8.1 Simple Interest

term
The contracted du...
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**.

Interest = Principal x rate x time

$\boxed{I = Prt}$

&

$\boxed{A = P + I}$

OR

$A = P + Prt$

$A = P(1 + rt)$

- 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.

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

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

Amount

a) $I = Prt$

$= 2500(0.025)(10)$

$= \$625$

b) $A = P + I$

$= 2500 + 625$

$= \$3125$

EXAMPLE #2:
Betty-Ann's bank offers a simple interst rate of 4% per annum. How much interest would Betty-Ann earn on her investment of $4000 after 8 months.

$$I = Prt$$

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

$$I = \$106.67$$

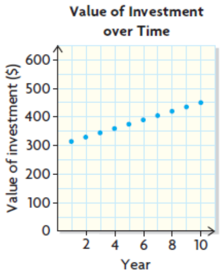
Time

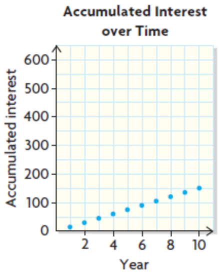
SIMPLE INTEREST...

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...

$$\frac{I}{P \mid r \mid t}$$

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

What was the interest rate?

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

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

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

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

$$\left(\frac{107.42}{4}\right) \div 671.37$$

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

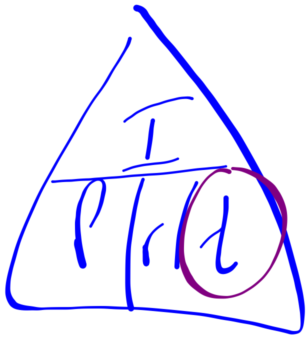
```
107.42/(671.37*4
)
     .0400002979
Ans*100
      4.00002979
```

$$\frac{107.42}{671.37 \times 4} = \frac{671.37 \times r \times 4}{671.37 \times 4}$$

$$= r$$

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

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



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.

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

$\frac{I}{P}$

EXAMPLE 3 p. 448

Determining the duration of a simple interest investment

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

$\frac{I}{P \mid r \mid t}$

$A = P + I$

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.

$t = \frac{3000}{5000 \times 0.08}$ $t = 7.5$ yrs

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

$I = A - P = \$3000$

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

b) What is Ingrid's rate of return?

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.

Interest earned:
$8200 − $5000 = $3200

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

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

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

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

The rate of return is 64% over 8 years.

$$ROR = \frac{\$ \text{ earn}}{\$ \text{ invest}}$$

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

$$= 64\%$$

<u>Interest on 8 yrs</u>

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

$$I = 3200$$

HOMEWORK...

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

$$\boxed{I = Prt}$$

&

$$\boxed{A = P + I}$$

OR

$$\boxed{\begin{array}{l} A = P + Prt \\ A = P(1 + rt) \end{array}}$$