# Section 6.1 – Interest, Investments, and Loans

**This booklet belongs to:_____ Block:_____**

## Investments

- Financial investing is the act of setting aside money with the hope of receiving a greater amount back in the future
- A particular way to get this back is to invest in low-risk, low interest savings
- These type of investment pay interest on the money invested, either: **Simple or Compound**

## Simple Interest

- Interest money that is added to the PRINCIPAL (money invested or borrowed)
- It is decided based on a given percentage rate
- Low Interest Rates
  - Awesome for a borrower, you pay less to the lender
  - Bad if you are trying to grow interest on savings

- High Interest Rates
  - Brutal/Crippling for a borrower, you pay more to the lender
  - Great if it is interest earned in savings

- **Simple Interest** is calculated this way: $\boldsymbol{I = Prt}$

- $I$: $is\ the\ amount\ of\ interest\ calculated$
- $P$: $is\ the\ Principal\ (the\ amount\ of\ money\ borrowed\ or\ saved)$
- $r$: $is\ the\ Percentage\ Rate, expressed\ as\ a\ decimal\ (25\% = 0.25)$
- $t$: $is\ Time, in\ years$

**Example:** Find the future amount of an investment of $\$8000$ at simple interest for $5yrs$ at $6\%$.

**Solution:** $I = Prt$

Here: $P = \$8000$ $t = 5$ $r = 6\% = 0.06$

$I = (8000)(0.06)(5)$

$I = 2400$

So in 5 years without touching the money, you earn an extra $\$2400$, giving a new total of:

$$8000 + 2400 = \$\mathbf{10\ 400}$$

**Example:** Yazia borrowed $\$5200$ at $7.5\%$ simple interest to build a swimming pool. If she paid $\$2340$ in interest, find the term of the loan and the monthly payments.

**Solution:** Since $\boldsymbol{I = Prt}$, We need $\boldsymbol{t}$ **alone,** and doing algebra give us:

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

So… $I = \$2340$ $r = 0.075$ $P = \$5200$

$$t = \frac{I}{Pr} \quad \rightarrow \quad \frac{2340}{5200(0.075)} \quad \rightarrow \quad \boldsymbol{6yrs}$$

- The term of the loan is 6 years, which is 72 months.
- The total amount paid is the principal plus interest.

$$\$5200 + \$2340 = \$7540$$

- Divide by 72 to find the monthly payment: $\frac{7540}{72} = \$\mathbf{104.73}$

## Discount Loans

- Sometimes the interest on a loan is paid up front by deducting the amount of the interest the lender gives you. **This is called a Discounted Loan.**

**Example:** Katrina obtained a $2\ year$ $\$6000$ loan for university. The rate was $8\%$ simple interest and the loan was a discounted loan.

a) Find the discount
b) Find the amount of money Katrina received
c) Find the actual interest rate

**Solution:**

a) The discount is the total interest of the loan: $I = Prt \quad \rightarrow \quad I = 6000(0.08)(2) = \$\mathbf{960}$

b) Katrina receives: $\$6000 - \$960 = \$\mathbf{5040}$

c) The actual interest rate should be calculated on $\$5040$ with $\$960$ in interest.

$r = \frac{I}{Pt} \quad \rightarrow \quad \frac{960}{(5040)(2)} = 0.0952$ The actual interest rate was: $\mathbf{9.52}\%$

## Compound Interest

❖ **Compound Interest** is much more complicated. You build/owe on the $\boldsymbol{Principal} + \boldsymbol{the\ Interest}$ earned in a compounding period

- It can be used to your benefit when savings, but it can drown you when it's used against your debt

- **Compound Interest** is calculated this way: $\boldsymbol{A = P\left(1 + \frac{r}{n}\right)^{n(t)}}$

  - $A$: $is\ the\ final\ amount\ earned$
  - $P$: $is\ the\ Principal\ (the\ initial\ amount\ of\ money\ borrowed\ or\ saved)$
  - $r$: $is\ the\ \boldsymbol{Yearly}\ Percentage\ Rate, expressed\ as\ a\ decimal\ (25\% = 0.25)$
  - $n$: is the number of times yearly interest is compounded per year
  - $t$: $is\ time, in\ years$

- Compounding periods means the number times the interest is calculated in a year
  - Yearly: $n = 1$
  - Quarterly: $n = 4$
  - Monthly: $n = 12$
  - Daily: $n = 365$

**Example:** To have savings for university, the parents of a child invest $\$25\ 000$ in a savings plan paying $6\%$ interst compounded quarterly. How much money will they have in 18 years?

