Chapter Three: The Mathematics of Finance

3.1 Simple Interest

**Definition** – The simple interest on an investment (or loan) of PV dollars at an annual interest rate of *r* for a period of *t* years is $INT = PVrt$.

**Definition** – The future value of an investment of PV dollars at an annual simple interest rate of *r* for a period of *t* years is given by $FV = PV + INT$ which can be simplified to $FV = PV(1+rt)$.

Example: Compute the simple interest and find the future value.

1. $2000 is invested for 10 years at 4% per year.

$INT = 2000(.04)(10) = \$800$

$FV = 2000 + 800 = \$2800$

2. $1000 is invested for 6 months at 5% per year.

$INT = 1000(.05)\left(\frac{6}{12}\right) = \$25$

$FV = 1000 + 25 = \$1025$

we use $\frac{6}{12}$ for t because 6 months is $\frac{6}{12}$ of a year

3. You try it: $10,000 is invested for 3 months at 11% per year.

Example: Find the present value.

1. An investment earns 2% per year and is worth $10,000 after 5 years.

$10{,}000 = PV(1+.02(5))$

$\frac{10{,}000}{(1+.02(5))} = PV$

$PV = \frac{10{,}000}{1.1} = \$9090.91$

2. An investment earns 7% per year and is worth $1000 after 6 months.

$1000 = PV\left(1+.07\left(\frac{6}{12}\right)\right)$

$1000 = PV(1+.035)$

$\frac{1000}{1.035} = PV$

$PV = \$966.18$

3. You try it: An investment earns 6% per year and is worth $30,000 after 20 months.

Example: The simple interest on a $1000 loan at 8% per year amounted to $640. When did the loan mature?

PV  r = 0.09  INT  find t

INT = PVrt becomes $640 = 1000(.08)t$

$640 = 80t$

$\frac{640}{80} = t$

It matured in 8 years.

Example: You take out a 2- year, $5000 loan at 9% simple annual interest. The lender charges you a $100 fee. Thinking of the fee as additional interest, what is the actual annual interest rate you will pay?

First sentence: $t = 2$, $PV = 5000$, $r = 9\% = 0.09$

$100 fee is additional interest so $INT = 5000(.09)(2) = 900$

Total fee/interest is $900 + 100 = 1000$.

$INT = 1000$, $t = 2$, $PV = 5000$, find $r$

$1000 = 5000r(2)$

$1000 = 10{,}000r$

$\frac{1000}{10{,}000} = r \longrightarrow r = \frac{1}{10} = 0.10 = 10\%$