Problem 1.
How much money could RTT Environmental Services borrow to finance a site reclamation project if it expects revenues of $280,000 per year over a 5-year cleanup period? Expenses associated with the project are expected to be $90,000 per year. Assume the interest rate is 10% per year.

**Cash Flow Diagram:**

\[ P = (280,000 - 90,000)(P/A, 10\%, 5) = 190,000(3.7908) = $720,252 \]

Problem 2.
For the cash flow shown below, determine the value of \( G \) that will make the future worth in year 4 equal to $6000 at an interest rate of 15% per year.

<table>
<thead>
<tr>
<th>Year</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
</table>

**Cash Flow Diagram:**

\[ 6000(P/F, 15\%, 4) = 2000(P/A, 15\%, 4) - G(P/G, 15\%, 4) \]
\[ 6000(0.5718) = 2000(2.8550) - G(3.7864) \]
\[ G = $601.94 \]

Problem 3.
A chemical engineer planning for her retirement will deposit 10% of her salary each year into a high-technology stock fund. If her salary this year is $60,000 (i.e., end of year 1) and she expects her salary to increase by 4% each year, what will be the present worth of the fund after 15 years if it earns 4% per year?

**Cash Flow Diagram:**

\[ P = 60,000(0.1)[15/(1 + 0.04)] = $86,538 \]
Problem 4.
A recent engineering graduate passed the FE exam and was given a raise (beginning in year 1) of $2000. At an interest rate of 8% per year, what is the present value of the $2000 per year over her expected 35-year career?

Cash Flow Diagram:

\[ P = 2000(P/A, 8\%, 35) = 2000(11.6546) = $23,309 \]

Problem 5.
Maintenance costs for a regenerative thermal oxidizer have been increasing uniformly for 5 years. If the cost in year 1 was $8000 and it increased by $900 per year through year 5, the present worth of the costs at an interest rate of 10% per year is closest to

Cash Flow Diagram:

\[ P = 8,000(P/A, 10\%, 5) + 900(P/G, 10\%, 5) = 8,000(3.7908) + 900(6.8618) = $36,502 \]

Problem 6.
Find the value of \( x \) in the diagram below that will make the equivalent present worth of the cash flow equal to $15,000, if the interest rate is 15% per year.

\[ P = $15,000 \]

\[ 15,000 = 2000 + 2000(P/A, 15\%, 3) + 1000(P/A, 15\%, 3)(P/F, 15\%, 3) + x(P/F, 15\%, 7) \]

\[ 15,000 = 2000 + 2000(2.2832) + 1000(2.2832)(0.6575) + x(0.3759) \]

\[ x = $18,442 \]
Problem 7.
In attempting to obtain a swing loan from a local bank, a general contractor was asked to provide an estimate of annual expenses. One component of the expenses is shown in the cash flow diagram below. Convert the amounts shown into an equivalent uniform annual amount in years 1 through 8, using an interest rate of 12% per year.

\[ P = 5000 + 5000(P/A, 12\%, 3) + 3000(P/A, 12\%, 3)(P/F, 12\%, 3) + 1000(P/A, 12\%, 2)(P/F, 12\%, 6) \]
\[ = 5000 + 5000(2.4018) + 3000(2.4018)(0.7118) + 1000(1.6901)(0.5066) = $22,994 \]
\[ A = 22,994(A/P, 12\%, 8) = 22,994(0.20130) = $4628.69 \]

Problem 8.
What effective interest rate per 6 months is equal to a nominal 2% per month, compounded continuously?

\[ i = e^{0.12} - 1 \]
\[ = 1.1275 - 1 = 0.1275 \text{ or } 12.75\% \]

Problem 9.
The cost of money is 10% per year. Compute the capitalized cost of machine X.

<table>
<thead>
<tr>
<th></th>
<th>Machine X</th>
<th>Machine Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial cost, $</td>
<td>–66,000</td>
<td>–46,000</td>
</tr>
<tr>
<td>Annual cost, $/year</td>
<td>–10,000</td>
<td>–15,000</td>
</tr>
<tr>
<td>Salvage value, $</td>
<td>10,000</td>
<td>24,000</td>
</tr>
<tr>
<td>Life, years</td>
<td>6</td>
<td>3</td>
</tr>
</tbody>
</table>

\[ CC_X = [-66,000(A/P, 10\%, 6) – 10,000 + 10,000(A/F, 10\%, 6)]/0.10 \]
\[ = [-66,000(0.22961) – 10,000 + 10,000(0.12961)]/0.10 \]
\[ = $-238,582 \]

Problem 10.
An alumna of Ohio State University wanted to set up an endowment fund that would award scholarships to female engineering students totaling $100,000 per year forever. The first scholarships are to be granted now and continue each year forever. How much must the alumna donate now, if the endowment fund is expected to earn interest at a rate of 8% per year?

\[ CC = 100,000 + 100,000/0.08 \]
\[ = $1,350,000 \]