**Solution:** $\boldsymbol{A = P\left(1 + \frac{r}{n}\right)^{n(t)}}$ so we sub in for the information given to fins the solution

$$\boldsymbol{A = 25\,000\left(1 + \frac{0.06}{4}\right)^{4(18)} \quad \rightarrow \quad A = 25\,000(1.015)^{72} \quad \rightarrow \quad A = \$73028.95}$$

- At 18 years old the child will have: $\boldsymbol{\$73028.95}$

**Example:** How much would you have to invest into a 10 year bond paying $4.2\%$ compounded weekly to make it worth $\$5000$ at the end of its term?

**Solution:** $\boldsymbol{A = P\left(1 + \frac{r}{n}\right)^{n(t)}}$ so we calculated what we can then use algebra to find the unknown

$$\boldsymbol{5000 = P\left(1 + \frac{0.042}{52}\right)^{52(10)} \quad \rightarrow \quad 5000 = P(1.5217) \quad \rightarrow \quad P = \frac{\$5000}{(1.5217)} = \$3285.79}$$

$\boldsymbol{P = \$3285.79}$ You need to invest $\boldsymbol{\$3285.79}$

# Section 6.1 – Practice Problems

Find the future value of the loan using Simple Interest

1. $P = \$1080, r = 3.45\%, t = 4.5\ years$

2. $P = \$4250, r = 5.3\%, t = 42\ months$

3. $P = \$6625, r = 4.7\%, t = 130\ weeks$

4. $P = \$3360, r = 9.5\%, t = 240 days$

The following loans are discounted. For each question find: the discount, the amount of money received, and the true interest rate

5. $P = \$6500, r = 6.5\%, t = 4\ years$

6. $P = \$9600, r = 8.25\%, t = 2\ years$

Find the future amount and interest, using the Compound Interest formula

| Principal | Rate | Compounded | Time | Future Amount | Interest |
|---|---|---|---|---|---|
| 7. $\$6200$ | $4.5\%$ | Semi-annually | $3\ year$ | | |
| 8. $\$7500$ | $5.3\%$ | Quarterly | $4.5\ years$ | | |
| 9. $\$9600$ | $8\%$ | Monthly | $1.5\ years$ | | |
| 10. $\$2500$ | $7.5\%$ | Weekly | $6\ years$ | | |
| 11. $\$5000$ | $6\%$ | Daily | $3\ years$ | | |

Work Space

12. A new computer has a 3 year payment plan with monthly payments of $\$36.80$. The cost of the computer is $964.20$. Find the interest rate of the computer using simple interest.

13. For a set of new tires costing $\$648.48$ including tax, you are offered low monthly payments of $\$42.60$ over 18 months. Find the interest rate for the tires using simple interest.

14. An 18 year old plans to retire at age 55. She decided to invest her inheritance of $\$50\,000$ at $6\%$ compounded quarterly. How much will she have at 55?

15. The Smiths hope to accumulate $\$40\,000$ for a new car in 5 years. How much would they need to invest right now at $5.2\%$ compounded monthly to reach their goal?

16. An investor deposits $\$8000$ into an account paying $6\%$ compounded quarterly. Three years later he deposits $\$5000$ into the same account. How much money was there at the end of 5 years?

17. What percentage of Simple Interest would be needed on a 12 year investment to have the same future value as one that pays $6\%$ compounded quarterly?

# Answer Key – Section 6.1

| | |
|---|---|
| 1. $I$: \$167.67 $FV$: \$1247.67 | 2. $I$: \$788.32 $FV$: \$5038.38 |
| 3. $I$: \$778.44 $FV$: \$7403.44 | 4. $I$: \$209.88 $FV$: \$3569.88 |
| 5. $I$: \$1690 $DL$: \$4810 $r$: 8.78% | 6. $I$: \$1584 $DL$: \$8016 $r$: 9.9% |
| 7. $I$: \$885.52 $FV$: \$7085.52 | 8. $I$: \$2005.18 $FV$: \$9505.18 |
| 9. $I$: \$1219.66 $FV$: \$10 819.66 | 10. $I$: \$1419.51 $FV$: \$3919.51 |
| 11. $I$: \$1106.96 $FV$: \$6106.96 | 12. $r$: 12.47% |
| 13. $r$: 12.16% | 14. $A$: \$452 839.45 |
| 15. $P$: \$30 859.39 | 16. $A$: \$16 407.31 |
| 17. $r$: 8.7% | |

**Extra Work Space**