



Subject: Financial
Mathematics

Chapter: Unit 3

Category: Practice questions

1. CT1 April 2017 Q10 Part (i)

An individual aged exactly 65 intends to retire in five years' time and receive an annuity-certain. The annuity will be payable monthly in advance and will cease after 20 years. The annuity will increase at each anniversary of the commencement of payment at the rate of 3% per annum. The individual would like the initial level of annuity to be £20,000 per annum. The price of the annuity will be the present value of the payments on the date it commences using an interest rate of 7% per annum effective.

(i) Calculate the price of the annuity. [4]

2. CT1 April 2016 Q12 Part (i)

(i) Show that:

$$(\bar{Ia})_{\overline{n}|} = \frac{\bar{a}_{\overline{n}|} - nv^n}{\delta}.$$

[4]

3. CT1 April 2015 Q5

An investor pays £120 per annum into a savings account for 12 years. In the first four years, the payments are made annually in advance. In the second four years, the payments are made quarterly in advance. In the final four years, the payments are made monthly in advance. The investor achieves a yield of 6% per annum convertible half-yearly on the investment.

Calculate the accumulated amount in the savings account at the end of 12 years. [7]

4. CT1 September 2014 Q5

Calculate, at a rate of interest of 5% per annum effective:

(i) $a_{\overline{5}|}^{(12)}$

(ii) ${}_4|a_{\overline{15}|}$

(iii) $(I\bar{a})_{\overline{10}|}$

(iv) $(\overline{I\bar{a}})_{\overline{10}|}$ [4] – 1 mark each

(v) the present value of an annuity that is paid annually in advance for 10 years with a payment of 12 in the first year, 11 in the second year and thereafter reducing by 1 each year. [2]

[Total 6]

5. CT1 April 2015 Q9

A property development company has just purchased a retail outlet for \$4,000,000. A further \$900,000 will be spent refurbishing the outlet in six months' time. An agreement has been made with a prospective tenant who will occupy the outlet beginning one year after the purchase date. The tenant will pay rent to the owner for five years and will then immediately purchase the outlet from the property development company for \$6,800,000. The initial rent will be \$360,000 per annum and this will be increased by the same percentage compound rate at the beginning of each successive year. The rental income is received quarterly in advance.

Calculate the compound percentage increase in the annual rent required to earn the company an internal rate of return of 12% per annum effective. [9]

6. CT1 September 2017 Q.6

An investor has a choice of two 15-year savings plans, A and B, issued by a company. In both plans, the investor pays contributions of \$100 at the start of each month and the contributions accumulate at an effective rate of interest of 4% per annum before any allowance is made for expenses.

In plan A, the company charges for expenses by deducting 1% from the annual effective rate of return.

In plan B, the company charges for expenses by deducting \$15 from each of the first year's monthly contributions before they are invested. In addition it deducts 0.3% from the annual effective rate of return.

Calculate the percentage by which the accumulated amount in Plan B is greater than the accumulated amount in Plan A, at the end of the 15 years. [6]

7. CT1 September 2009 Question 7

A member of a pension's savings scheme invests £1,200 per annum in monthly installments, in advance, for 20 years from his 25th birthday. From the age of 45, the member increases his investment to £2,400 per annum. At each birthday thereafter the annual rate of investment is further increased by £100 per annum. The investments continue to be made monthly in advance for 20 years until the individual's 65th birthday.

(i) Calculate the accumulation of the investment at the age of 65 using a rate of interest of 6% per annum effective. [6]

At the age of 65, the scheme member uses his accumulated investment to purchase an annuity with a term of 20 years to be paid half-yearly in arrears. At this time the interest rate is 5% per annum convertible half-yearly.

(ii) Calculate the annual rate of payment of the annuity. [3]

[Total 12]

8. CT1 April 2009 Question 11

An individual wishes to receive an annuity which is payable monthly in arrears for 15 years. The annuity is to commence in exactly 10 years at an initial rate of £12,000 per annum. The payments increase at each anniversary by 3% per annum. The individual would like to buy the annuity with a single premium 10 years from now.

(i) Calculate the single premium required in 10 years' time to purchase the annuity assuming an interest rate of 6% per annum effective. [5]

9. CT1 April 2018 Question 3

An investor pays £80 at the start of each month into a 25-year savings plan. The contributions accumulate at an effective rate of interest of 3% per half-year for the first 10 years, and at a force of interest of 6% per annum for the final 15 years.

Calculate the accumulated amount in the savings plan at the end of 25 years. [6]

10. CT1 April 2008 Question 6

(i) An investor is considering the purchase of an annuity, payable annually in arrear for 20 years. The first payment is £500. Using a rate of interest of 8% per annum effective, calculate the duration of the annuity when:

- (a) the payments remain level over the term.
- (b) the payments increase at a rate of 8% per annum compound. [6]

(ii) Explain why the answer in (i)(b) is higher than the answer in (i)(a). [2]

11. CT1 April 2007 Question 1

An investor pays £400 every half-year in advance into a 25-year savings plan.

Calculate the accumulated fund at the end of the term if the interest rate is 6% per annum convertible monthly for the first 15 years and 6% per annum convertible half yearly for the final 10 years. [5]