

1.1 – SIMPLE INTEREST

Goal: Solve problems that involve simple interest.

Example 1: Solving a simple interest problem

Aaron is 18 years old and needs money to pay for college. When he was born, his grandparents bought him a \$500 Canada Savings Bond (CSB) with a term of 10 years. They chose a CSB as an investment because they like the security of loaning money to the government. The interest earned was determined using a fixed interest rate of 6% per year on the original investment and was paid at the end of each year until Aaron’s 10th birthday.

Determine the simple interest earned on the principal and the future value of the investment when it reaches maturity.

To understand the question, we need to know:

- term: duration of investment
- interest: money earned on an investment or paid on a loan
- fixed interest rate: interest rate guaranteed for the term
- simple interest: interest earned on original investment only
- principal: original amount invested
- future value: the amount, A, that an investment will be worth
- maturity: the contracted end date of an investment

To answer the question, we will organize our calculation into a table like the one below:

Year	Value of Investment at Start of Year (\$)	Simple Interest Earned Each Year (\$)	Accumulated Interest (\$)	Value of Investment at End of Year (\$)
0	500	$500 \times 0.06 = 30$	30	530
1	500	30	60	560
2	500	30	90	590
3	500	30	120	620
4	500	30	150	650

Note that the interest does not change in a scenario involving simple interest at a fixed interest rate. So instead we can simply calculate a year’s interest and multiply it by the number of years in the term, or:

$$i = Prt$$

← time
↑ rate
↑ principal
↑ interest

$$i = 500 \cdot 0.06 \cdot 10 = \$300$$

Adding the principal allows us to determine the future value of the investment, A

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

↑ future value / amount

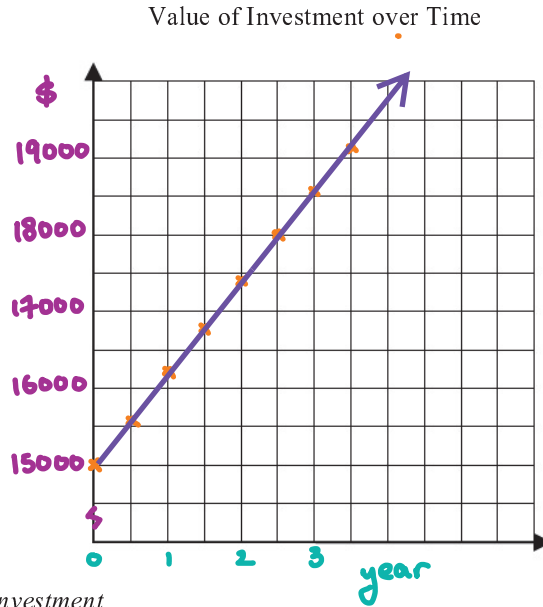
$$\begin{aligned}
 A &= 500(1 + 0.06 \cdot 10) \\
 &= 500(1 + 0.6) \\
 &= 500(1.6) \\
 &= \$800
 \end{aligned}$$

Example 2: Representing the growth of a simple interest investment

Betty invested \$15 000 in a savings account. Betty earned a simple interest rate of 8%, paid semi-annually on her investment. She intends to hold the investment for 3.5 years, when she will use the money to buy a car. Determine the value of the investment at each half year until she withdraws the money.

$A = P(1 + rt)$

Year	Value of Investment (\$)
0	15000
0.5	$15000(1 + 0.08 \cdot 0.5) = 15600$ +600
1	$15000(1 + 0.08 \cdot 1) = 16200$ +600
1.5	16800
2	17400
2.5	18000
3	18600
3.5	19200



Example 3: Determining the duration of a simple interest investment

Charles invested his savings of \$5000 at 6% simple interest, paid annually.

How long will it take for the future value of the investment to grow to \$6500?

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

$$\begin{aligned} 6500 &= 5000(1 + 0.06t) & 0.3 &= 0.06t \\ \div 5000 &\div 5000 & \div 0.06 &\div 0.06 \\ 1.3 &= (1 + 0.06t) & 5 &= t \end{aligned}$$

5 years

What is Charles rate of return?

rate of return: ratio of earnings to principal

rate of return = $\frac{\text{interest}}{\text{principal}} = \frac{1500}{5000} = 0.3$ or 30%

↖ amount - principal

Example 4: Determining the rate of interest on a simple interest investment

Danielle invested \$25 000 in a simple interest CSB that paid interest annually. If the future value of the CSB is \$29 375 at the end of the term, what interest rate does the CSB earn? Given that rate, how much would the investment be worth if she withdrew after four years instead?

$A = P(1 + rt)$

$$\begin{aligned} 29375 &= 25000(1 + r5) \\ \div 25000 &\div 25000 \\ 1.175 &= 1 + r5 \end{aligned}$$

$$\begin{aligned} 0.175 &= 5r \\ \div 5 &\div 5 \\ r &= 0.035 = 3.5\% \end{aligned}$$

↙ for 5 years

$$\begin{aligned} A &= 25000(1 + 0.035 \cdot 4) \\ &= 25000(1 + 0.14) \\ &= 25000(1.14) \\ &= \$28500 \end{aligned}$$