Section 7.2 – Interest and Deductions

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

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: $I = Prt$

  - 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 1:   How much interest is paid over a $3\ year$ period on $5000 at an APR (Annual Percentage Rate) of 3%?

Solution 1: $I = Prt$

Here: $P = \$5000$ $t = 3$ $r = 3\% = 0.03$

$I = (5000)(0.03)(3)$

$I = 450$

So, in 5 years without touching the money, you earn an extra $450

- You can simply flip the scenario to borrowing and if you borrowed $5000 you would owe an extra $450 back on top of the $5000
- You can also use algebra to manipulate the equation to solve for $P, r, or\ t$

Example 2: What Principal at 4.75% will earn interest of $27.15 in 9 months?

Solution 2:   Since $I = Prt$, We need P **alone,** and doing algebra give us:

$$\frac{I}{rt} = P$$

and since $Time\ in\ in\ years$, **9 months means 9 out of 12 months,**

$$\frac{9}{12}\ of\ a\ year \qquad\qquad \text{Or….} \qquad\qquad \frac{3}{4}\ years$$

So…

$$P = \frac{I}{rt} \quad \rightarrow \quad \frac{27.15}{(0.0475)(\frac{3}{4})} \quad \rightarrow \quad \$762.11$$

Compound Interest

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

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

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

  - 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
    - o   Yearly: $n = 1$
    - o   Quarterly: $n = 4$
    - o   Monthly: $n = 12$
    - o   Daily: $n = 365$

Example 3: Find the interest earned if \$6500 is deposited in an account paying 6% compounded monthly for 5 *years*

Solution 3: $A = P\left(1 + \frac{r}{n}\right)^{n(t)}$ so we sub in for the information given to fins the solution

$$A = 6500\left(1 + \frac{0.06}{12}\right)^{12(5)} \quad \rightarrow \quad A = 6500(1.005)^{60} \quad \rightarrow \quad A = \$8767.53$$

- The interest is: $I = A - P \quad \rightarrow \quad \$8767.53 - \$6500 = \$2267.53$

Example 4: What is the initial investment needed to become a millionaire in 25 years if interest is 12% compounded quarterly?

Solution 4: $A = P\left(1 + \frac{r}{n}\right)^{n(t)}$ so we calculated what we can then use algebra to find the unknown

$$1\,000\,000 = P\left(1 + \frac{0.12}{4}\right)^{4(25)} \quad \rightarrow \quad 1\,000\,000 = P(1.03)^{100} \quad \rightarrow \quad P = \frac{\$1\,000\,000}{(1.03)^{100}}$$

$P = \$52\,032.84$ You only need to invest $\$52\,032.84$ to be a millionaire in 25 years

Example 5: What is the difference in earnings on an investment of \$8000 for 10 years at 6% compounded yearly, monthly, and daily?

Solution 5:

Yearly	Monthly	Daily
$A = P\left(1 + \frac{r}{n}\right)^{n(t)}$	$A = P\left(1 + \frac{r}{n}\right)^{n(t)}$	$A = P\left(1 + \frac{r}{n}\right)^{n(t)}$
$A = 8000\left(1 + \frac{0.06}{1}\right)^{1(10)}$	$A = 8000\left(1 + \frac{0.06}{12}\right)^{12(10)}$	$A = 8000\left(1 + \frac{0.06}{365}\right)^{365(10)}$
$A = \$14\,326.78$	$A = \$14\,555.17$	$A = \$14\,576.23$

Deductions

GROSS PAY: Is your pay calculated before any deductions

NET PAY: Is your take home pay, the money you actually get paid

- Why aren't these the same?

    o   Well we get money deducted from our paychecks
    o   There are three main deductions that everyone gets:

Employment Insurance (EI):   This is a fund we all pay into so if you ever get laid-off you can apply for EI, it pays you a percentage of your wage for a certain period of time

Canadian Pension Plan (CPP):   This is a fund we all pay into so that generally when you turn 65 you start getting CPP Pension payments

	2017	2018
Canada/Quebec Pension		
Annual Maximum Pensionable Earnings	$55,300.00	$55,900.00
Annual Basic Exemption	$3,500.00	$3,500.00
Annual Maximum Contributory Earnings	$51,800.00	$52,400.00
CPP Contribution Rate	4.95%	4.95%
QPP Contribution Rate	5.40%	5.40%
Annual Maximum CPP Employee Contribution	$2,564.10	$2,593.80
Annual Maximum CPP Employer Contribution	$2,564.10	$2,593.80
Annual Maximum QPP Employee Contribution	$2,797.20	$2,829.60
Annual Maximum QPP Employer Contribution	$2,797.20	$2,829.60

