THE UNIVERSITY OF MELBOURNE

# FNCE10002 Principles of Finance
**Semester 1, 2019**

## Introduction to Financial Mathematics I
**Tutorial Questions for Week 1**

*This tutorial is divided into two parts. The answers to the questions in Part I need to be submitted at the **beginning** of your tutorial. All answers must be **handwritten** and in **original** (photocopies/emails will not be accepted). Please follow the instructions on the Tutorial Hand-in Sheet available on the LMS via the Tutorials link. The answers to questions in Part II do not need to be submitted and will be discussed in your tutorial. Please make sure that you have worked through these questions and are prepared to discuss them if called upon by your tutor.*

*Note that questions flagged as "EXM" are past exam questions that I've used in this subject or subjects similar in scope to this subject, while those flagged as "TXT" are sourced from the textbook. Detailed answers to the questions in Part II will only be provided in tutorials. Brief answers may be provided via the LMS after a time lag. This policy is in place to ensure that you attend your tutorials regularly and receive timely feedback from your tutor. If you are unsure of any answer you should check with your tutor, a pit stop tutor, online tutor or me.*

## Part I: Answers to be Submitted to Your Tutor

### A. Problems

A1. Assume that you have $4,000 invested in an account today (that is, year 0). Calculate the future value of this amount at the end of each of the following time horizons and interest rates:

a) End of three years at an interest rate of 6% per annum.

b) End of six years at an interest rate of 6% per annum.

c) End of three years at an interest rate of 12% per annum.

d) Note that the time horizon in part (a) is half the time horizon in part (b) but the total amount of interest earned in part (a) is less than half the amount of interest earned in part (b). Why is this the case? *Explain*.

e) Provide a breakup of the total interest, simple interest and interest-on-interest earned in parts (a) and (b).

A2. EXM Your friend's grandfather put some money in an investment account for her on the day she was born. She is now 18 years old and can withdraw the money for the first time. The account currently has $4,200 in it and pays an interest rate of 12% per annum. Assume end of the year cash flows and show all calculations. (*Hint:* Use a timeline to visualize the cash flows.)

a) How much money would be in the account if she left the money there until her 25th birthday?

b) How much money would be in the account if she left the money there until her 65th birthday?

c) How much money did her grandfather *originally* put in the account when she was born?

A3. TXT As part of your personal budgeting process, you have determined that at the end of each of the next five years you will incur significant maintenance expenses on your apartment. You'd like to cover these expenses by depositing a lump sum in an account today (or year 0) that earns 8% per annum. You will draw down this account each year as maintenance bills come due.

| End of Year | Budget Shortfall |
|---|---|
| 1 | $5,000 |
| 2 | $4,000 |
| 3 | $6,000 |
| 4 | $10,000 |
| 5 | $3,000 |

a) How much money must you deposit today to cover these expenses? *Round your calculations to the nearest dollar*.

b) Demonstrate that the amount you have deposited today is just enough to cover your expenses over the five-year period. *Show all calculations*.

c) What effect does an increase in the interest rate have on the amount calculated in part (a)? *Explain*.

## Part II: Submission of Answers Not Required

### B. Multiple Choice Questions

For each question pick the *most reasonable* response based *only* on the information provided.

C. B1. If you invest $50,000 in a savings account paying 6% per annum, the amount you will have accumulated at the end of five years is **closest** to:

annual = year

$50,000 \times (1+6\%)^5 = \$60911.27838$

$50000\ (1+6\%)^5$

a) $50,250.
b) $63,124.
c) $66,911.
d) $67,443.

b B2. TXT Melissa Gould wants to invest today in order to assure adequate funds for her son's university education. She estimates that her son will need $20,000 in 18 years; $25,000 in 19 years; $30,000 in 20 years; and $40,000 in 21 years. The total amount Melissa would need to invest today if the fund earns an interest rate of 6% per annum is **closest** to:

a) $34,330.

