IAQS | INSTITUTE OF ACTUARIAL & QUANTITATIVE STUDIES

Subject: Financial Mathematics

Chapter: Varying annuities

Category: Practice questions - extras

1. Find the present value at time 0 of regular payments of $50 at times 25, 26, and so on, with the last payment at time 40. Use an annual effective interest rate of 12%.

[$22.97]

2. Find the accumulated value at time 15 of payments of $300 at times 5, 6, and so on, with the last payment at time 10. Use an annual effective interest rate of 3% and an annuity immediate.

[$2,249.60]

3. A university student receives a 3-year sponsorship grant. The payment under the grant as follows:

Year 1 Rs 5,000 per annum paid continuously

Year 2 Rs 5,000 per annum paid monthly in advance

Year 3 Rs 5,000 per annum paid half yearly in advance.

Calculate the total present value of these payments at the beginning of the first year using a rate of interest of 8% per annum convertible quarterly.

[Rs. 13,447.39]

4. Payments of $5,000 are received at the end of each year for 10 years, after which payments of $1,000 are received at the end of each year forever. The annual effective interest rate is 9%. Determine the present value of these payments.

[$36,781.74]

5. An annuity immediate has 40 initial quarterly payments of 20 followed by perpetuity of quarterly payments of 25 starting in the eleventh year. Find the present value at 4% pa convertible quarterly.

[2,335.83]

6. An annuity pays 100 at the end of each of the next 5 years and 300 at the end of each of the five following years. If i = 0.06, find the present value of the annuity.

[1,365.59]

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7. Max receives $300 in 1 year, $350 in 2 years, and $400 in 3 years, and so on until the final payment of $800. Using an annual effective rate of interest of 4%, find present value of these payments at time 0.

[$4,647.00]

8. You invest $500 at time 8, $1,000 at time 9, $1,500 at time 10, and so on, up to the last payment at time 20. What is the accumulated value of these payments at time 25 using an annual effective rate of interest of 4.5%?

[$68,292.28]

9. Calculate the present value of a series of 25 payments of $50 at the beginning of first year and increasing by $5 each year thereafter. The annual effective interest rate is 4%.

[$1,624.09]

10. You set up a retirement fund by making annual payments at the end of each year for 30 years. The first payment is 1000 and each subsequent payment is increased by 100 over the previous one. The interest rate is 5.8% pa effective. How much has accumulated in the fund at the end of the 30 years?

[156,208.77]

11. An annuity immediate has a first payment of 200 and increases by 100 each year until payments reach 600. There are 5 further payments of 600. Find the present value at 5.5% pa effective.

[3622.61]

12. An annuity is payable annually in arrears for a term of 15 years. The payment is 3000 in year 1, 3400 in year 2, and so on, increasing by 400 each year. Calculate the present value of this annuity assuming effective rate of interest is 7% pa for first 8 years and 10% pa thereafter.

[45968.166]

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13. Alex receives $600 in 1 year, $580 in 2 years, and $560 in 3 years, and so on, until the final payment of $400. Using an annual effective rate of interest of 4%, find present value of these payments.

[$4448.74]

14. Mary is saving money for her retirement. She needs $750,000 in 10 years to purchase a retirement apartment in Florida. She invests X now, X-5,000 in 1 year, X-10,000 in 2 years, and so on, down to X - 45,000 in 9 years. Using an annual effective rate of interest of 5%, find X.

[$77,284.407]

15. A 20-year annuity certain provides payments annually of $200 at time 1, $180 at time 2, $160 at time 3, and so on, until the payments have been reduced to $60. Payments then continue at $60 per year until the 20th payment has been made. The annual effective interest rate is 4%. Determine the present value of the annuity.

[$1,314.39]

16. Rhonda receives annual payments that begin with the first payment of $50 today. Each subsequent payment decreases by $10 per year until 4th year, and then each subsequent payment increases by $10 per year until 8th year. The annual effective interest rate is 5%. Determine the present value of the payments at time 0.

[$241.14]

17. Olga buys a 5-year increasing annuity. Olga will receive $2 at the end of the first month, and for each month thereafter the payment increased by $2. The nominal interest rate is 9% pa convertible quarterly. Calculate the present value.

[$2729.21]

18. Determine the accumulated value after 5 years of payments of $50 at the end of the first quarter, $55 at the end of the second quarter, $60 at the end of the third quarter, and so on for 5 years. The annual effective interest rate is 6% pa.

