

Fin. Math. Assignment 1

Due on Oct.8. 2024. 17:00

1. The annually compound interest rate is 6%.
 - (i) What is the effective continuously compound interest rate?
 - (ii) What is the effective **annual interest rate compounded daily**, assuming there are 365 days in a year.
2. A bank offers a continuous compounded saving product. The continuous **compound interest** rate is **adjusted** annually, the rate is 3% in the first year, 4% in the second year and remains fixed at 5% starting from the third year. A person invested in this product for 4 years.
 - (i) What is the effective constant continuous **compound** rate for this four-year investment?
 - (ii) What is the effective **constant interest rate compounded annually** for this four-year investment?

3. The force of interest rate is given by

$$\delta(t) = \frac{a}{b+t}$$

Here a and b are positive constants. An **investor** needs to deposit X_0 dollars at t_0 , **and** will receive X_1 dollars at time t_1 and X_2 dollars at time t_2 . What is the value of this investment at investment horizon T ?

Here $0 < t_0 < t_1 < t_2 < T$.

4. A person invested \$100 in a saving account. It is known that the wealth in the account changes with time and can be expressed mathematically as

$$A(t) = C_2 t^2 + C_1 t + C_0$$

The person checked this balance at time $t=1$ and $t=2$ and the results are $A(1) = \$120$ and $A(2) = \$135$. What is the force of interest for this saving account?

5. An investment will triple in 90 years at a constant force of interest δ . Another investment will quadruple in t years at a nominal rate of interest numerically equal to δ and convertible once every 4 years. Calculate t .
6. Fund A accumulates at a force of interest of $\delta_A = 3a$. Fund B accumulates at a force of interest of $\delta_B = at$. **Initially two funds have the same value**, namely,

$A(0)=B(0)$, at what time the two funds will have the same value again?

7. You are given the force of interest

$$\delta(t) = \frac{4}{2+t}$$

A payment of 150 at the end of 3 years and 300 at the end of 6 years has the same present value as a payment of 100 at the end of 2 years and X at the end of 5 years. Calculate X .

8. At time 0, an investor deposits same amount of money into each of Fund X and Fund Y. Fund X accumulates at a constant annually compound interest rate of r_1 . Fund Y accumulates at a simple interest rate of r_2 . What is the difference between the money in Fund X and that in Fund Y at the moment when the forces of interest on the two funds are equal? Express your results in **terms** of r_1 and r_2 only.

9. You are given:

(i) Fund X pays interest at the rate of 5% convertible monthly;

(ii) Fund Y pays interest at a force of interest

$$\delta(t) = \frac{1}{t+10}$$

(iii) Ron deposited P **dollars** into each fund; and

(iv) at the end of 10 years, the accumulated amount in Fund X was 2000 **dollars** and the accumulated amount in Fund Y was Z .

Determine Z .

