest is paid annually so he won't get any interest after the 4th year)

$$P = 25000$$

$$t = 4$$

$$r = 0.035$$

$$I = ?$$

$$I = Prt$$

$$I = 25000(0.035)4$$

$$I = \$3500$$

$$FV = P + I$$

$$= 25000 + 3500$$

$$= \$28500$$

Example 4: A bank is offering a simple interest rate of 4.6% for a GIC with a 10 year term. How much would you have to invest if you wanted to have \$25 000 at the end of the term?

We don't know the Principal so can't work out the Interest Earned. But $\rightarrow (I = Prt)$

$$FV = P + I$$

$$FV = P + Prt$$

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

$$25000 = P(1 + (0.046)(10))$$

$$\frac{25000}{1.46} = \frac{P(1.46)}{1.46}$$

$$17123.29 = P$$

You would have
to invest
\$17123.29

(factor out P)

$$FV = 25000$$

$$P = ?$$

$$r = 0.046$$

$$t = 10$$