[$2191.59]

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19. Reggie buys a 5-year decreasing annuity. Reggie will receive $500 today, $490 three months from now, $480 six months from now, and for each quarter thereafter the payment decreases by $10 for the remaining part of the 5-year period. The nominal interest rate is 9% pa convertible monthly. Determine present value.

[$6,722]

20. A 20-year annuity immediate with annual payments earns 6.2% pa effective rate of interest. The first payment is 500 and each subsequent payment is increased by 4% over the previous one. Find the present value of this annuity.

[7,774.43]

21. An annuity provides for 20 annual payments, the first payments a year hence being $1000. The payments increase in such a way that each payment is 4% greater than the preceding payment. Find the present value of this annuity at an annual effective rate of interest of 7%.

[$14,459]

22. An insurance company has an obligation to pay the medical costs for a claimant. Average annual claim costs today are $5,000, and medical inflation is expected to be 7% per year. The claimant is expected to live an additional 20 years. Claim payments are made at yearly intervals, with the first claim payment to be made one year from today. Find the present value of the obligation if the annual interest rate is 5 % pa effective.

[$122,634]

23. Annual deposits are made into a fund at the beginning of each year for 10 years. The first 5 deposits are $1000 each and deposits increase by 5% per year thereafter. If the fund earns 8% pa effective, find the accumulated value at the end of 10 years. Answer the nearest dollar.

[$16,607]

24. Find the present value of a 20-year annuity with annual payments which pays $600 immediately and each subsequent payment is 5 % greater than the preceding payment. The annual effective rate of interest is 10.25%. Answer to the nearest dollar. [$7851]

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25. Perpetuity provides payments every six months starting today. The first payment is 1 and each payment is 3% greater than the immediately preceding payment. Find the present value of the perpetuity if the effective rate of interest is 8% per annum.

[112.59]

26. Brian turns 25 years old today and would like to receive inflation-adjusted retirement payments on each of his birthdays from age 65 to 95, inclusive. The first payment at age 65 will be $1, 00,000. The inflation rate is assumed to be 0% until age 65, and then it is assumed to be 2% per year. The annual effective interest rate is 6%. How much money should Brian set aside today to fund these future payments? Use an annuity-immediate to determine the answer.

[$179,451.76]

27. Calculate present value of an annuity payable continuously for 20 years, where the annual payment is 2000 in the first year and subsequent payments increase by 5% pa compound. Assume the effective annual interest rate is 9%.

[27496.254]

28. Determine the accumulated value at the end of 10 years of payments that are received continuously over each year. The payment is $100 during the first year, $105 during the second year, $110 during the third year, and so on, up to the last payment of $145 in year 10. The annual effective interest rate is 7%.

[$1,711.49]

29. Calculate the accumulated value at the end of 10 years of payments that are received continuously over each year. The payment is $200 during the first year, and each subsequent payment decreases by $15 per year, until the last payment of $80 is received in the ninth year. The annual effective interest rate is 4%.

[$1,615.40]

30. An annuity is payable continuously for a term of 25 years. The annual payment is 700 in year 1, 730 in year 2, and so on, increasing by 30 each year. Calculate the present value of this annuity assuming force of interest is 4% pa for the first 13 years and 6% pa thereafter.
[15025.2998]

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31. Following are the payments:-

400 on 1st November 2015, 1st March 2016, 1st July 2016

800 on 1st November 2016, 1st March 2017, 1st July 2017

1200 on 1st November 2017, 1st March 2018, 1st July 2018 and so on.

The last payment will be 2800 on 1st November 2021, 1st March 2022, 1st July 2022.

Assume Interest rate of 8% pa convertible quarterly.

Calculate value on

a) 1st July 2015

b) 31st October 2012

c) 1st December 2030.

[a. 23447.373, b. 18982.745, c. 79512.995]

32. Find the present value on 1st January 2002 of following payments:-

200 on 1st January, 1st April, 1st July, 1st October 2007

400 on 1st January, 1st April, 1st July, 1st October 2008

600 on 1st January, 1st April, 1st July, 1st October 2009

800 on 1st January, 1st April, 1st July, 1st October 2010

1000 on 1st January, 1st April, 1st July, 1st October 2011

1200 on 1st January, 1st April, 1st July, 1st October 2012

Assume interest rate of 6% pa convertible quarterly until 31st December 2006, and 9% pa convertible monthly thereafter.

[9030.161]

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