$PV = \frac{\$20000}{(1+6\%)^{18}} + \frac{\$25000}{(1+6\%)^{19}} + \frac{\$30000}{(1+6\%)^{20}} + \frac{\$40000}{(1+6\%)^{21}}$

$> \$36390$

b) $36,390.
c) $38,573.
d) $40,000.

B3. Consider the following cash flow alternatives:

*Alternative 1:* $140 received at the end of one year.
*Alternative 2:* $230 received at the end of five years.
*Alternative 3:* $320 received at the end of ten years.

The rank of these alternatives from *most* valuable to *least* valuable if the interest rate is 8% per annum is:

a) Alternative 1, then alternative 2, followed by alternative 3.
b) Alternative 2, then alternative 3, followed by alternative 1.
c) Alternative 1, then alternative 3, followed by alternative 2.
d) Alternative 3, then alternative 2, followed by alternative 1.

B4. EXM Suppose you invested $10,000 in an investment account paying an interest rate of 2% per annum. The total amount of interest-on-interest that you would have earned on this investment at the end of 20 years would be **closest** to:

a) $859.
b) $4,000.
c) $4,859.
d) $10,859.

B5. EXM Your friend owns her own business and is considering an investment opportunity. If she undertakes the investment, it will pay $4,000 at the end of each of the next three years. The opportunity requires an initial investment of $1,000 and an additional investment at the end of the second year of $5,000. The net present value of this investment opportunity if the interest rate is 2% per annum is **closest** to:

a) $5,730.
b) $6,000.
c) $6,730.
d) $7,652.

## C. Problems

C1. TXT Ruth Nail receives two offers for her seaside home. The first offer is for $1 million today while the second offer involves the following annual payments:

| End of Year | Payment |
|---|---|
| 0 | $200,000 |
| 1 | $200,000 |
| 2 | $200,000 |
| 3 | $200,000 |
| 4 | $200,000 |
| 5 | $300,000 |

Assuming that Ruth earns an interest rate of 8% per annum on her investments, which offer should she take? *Round your calculations to the nearest dollar.*

C2. [TXT] Robert Williams is considering an offer to sell his medical practice, allowing him to retire five years early. He has been offered $500,000 for his practice and can invest this amount in an account earning 10% per annum. If the medical practice is expected to generate the following cash flows, should Robert accept this offer and retire now? *Round your calculations to the nearest dollar.*

| End of Year | Cash Flow |
|---|---|
| 1 | $150,000 |
| 2 | $150,000 |
| 3 | $125,000 |
| 4 | $125,000 |
| 5 | $100,000 |

medical practice $PV = \frac{\$150{,}000}{(1+10\%)^1} + \frac{\$150{,}000}{(1+10\%)^2} + \frac{\$125{,}000}{(1+10\%)^3} + \frac{\$125{,}000}{(1+10\%)^4} + \frac{\$100{,}000}{(1+10\%)^5} = \$501{,}114 > \$500{,}000$

he should not sell his medical practice

he should accept this offer and retire now.

C3. [EXM] You have been offered an investment opportunity which involves investing $20,000 today to receive $1,000 one year from now, $3,000 two years from now and $20,000 ten years from now. *Assume that all cash flows occur at the end of the year.*

a) What is the *NPV* of the opportunity if the interest rate is 12% per annum? Should you take the opportunity?

b) What is the *NPV* of the opportunity if the interest rate is 2% per annum? Should you take the opportunity now?

a) $NPV = \frac{\$1000}{(1+12\%)^1} + \frac{\$3000}{(1+12\%)^2} + \frac{\$20000}{(1+12\%)^{10}} - \$20000 = \$-1026 < 0$

reject (NPV −)

b) $NPV = \frac{\$1000}{(1+2\%)^1} + \frac{\$3000}{(1+2\%)^2} + \frac{\$20000}{(1+2\%)^{10}} - \$20000 = \$270.86 > 0$

accept (NPV +)