1. David can receive one of the following two payment streams:
   - 100 at time 0, 200 at time \( n \), and 300 at time \( 2n \).
   - 600 at time 10.

   At an annual effective interest rate of \( i \), the present values of the two streams are equal. Given \( v^n = 0.75941 \), determine \( i \).

2. Smith receives income from his investments in Japanese currency (yen). Smith does not convert the yen in dollars, but invests the yen in a term deposit that pays interest in yen. He finds a bank that will issue such a term deposit, but it charges a 1% commission on each initial placement and on each rollover. The current interest rate on the yen deposits is a nominal annual rate of 3.25% convertible quarterly for a 3-month deposit. To keep his yen available Smith decides to roll over the deposit every 3 months. What is the annual effective rate that Smith earns?

3. Jeff deposits 10 into a fund today and 20 fifteen years later. Interest is credited at a nominal discount rate of \( d \) compounded quarterly for the first 10 years, and at a nominal interest rate of 6% compounded semiannually thereafter. The accumulated balance in the fund at the end of 30 years is 100. Calculate \( d \).

4. Ernie makes deposits 100 at time 0, and \( X \) at time 3. The fund grows at a force of interest \( \delta_t = \frac{r^t}{100}, t > 0 \). The amount of interest earned from time 3 to time 6 is \( X \). Calculate \( X \).

5. Jim borrowed 10,000 from Bank X at an annual effective rate of 8%. He agreed to repay the bank with five level annual installments at the end of each year. At the same time he also borrowed 15,000 from Bank Y at an annual effective rate of 7.5%. He agreed to repay this loan with five level annual installments at the end of each year. He lent 25,000 to Wayne immediately in exchange for four annual level repayments at the end of each year, at an annual effective rate of 8.5%. Jim can only reinvests the proceeds at annual effective rate of 6%. Immediately after repaying the loans to the banks in full, determine how much Jim has left.

6. Jim began saving money for his retirement by making monthly deposits of 200 into a fund earning nominal interest of 6% compounded monthly. The first deposit occurred on January 1, 1985. Jim became unemployed and missed making deposits 60 through 72. He then continued making monthly deposits of 200. How much did Jim accumulate in his fund on December 31, 1999?

7. Megan purchases a perpetuity-immediate for 3250 with annual payments of 130. At the same time and interest rate, Chris purchases an annuity-immediate with 20 annual payments that begin at amount \( P \) and increase by 15 each year there after. Calculate \( P \).

8. Matthew makes a series of payments at the beginning of each year for 20 years. The first payment is 100. Each subsequent payment through the tenth year increases by 5% from the previous payment. After the tenth payment, each payment decreases by 5% from the previous payment. Calculate the present value of these payments at the time the first payment is made using an annual effective rate of 7%.
Every step in the equations needs to be justified. Not only writing the equation.

\[100 + 200 r^n + 300 r^{2n} = 600(1+i)^{-10} \quad i = 0.0351\]

2 Assume that he has 1 yen.

\[0.99(1+i) \quad (0.99)^2(1+i) \quad (0.99)^4(1+i)^4 \]

\[0.9921 = 1+i \quad i = 0.0078\]

3 \[10 \left(1-\frac{d}{4}\right)^{40} (1.03)^{40} + 20 \cdot (1.03)^{30} = 100 \quad d = .0453\]

4 \[\int_3^6 \frac{t^2}{100} dt = 109.4 \quad \text{AV of 100 at } t=3\]

\[\int_3^6 \frac{t^2}{100} dt - 109.4 = 96.026 \quad \text{interest of 100 from } t=3 \text{ to } 6\]

\[96.026 + X \int_3^6 \frac{t^2}{100} dt \quad X = X \quad \Rightarrow \quad X = 784.6\]
\begin{align*}
P_1 & = 10,000 \\
P_2 & = 15,000 \\
P_3 & = 25,000 \\
P_1 & = 2,504,565 \\
P_2 & = 3,707,471 \\
P_3 & = 7,632,197 \\
\frac{P_3 - P_2 - P_1}{5} & = 470.06 \\
(P_3 - P_2 - P_1) & = 470.06 \\
- P_1 - P_2 & = 373.4
\end{align*}

6. \begin{align*}
\text{i} & = 0.06/12 = 0.005 \\
\text{AV} & = 200 \cdot \frac{5}{59} (1+i)^{121} + 200 \cdot \frac{2}{108} = 53832.8
\end{align*}
The value of Megan's perpetuity immediate of 130 is \( \frac{130}{i} = 32.50 \) \( i = 0.04 \) \( \textcircled{3} \)

Chris has payments \( P, P+15, \ldots, P+19(15) \) \( \textcircled{1} \)

The PV of these year-end payments at 4% is

\[
PV = Pa_{\overline{20}^0} + \frac{15}{1.04} (Ia)_{19} = 13.59P + 1673.51 \quad \textcircled{2}
\]

\[3250 = 13.59P + 1673.51 \quad P = 116. \]

\[\textcircled{2}\]

\[
\begin{array}{c}
0 \quad 1 \quad 9 \quad 10 \quad 19 \\
100 \quad 100(1.05) \ldots \ldots = 15.13 \\
\end{array}
\]

PV at 7\% is

\[
100 \left( 1 + \frac{1.05}{1.07} + \ldots + \left( \frac{1.05}{1.07} \right)^9 \right) + \frac{15.13(0.95)}{1.07^{10}} \left( 1 + \frac{0.95}{1.07} + \ldots + \left( \frac{0.95}{1.07} \right)^9 \right)
\]

\[
= 100 \left( \frac{1 - \left( \frac{1.05}{1.07} \right)^{10}}{1 - \left( \frac{1.05}{1.07} \right)} \right) + 74.99 \left( \frac{1 - \left( \frac{0.95}{1.07} \right)^{10}}{1 - \left( \frac{0.95}{1.07} \right)} \right)
\]

\[
= 1384.66 \quad \textcircled{2}
\]