

# 8.1

## Simple Interest

### term

The contracted duration of an investment or loan.

### interest

The amount of money earned on an investment or paid on a loan.

### fixed interest rate

An interest rate that is guaranteed not to change during the term of an investment or loan.

### principal

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

The amount,  $A$ , that an investment will be worth after a specified period of time.

### GOAL

Solve problems that involve 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.

### Communication | Tip

Interest rates are communicated as a percent for a time period. Since most often the time period is per year or **per annum** (abbreviated as **/a**), a given percent is assumed to be annual unless otherwise stated. For example, an interest rate of 4% means 4%/a or 4% interest per year.

# SIMPLE Interest

Based on the **principal** (original amount) that is invested/borrowed. Interest is a certain percentage per **annum** (year). Often used for personal loans and short-term investments. The length of time for the investment/loan is called the **term**.

$$I = Prt$$

&

$$A = P + I$$

OR

$$A = P + Prt$$

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

Interest = Principal x rate x time

- I - interest earned
- P - principal (original investment/loan)
- r - interest rate as a percent (change to a decimal)
- t - is ALWAYS time in **years**  
(how long the money is invested/borrowed)
- A - amount of money including interest



## APPLY the Math p. 446

### EXAMPLE 1

### Solving a simple interest problem

Marty invested in a \$2500 guaranteed investment certificate (GIC) at 2.5% simple interest paid annually, with a term of 10 years.

- How much interest will accumulate over the term of Marty's investment?
- What is the **future value** of his investment at maturity?

Amount

$$\begin{aligned} a) \quad I &= P \cdot r \cdot t \\ I &= 2500(0.025)(10) \\ I &= \$625 \end{aligned}$$

$$\begin{aligned} b) \quad A &= P + I \\ A &= 2500 + 625 \\ A &= \$3125 \end{aligned}$$

**NOTE:**

Means that interest is paid only in yearly increments.

ex Paid Annually  $\rightarrow$  once a year  
 $t = 4.5$  yrs  
Interest on 4 years

Paid semi-annually  $\rightarrow$  twice a year  
 $t = 3.8$  years  
Interest up to 3.5 yrs

**EXAMPLE #2:**

Betty-Ann's bank offers a simple interest rate of 4% per annum. How much interest would Betty-Ann earn on her investment of \$4000 after 8 months.

$$I = Prt$$

$$I = 4000 (0.04) (8/12)$$

$$I = \$106.67$$



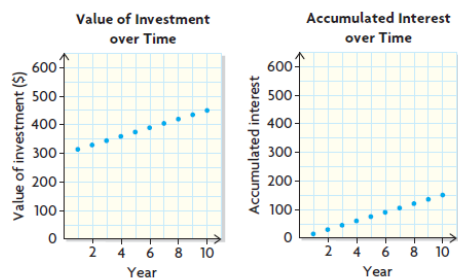
Time

# SIMPLE INTEREST...

## In Summary p. 451

### Key Ideas

- Simple interest is determined only on the principal of an investment.
- The value of an investment that earns simple interest over time is a linear function. The accumulated simple interest earned over time is also a linear function. Since the interest is paid at the end of each period, the growth is not continuous. For example, the following graphs show principal of \$300 invested at 5% interest, paid annually, over a term of 10 years.



### Need to Know

- The amount of simple interest earned on an investment can be determined using the formula

$$I = Prt$$

where  $I$  is the interest,  $P$  is the principal,  $r$  is the annual interest rate expressed as a decimal, and  $t$  is the time in years.

- The future value or amount,  $A$ , of an investment that earns simple interest can be determined using the formula

$$A = P + Prt$$

$$\text{or } A = P(1 + rt)$$

where  $P$  is the principal,  $r$  is the interest rate expressed as a decimal, and  $t$  is the time in years.

- Unless otherwise stated, an interest rate is assumed to be annual, or per annum.
- Even though interest rates are usually annual, interest can be paid out at different intervals, such as annually, semi-annually, monthly, weekly, and daily.

# WARM-UP...

You earned \$107.42 simple interest on a \$671.37 investment over four years.

What was the interest rate?



$$r = \frac{I}{Pt}$$

$$I = \frac{P \cdot r \cdot t}{100}$$

$$107.42 = \frac{671.37 \cdot r \cdot 4}{100}$$

```
107.42/(671.37*4
)
.0400002979
Ans*100
4.00002979
```

**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.

$$ROR = \frac{\text{earn / lost}}{\text{invested}}$$

$$\frac{I_{\text{earn/lost}}}{P}$$



EXAMPLE 3  
p. 448

Determining the duration of a simple interest investment

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 girlfriend.

$$A = P + I$$

$$I = A - P$$

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

b) What is Ingrid's rate of return?

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

$$I = 3200$$

$$ROR = \frac{3200}{5000} \times 100\%$$

$$ROR = 64\%$$



$$t = \frac{I}{Pr}$$

$$t = \frac{3000}{5000 \times 0.08}$$

$$t = 7.5 \text{ yrs}$$

$$t = 8 \text{ yrs}$$

Ingrid's Solution

a)  $A = P + Prt$

$P$  is \$5000.  
 $r$  is 8%, or 0.08.  
 $A$  is \$8000.

$$8000 = 5000 + (5000)(0.08)t$$

$$3000 = 400t$$

$$7.5 = t$$

I knew  $P$ ,  $r$ , and  $A$ . I determined  $t$  by substituting these known values into the formula  $A = P + Prt$  and solving for  $t$ .

Because I needed to isolate  $t$ , I knew that the  $A = P + Prt$  form of the equation would have fewer solution steps than the  $A = P(1 + rt)$  form would.

It will take 8 years for the future value of the investment to be at least \$8000.

I knew 7.5 years would not work because the interest is paid annually. This meant that I had to round up to the next whole year. It also meant that, at 8 years, the future value would be more than \$8000.

b) After 8 years:

$$A = P + Prt$$

$$A = 5000 + (5000)(0.08)(8)$$

$$A = 8200$$

At 8 years, the future value will be \$8200.

I determined the interest earned by subtracting the principal from the future value.

Interest earned:  
 $\$8200 - \$5000 = \$3200$

$$\text{Rate of return} = \frac{3200}{5000}$$

I compared the interest earned with the principal to determine the rate of return.

$$\text{Rate of return} = 0.64$$

The rate of return is 64% over 8 years.

# HOMEWORK...

p. 452: #1 - 6, 10, 11, 12

$$I = Prt$$

&

$$A = P + I$$

OR

$$A = P + Prt$$

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