

MATH 2600/STAT 2600, Theory of Interest

FALL 2013

Toby Kenney

Homework Sheet 2

Due: Thursday 3rd October: 11:30 AM

1. Mr. Irving invests \$300 a month at $j_{12} = 5\%$ into a fund for his granddaughter's education. How much is in the fund when she starts university 8 years 4 months from the first investment in the fund?
2. Mrs. Jones wants to save up \$600,000 for her retirement. She starts a savings account, which pays interest at $j_{12} = 4\%$. She plans to make monthly contributions into the account from now until her retirement in 22 years 4 months time.
 - (a) How much should she pay into the account each month in order to meet her retirement goal?
 - (b) If she can only afford \$900 a month, how long does she have to delay her retirement?
 - (c) If she does not want to delay her retirement, what interest rate does she need to receive on her savings?
3. Mr. King borrows \$20,000 from a bank at $j_{12} = 7\%$. He plans to pay this off with monthly payments over the next 3 years.
 - (a) What are the monthly payments?
 - (b) After 1 year, the bank sells the loan to another bank, which wants to receive $j_{12} = 6.8\%$. How much does that bank pay for the loan?
4. Dr. Lee is investing for her retirement. She makes monthly payments of \$300 into an account that pays $j_{12} = 6\%$, starting in January 2002. In January 2006, interest rates drop to $j_{12} = 4\%$. From August 2007, she increases her monthly payments to \$400. How much is in the account when she makes her last payment in March 2011?
5. Miss MacDonald donates \$4,000,000 to her old university. She states that the donation should be used to fund an annual scholarship of \$8,000 for each of 15 students. At what interest rate does the money need to be invested to provide this scholarship forever.
6. Mr. Neil deposits \$800 every quarter into an account which pays interest at $j_{12} = 9\%$. How much is in the account when he makes the 11th deposit?
7. Mrs. O'Riley is saving up to go on holiday. Every day she puts \$10 into an account which pays interest at $j_1 = 5\%$. How long does she have to wait before she has saved up \$1,500 for her holiday?

8. Mr. and Mrs. Purcell are retiring. They have saved up \$600,000, from which they want to live for the next 25 years. They want to take out monthly withdrawals, which will increase every month in line with inflation at an annual rate of 3%. (That is, the withdrawals form a geometric progression, with each payment 3% more than the one twelve months earlier.) If their money is invested at $j_{12} = 6\%$, how much should the first withdrawal be?
9. Mr. Quiggly takes out a loan for \$8,000 at $j_{12} = 7\%$. He wants to repay the loan with an increasing arithmetic progression of payments. He would like the first payment in one month's time to be \$100, and he would like the loan to be paid off after two years. By how much should the payments increase each month?
10. The stock of company XYZ currently pays a dividend of \$0.10 every month. Every year the company increases the dividend by 4%. What is a fair price for the stock at $j_{12} = 11\%$?
11. Mrs. Rogers makes a loan of \$15,000 at $j_{12} = 9\%$. The loan is repaid over 4 years with equal monthly payments. When Mrs. Rogers receives each payment, she immediately deposits it in an account which receives $j_{12} = 3\%$ interest. What yield does she make on her investment at the end of the 4 years?
12. A company buys a machine for \$50,000. The machine is expected to last for 7 years, after which it will have a salvage value of \$1,500. Prepare a depreciation schedule using:
 - (a) The sum of digits method.
 - (b) The constant percentage method
 - (c) The straight line method
 - (d) The compound interest method, with cost of capital $j_1 = 6\%$.
13. You are deciding between two cars. The first car costs \$16,000, lasts for 8 years, after which it has a resale value of \$1,600, and has fuel and maintainance costs of \$1,300 in the first year, and increasing by \$100 every subsequent year. The second car costs \$22,000, lasts for 9 years, with a resale value of \$3,200, and has fuel and maintainance costs of \$800 in the first year, and increasing by \$80 in each subsequent year.
 - (a) If the cost of capital is $j_1 = 8\%$, which car has lower total capitalised cost?
 - (b) [bonus] At what cost of capital would the two cars have the same total capitalised cost?