



# MATHEMATICS APPLICATIONS

## Investigation Finance 1, 2018

### Section B - In Class Validation

Name: Solutions

ALL working must be shown for full marks.

Total: /58 = \_\_\_\_\_%

#### Calculators allowed

Section A: To be completed at home. 35 marks

Section B: To be done in class on completion of part A

Rachel's Grandma has given her \$6000 for her birthday.

#### Question 1

(6 marks)

Investigate what happens to Rachel's money in the Term Deposit bank account below. You may have discovered in your research from part A that different interest rates apply to term deposits of a different time period.

In the situation below:

- One year term deposits earns 3%
- Two year term deposits earns 3.25%
- Three year term deposits earns 3.5%
- Four year term deposits earns 3.75%
- Five year term deposits earns 4%

Fill in the table below to find out Rachel's balance if she invested in a Term Deposit for 1, 2, 3, 4 or 5 years. Rachel first invested her \$6000 on the 11/3/18

TIME	DATE	PRINCIPAL	RATE	TIME	SIMPLE INTEREST $SI = P \times R \times T$	ACCOUNT BALANCE
One year	11/3/19	\$6 000	3% 0.03	1	$\$6000 \times 0.03 \times 1$ $= \$150$	$\$6000 + \$180$ $= \$6180$
Two years	11/3/20	\$6000	3.25% 0.0325	2	$\$6000 \times 0.0325 \times 2$ $= \$390$	$\$6000 + \$390$ $= \$6390$
Three years	11/3/21	\$6000	3.5%	3	$6000 \times 0.035 \times 3$ $= 630$	$6000 + 630$ $= \$6630$
Four years	11/3/22	\$6000	3.75%	4	$6000 \times 0.0375 \times 4$ $= 900$	$6000 + 900$ $= \$6900$
Five years	11/3/23	\$6000	4%	5	$6000 \times 0.04 \times 5$ $= 1200$	$6000 + 1200$ $= \$7200$

Instead of investing in a 5 year term deposit, Rachel thinks she will earn more interest if she re-invests her money into a new 1 year term deposit each year for 5 years. She will be earning interest on the interest from the previous years. This process is more like Compound Interest rather than earning Simple Interest for 5 years.

- a) Investigate what happens to Rachel's money in the Term Deposit bank account below.

Rachel first invested her \$6000 on the 11/3/18 and is now earning 3% per annum in each 1 year Term Deposit.

Fill in the table below to find out Rachel's account balance after 1, 2, 3, 4 and 5 years.

TIME	DATE	PRINCIPAL	RATE	TIME	SIMPLE INTEREST $SI = P \times R \times T$	ACCOUNT BALANCE
year 1	11/3/19	\$6 000	3% 0.03	1	$\$6000 \times 0.03 \times 1$ $= \$180$	$\$6000 + \$180$ $= \$6180$
year 2	11/3/20	\$6180	3% 0.03	1	$\$6180 \times 0.03 \times 1$ $= \$185.4$	$\$6180 + \$185.40$ $= \$6365.40$
year 3	11/3/21	\$6365.40	0.03	1	$\$6365.40 \times 0.03 \times 1$ $= 190.96$	$6365.40 + 190.96$ $= \$6556.36$
year 4	11/3/22	6556.36	0.03	1	$\$6556.36 \times 0.03 \times 1$ $= 196.69$	$\$6556.36 + 196.69$ $= \$6753.05$
year 5	11/3/23	\$6753.05	0.03	1	$\$6753.05 \times 0.03 \times 1$ $= 202.59$	$6753.05 + 202.59$ $= \$6955.64$

- b) Was Rachel correct? Explain.

(✓)

No, she was not correct. Investing at 1 year at a time gives \$6955.64. Compared to \$7200, \$244.36 less. (✓)

Rachel has decided she would also like to investigate what happens to her money in the 'Completely Compound' bank account paying 4% per annum **COMPOUND INTEREST**.

- a) Give the formula for calculating Compound Interest that you used in your take home section. Use P - Principal, R - Rate and t - time in years.

$$CI = P(1 + R)^t \quad (\checkmark)$$

- b) Using the formula above, calculate the interest earned on Rachel's \$6000 at 4% pa compounded annually.

$$CI = 6000(1.04)^5$$

$$= \$7299.92 \quad (\checkmark)$$

$$\text{Interest} = 7299.92 - 6000$$

$$= \$1299.92 \quad (\checkmark)$$

#### Question 4

(8, 1, 1, 1 = 11 marks)

Rachel later discovered that 'Completely Compound' bank account with interest at 4% pa can also be compounded six monthly, quarterly, monthly, weekly and daily.

- a) Fill in the table below to find out Rachel's account balance every 6 months for the next 5 years.

