# Midterm 2 Review

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1. If $s_{\overline{n}|i} = 28$ and $s_{\overline{3n}|i} = 189.24$ what is $i$?

2. Investing 10k at the effective annual rate $i$ accumulates the same amount after 24 years as an annuity-immediate with 24 level annual payments (at effective annual rate of 10%), whose payments are then invested into a fund at effective annual rate of 5%. What is $i$?

3. A 5000 loan will be repaid in 20 annual payments, starting with 1 year after the loan starts. The payments in odd-indexed years (so the first payment occurs in the first year, i.e., an odd-indexed year) are $X$ each, and the payments in even-indexed years are $Y$ each. The constant annual interest rate it 8% and, over the 20 years, a total of 10233 is paid. What are $X$ and $Y$?

4. Force of interest if $\delta_t = \dfrac{0.05e^{0.05t}}{1 + e^{0.05t}}$. What is the present value of a 10-year arithmetic continuous annuity which pays at the rate $h(t) = e^{0.05t}$?

5. A 20-year annuity pays at the end of each month. The monthly payments in the first year are equal to 1, the monthly payments in the second year are equal to 2, and so on. Write an expression that computes the present value of the annuity at the time of the 3rd payment . You do not need to compute this expression. You are allowed to use any of the standard expressions $i, d, \nu, a_{\overline{n}|i}, \ddot{a}_{\overline{n}|i}, \bar{a}_{\overline{n}|i}, s_{\overline{n}|i}, \ddot{s}_{\overline{n}|i}, \bar{s}_{\overline{n}|i}, Ia_{\overline{n}|i}, Da_{\overline{n}|i}, Is_{\overline{n}|i}, Ds_{\overline{n}|i}$, etc.

6. You deposit $X$ into an account at the start of every year, the interest rate being 8%. At the end of each year, the interest that accumulated over the year is given to you, and you reinvest into an account which earns 5.8% interest. At the end of $n$ years, you see that the two accounts have the same balance. What is $n$?

7. 100k is used to buy an annual perpetuity immediate with $i = 4.5\%$. The first 3 payments are 2k, the next 3 are $2k(1 + r)$, and so on, increasing by a factor of $1 + r$ every 3 years. What is $r$?

8. An annuity immediate that pays 9 every years has the same present value as an annuity immediate that pays 2 quarterly. What is the constant common interest rate?

9. Inflation is 5%. You repay a 20k loan over 20 yearly payments (first payment due after one year) which grow at the inflation rate. The interest rate on the loan is 7%. How much do you still owe after 10 years?

10. You deposit money into a pension account at the end of each year as follows: 1, 2, 2, 3, 3, 3. At the time of this last deposit, you spend all the accumulated money in the pension fund to purchase a yearly annuity immediate that pays as follows: 4, 4, 4, 4, 5, 5, 5, 5, 5. The interest rate on the annuity immediate you just purchased is the same as that of the pension fund. Write an equation that will compute this common interest rate, but do not solve it.