	2017	2018
Employment Insurance (EI) - Non-Quebec Employee		
Annual Maximum Insurable Earnings	$51,300.00	$51,700.00
Employee Contribution Rate	1.63%	1.66%
Employer Contribution Rate	2.282%	2.324%
Annual Maximum Employee Contribution	$836.19	$858.22
Annual Maximum Employer Contribution	$1,170.67	$1,201.51

Income Tax Provincial and Federal:

This is tax taken on your income by the Provincial and Federal Government and is based on your annual salary. It is combined and quite complicated, so reference the list below when making your calculations.

Taxable Income	Average Tax Rate
$30 000	12.4%
$40 000	14.3%
$50 000	16.4%
$60 000	18.4%
$70 000	19.8%
$80 000	20.8%
$90 000	22.0%
$100 000	23.4%
$110 000	24.8%
$120 000	26.1%
$130 000	27.2%
$140 000	28.2%
$150 000	29.1%
$200 000	33.3%
$250 000	36.5%
$500 000	43.1%

- So, using the percentages above we can determine how much money gets deducted from our paycheck.

Example 6:   Gwen's annual income is $62 000, her semi-monthly GROSS pay is $2583.33. It is her first paycheck of the year. How much money will get deducted for CPP, EI, Income Tax, and what is her NET pay?

Solution 6:

First, we need to identify her tax brackets.

- Since she makes $62000
- Income Tax is: 18.40%
- For EI she will always pay my 1.66%
- For CPP she will always pay my 4.95%

Remember its percentage so:

$18.4\% \rightarrow 0.184$
$1.66\% \rightarrow 0.0166$
$4.95\% \rightarrow 0.0495$

Income: $\$2583.33 \cdot 0.184 = \$475.33$

EI: $\$2583.33 \cdot 0.0166 = \$42.88$

CPP: $\$2583.33 \cdot 0.0495 = \$127.87$

Then add all the deductions together and subtract the total from the GROSS wage to get your NET.

$$\$475.33 + \$127.87 + \$42.88 = \mathbf{\$646.08}$$

$$\$2583.33 - \$646.08 = \mathbf{\$1937.25}$$

Gwen's NET pay is: $\mathbf{\$1937.25}$

- There are other deductions that various jobs require to get deducted from your paycheck, but we will only focus on these 4.
- Can you figure this out another way?

Section 7.2 – Practice Problems

Given the information provided, solve for Interest

1. $P = \$4500$ $r = 12\%$ $t = 3\,yrs$ $I = ?$	2. $P = \$12\,250$ $r = 6.2\%$ $t = 6\,mnths$ $I = ?$
3. $P = \$47\,200$ $r = 3\%$ $t = 5\,yrs$ $I = ?$	4. $P = \$200$ $r = 28\%$ $t = 6\,yrs$ $I = ?$

Given the information provided, solve for the missing value

5. $P = ?$ $r = 7.5\%$ $t = 4\,yrs$ $I = \$150.30$	6. $P = \$4800$ $r = ?$ $t = 4\,mnths$ $I = \$12$
7. $P = \$2500$ $r = ?$ $t = 5\,yrs$ $I = \$675$	8. $P = \$1\,250\,000$ $r = 8\%$ $I = \$400\,000$ $t = ?$

9. What amount will an account have after 4 years, if $7500 is invested at an annual rate of 8% compounded daily?

10. An investment opportunity of $50 000 for 10 years has two options: the first pays 11% compounded quarterly, the second pays 9% compounded monthly. Which is the belter investment, and by how much?

11. John started an RRSP on January 1st, 2013, with a deposit of $2500. He added $1500 on January 1st, 2014, and $2000 on January 1st, 2015. What is the accumulated value of his account on January 1st, 2016, if the interest is 6% compounded quarterly?

12. Steve makes $120 000 annually, calculate his deductions from his semi-monthly paycheques.

13. Solace makes $2450 Gross income bi-weekly, what is her annual salary? Use that info to calculate her deductions for her Net pay.

14. If Simon had a deduction percentage of 27.2% what are the boundaries of his salary? Pick any annual salary in-between the boundaries and calculate the deductions and bi-weekly Net salary.

15. If Houssam has a semi-monthly Gross pay of $5400, what is his annual salary and then calculate his deductions from his paycheck. What is his Net pay semi-monthly?

Extra Work Space