

# MATH1510: Financial Mathematics I

## Example Sheet 1

### Questions for the example class

Attempt these questions before the example class on Monday 6 February. Your tutor will discuss the answers with you.

For all questions in this module, you may assume that interest is compound and rates are per year except when the question notes otherwise. Final answers may be rounded to the nearest penny / cent / basis point.

1. Assuming an interest rate of 5%, what is better, to pay £20.00 at the start of the month or to pay £20.10 at the end of the month?
2. An investor is offered a contract which pays out £11000 at the end of two years in return for payments of £5000 now and £5000 in one year's time. What is the interest rate implied by this contract (this rate is called the *internal rate of return*)?
3.
  - (a) Find the discounted value of \$500 due in 82 days at 9% (compound) interest.
  - (b) Find the discounted value of \$500 due in 82 days at a (compound) discount rate of 9%.
  - (c) Find the discounted value of \$500 due in 82 days at 9% simple interest.
  - (d) Find the discounted value of \$500 due in 82 days at 9% simple discount.
4. Find the annual effective rate equivalent to:
  - (a) a discount rate of 4% p.a.
  - (b) simple interest at 4% p.a., if the money is invested for two years.
  - (c) simple discount at 4% p.a., if the money is discounted over a period of two years.
5. Assume that somebody has to pay £2000 in three years' time and £3000 in seven years' time. They want to pay off both debts by a single payment in six years' time. Assuming an interest rate of 8% p.a., how much do they have to pay?
6. You are paid £1000 annually for five years, with the first payment due in one year and the last payment due in five years. Find the present value of all these payments, using an interest rate of 3%. (Such a sequence of payments is called an *annuity*, and we will study them in detail in the second chapter.)

## Homework questions

Hand in solutions to these questions on **Wednesday 15 February** in your tutor's pigeon hole on level 8 of the School of Mathematics. The tutors for this module are Niloufar Abourashchi, Zhidi Du, James Fung, Jitse Niesen and Tongya Wang.

H1. Suppose that you deposit £2500 for three years on an account paying interest at 5% per annum.

- (a) How much interest do you get if the account pays simple interest? And how much if it pays compound interest?
- (b) What is the rate at which an account paying compound interest pays out as much as an account paying simple interest at 5%? In other words, find the rate  $r$  such that simple interest at 5% over three years is equivalent to compound interest at rate  $r$  over three years.
- (c) Explain why the rate you found in part (b) is lower than 5%.

H2. Derive a formula for the compound interest rate  $i$  equivalent to:

- (a) simple interest at a rate  $i_s$ , if the money is invested for  $n$  years.
- (b) a discount rate of  $d$ , if the money is discounted over a period of  $n$  years.
- (c) simple discount at a rate  $d_s$ , if the money is discounted over a period of  $n$  years.

In all cases, explain how the formula is derived.

- (d) Derive a formula for the simple interest rate  $i_s$  equivalent to simple discount at a rate  $d_s$ , if the money is discounted over a period of  $n$  years.

H3. Assume that somebody has to pay £2000 in three years' time and £3000 in seven years' time. The interest rate is 8%. They want to pay off both debts by a single payment of £5000 at some time. What is the appropriate time for that payment?

- H4. (a) What is the annual rate of interest equivalent to a nominal interest rate of 4% compounded monthly?
- (b) What is the nominal interest rate compounded monthly equivalent to an annual interest rate of 4%?