

THE CHINESE UNIVERSITY OF HONG KONG
Department of Mathematics
MATH4210 Financial Mathematics 2020-2021 T1
Assignment 1 v2
Due date: 30 September 2020 11:59 p.m.

Please submit this assignment on blackboard. If you have any questions regarding this assignment, please email your TA Wong Wing Hong (whwong@math.cuhk.edu.hk).

1. Find the price of a bond with face value \$2,000 and \$10 annual coupons that matures in 4 years, given that the continuous compounding rate is a) 8%, b) 5%, c) 0%. What is the limit of this price as r goes to infinity?
2. Suppose the discrete annual compound interest rate is 5% where ones compound monthly. Compute the corresponding continuous compounded interest rate r up to 6 decimal places.
3. Suppose price and the face value of a bond is both \$1,000. The bond matures in 5 years with annual coupon \$100. Find its a) bond yield by applying Newton's method with initial guess $x_0 = e^{-r_0} = 1$; b) duration; and c) convexity, if the interest rate is continuously compounded. (You may refer to tutorial 1 for Newton's method.)
4. (a) Suppose $x \neq 1$. Show that

$$\sum_{i=0}^n x^i = \frac{1 - x^{n+1}}{1 - x},$$

for all positive integer n .

- (b) Suppose $|x| < 1$. Show that

$$\sum_{i=0}^{\infty} x^i = \frac{1}{1 - x}.$$

- (c) Joyce wants to use a land to build a church. The government requires she to pay the nominal rent \$1,000 every year perpetually. A bank offer a plan: Joyce pay the bank \$50,000 at once and

the bank promises to pay \$1,000 to the government every year. Suppose the discrete annual compound interest rate is 2%. Should Joyce accept this offer? (Note that you must pay the rent for the first year before using the land.)