TIME	DATE	PRINCIPAL	RATE	TIME years	FORMULAE	FINAL BALANCE
1 <sup>st</sup> 6mths	11/9/18	\$6000	0.02	0.5	$\$6000 \times (1.02)^1$	\$6120
2 <sup>nd</sup> 6mths	11/3/19	\$6000	0.02	1	$\$6000 \times (1.02)^2$	\$6242.40
3 <sup>rd</sup> 6mths	11/9/19	"	"	1.5	$6000 \times (1.02)^3$	\$6367.25
4 <sup>th</sup> 6mths	11/3/20	"	"	2	$6000 \times (1.02)^4$	\$6494.59
5 <sup>th</sup> 6mths	11/9/20	"	"		$6000 \times (1.02)^5$	\$6624.48
6 <sup>th</sup> 6mths	11/3/21	"	"	3	$6000 \times (1.02)^6$	\$6756.91
7 <sup>th</sup> 6mths	11/9/21	"	"	3.5	$6000 \times (1.02)^7$	\$6892.11
8 <sup>th</sup> 6mths	11/3/22	"	"	4	$6000 \times (1.02)^8$	\$7029.96
9 <sup>th</sup> 6mths	11/9/22	"	"	4.5	$6000 \times (1.02)^9$	\$7170.56
10 <sup>th</sup> 6mths	11/3/23	"	"	5	$6000 \times (1.02)^{10}$	\$7313.97

Interest increases.

(✓)

c) How many times is interest paid in the <sup>5</sup> year investment?

10 times

(✓)

d) Create a formula for the **Compound Interest** accounts that are not compounded annually. Use the following to construct your formula:

P - Principal

R - Rate

T - time in years and

n - is the number of interest payments each year.

$$CI = P \left( 1 + \frac{R}{n} \right)^{T \times n}$$

### Question 5

(2, 2, 2, 2 = 8 marks)

Use your formulae above to calculate the balance in Rachel's Completely Compound account from question 4, if her interest is now compounded

a) Quarterly

$$6000 \left( 1 + \frac{0.04}{4} \right)^{5 \times 4} = \$7321.14$$

b) Monthly

$$6000 \left( 1 + \frac{0.04}{12} \right)^{5 \times 12} = \$7325.98$$

c) Weekly

$$6000 \left( 1 + \frac{0.04}{52} \right)^{5 \times 52} = \$7327.85$$

d) Daily

$$6000 \left( 1 + \frac{0.04}{365} \right)^{5 \times 365} = \$7328.34$$

For the 6 Completely Compound accounts of \$6000, invested at 4% compounded: annually, six monthly, quarterly, monthly, weekly and daily.

a) Which account will be the first to double and when will this occur?

b) After 5 years how much interest has each account earned?

(✓ 1 each)

Annually = \$12999.2

Monthly = \$1325.98

6 monthly = \$1313.97

Weekly = \$1327.85

Quarterly = \$1321.14

Daily = \$1328.34

#### Question 7

(2, 2, 2, 2 = 8 marks)

Calculate the following amounts in each bank account for a \$20 000 investment at 4% pa for 25 years using the following accounts

a) Simple interest

i) Total Amount

\$40 000

(✓ 1 each)

ii) Interest only

\$20 000

b) Compound Interest yearly

i) Total Amount

\$33 316.73

ii) Interest only

\$33 316.73

c) Compound Interest monthly

i) Total Amount

\$54 275.30

ii) Interest only

\$34 275.30

d) Compound Interest daily

i) Total Amount

\$ 54 362.66

ii) Interest only

\$ 34 362.66

Question 8

(5 marks)

Sharon invests \$1 000 on the day her son Robbie is born to be given to him on his 21<sup>st</sup> Birthday. The account pays Compounded Interest at 8% pa. What rate of Simple Interest would be required to achieve the same final balance in Robbie's account on his 21<sup>st</sup> Birthday?

$$\begin{aligned} \$ \quad CI &= 1000(1 + 0.08)^{21} \quad (\checkmark) \\ &= \$5033.83 \quad (\checkmark) \end{aligned}$$

$$\text{Interest} = \$4033.83 \quad (\checkmark)$$

$$SI = P \times R \times T$$

$$4033.83 = 1000 \times R \times 21 \quad (\checkmark)$$

$$\frac{4033.83}{1000 \times 21} = R$$

$$R = 0.1921$$

$$R = 19\% \quad (\checkmark)$$

# APPS EPW 1 - Take Home Marking Key.

- 1) • Investigate best place to invest \$10,000 (✓)  
• More detail, banks Savings Acc Term Deposit or Time Periods (✓)  
• Def ( $\frac{1}{2}$  each)  
• Questions (✓ each)

- 2) • Research  
1 Savings ① ✓ Term Dep ① ✓  
Savings ② ✓ Term Dep ② ✓  
Rate, Min Bal Rate, Min Bal, Time

- | • Sav ① | Sav 2 | • Term Dep ① | Term Dep ② |
|---------|-------|--------------|------------|
| 1 ✓     | 1 ✓   | 1 ✓          | 1 ✓        |
| 2 ✓     | 2 ✓   | 2 ✓          | 2 ✓        |
| 5 ✓     | 5 ✓   | 5 ✓          | 5 ✓        |

- Spread Sheet min formulae (✓)  
" " all formulae (✓✓)

3) Best Account ✓  
which Bank ✓  $(-\frac{1}{2})$  how long

Other factors ✓  
✓

Other questions ✓  
✓ (6)

A) Conclusion

- ~~great~~ I did (✓)
- I found (✓)
- — was best (✓)
- next time (✓) (4)