1. (3pts) Solve the linear systems
\[
\begin{align*}
1.013x - 6.099y &= 14.22 \\
-18.11 + 112.2y &= -0.1376
\end{align*}
\]
using four-digit rounding arithmetic.

2. (3pts) Find the rate of convergence of the sequence \(\{\sin \left(\frac{1}{n^2}\right)\}_{n=1}^{\infty}\) which converges to 0 as \(n \to \infty\).

3. (3pts) How many iterations of Bisection method are needed to find a root of \(f(x) = \cos x - x\) in the interval \([0, 2]\) to within \(10^{-100}\).

4. (3pts) Find all solutions of \(x^2 + 10 \cos x = 0\) accurate to within \(10^{-5}\).

5. (3pts) The following table lists the population of the United States from 1940 to 1990.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Population (in thousands)</td>
<td>132,165</td>
<td>151,326</td>
<td>179,323</td>
<td>203,302</td>
<td>226,542</td>
<td>249,633</td>
</tr>
</tbody>
</table>

Estimate the population in the year 1930, 1965, and 2010.

6. (3pts) Suppose \(x_j = j\) for \(j = 0, 1, 2, 3\) and it is known that
\[P_{0,1}(x) = 2x + 1,\quad P_{0,2}(x) = x + 1,\quad \text{and} \quad P_{1,2,3}(2.5) = 3.\]
Find \(P_{0,1,2,3}(2.5)\).

7. (3pts) Use Hermite interpolation to construct an approximating polynomial for the following data.

<table>
<thead>
<tr>
<th>(x)</th>
<th>(f(x))</th>
<th>(f'(x))</th>
</tr>
</thead>
<tbody>
<tr>
<td>-0.5</td>
<td>-0.0247500</td>
<td>0.7510000</td>
</tr>
<tr>
<td>-0.25</td>
<td>0.3349275</td>
<td>2.1890000</td>
</tr>
<tr>
<td>0</td>
<td>1.1010000</td>
<td>4.0020000</td>
</tr>
</tbody>
</table>

8. (3pts) A clamped cubic spline \(s\) for a function \(f\) is defined on \([1, 3]\) by
\[
s(x) = \begin{cases} 
  s_0(x) = 3(x - 1) + 2(x - 1)^2 - (x - 1)^3, & \text{if } 1 \leq x \leq 2, \\
  s_1(x) = a + b(x - 2) + c(x - 2)^2 + d(x - 2)^3, & \text{if } 2 \leq x \leq 3.
\end{cases}
\]
Given \(f'(1) = f'(3)\), find \(a, b, c,\) and \(d\).