

MATH1007

Homework 4

Due Friday, September 30

When submitting homework, please remember the following:

- Show all work leading to each solution.
- *You must use a staple* (not paper clip) if your answers are longer than a single page.
- Do not submit crossed-out or sloppy work.
- Do not submit ripped or torn pages.
- Be sure to submit your own work.

1. Suppose that you have a bank account which contains \$13,500 on January 1. On March 15, you deposit \$450, and on August 31, you deposit \$750. Assume that there are 365 days in a year.

- (a) Suppose that the account earns 7% APR compounded continuously. What is the balance on December 31?
- (b) Suppose that the account earns 7% APR compounded daily. What is the balance on December 31?

2. Suppose that your credit card billing cycle runs from July 14 through August 13, a period of 31 days. Suppose that the balance on July 14 is \$341.80. On July 19, you charge \$32.50, on July 28 you make a payment of \$300, and on August 10 you charge \$89.75.

Suppose that the credit card has an annual interest rate of 17.5%. What is the interest fee for this billing period?

3. Suppose that a young person with no initial savings decides to save  $k$  dollars per month at an APR of  $r\%$ . Assume that the investments are made monthly and that the return is compounded monthly.

- (a) Suppose that  $r = 5\%$ , and our young person wishes to have accumulated \$1 million after 30 years. Assume 360 deposits and 360 interest payments. What is  $k$ ?
- (b) Suppose that  $k$  is \$900/month, and our young person wishes to have accumulated \$1 million after 30 years. What is  $r$ ? (This is a hard computation, and you need to approximate  $r$  by trial and error.)

4. According to a *Philadelphia Inquirer* finance column,

Borrow \$100000 with a 6% fixed-rate mortgage, and you'll pay nearly \$116000 in interest over 30 years. Pay an extra \$100 each month, and you'd pay just \$76000—and be done with the mortgage nine years earlier.

This quotation comes from our textbook, which in turn explains that it was used by permission of the *Philadelphia Inquirer*, ©2012, all rights reserved.

- (a) Verify the claim that you will pay about \$116000 in interest.
- (b) Verify that if the monthly payment is increased by \$100, then the time needed to pay off the mortgage is about 21 years, and that the total interest paid is about \$76000.

(c) How much should the monthly payment be increased to pay off the mortgage in 15 years? What is the total amount of interest paid?

5. Suppose that you have a large coin jar which contains nickels, dimes, and quarters. You would like to know roughly how much money is in the jar without taking the trouble to count all of the coins, so you try using two-sample estimation. You shake the jar, and pull out 75 coins: 32 nickels, 14 dimes, and 29 quarters. Put large black dots on each of the coins, put them back in the jar, shake well, and grab 55 coins. This time, you get 24 nickels, 10 dimes, and 21 quarters, and of these, there are dots on 8 nickels, 5 dimes, and 11 quarters. Estimate how much money is in the jar. Round off to a whole number of nickels, dimes, and quarters.