Trigonometry reminder:

<table>
<thead>
<tr>
<th>$x$</th>
<th>0</th>
<th>$\frac{\pi}{6}$</th>
<th>$\frac{\pi}{4}$</th>
<th>$\frac{\pi}{3}$</th>
<th>$\frac{\pi}{2}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\sin(x)$</td>
<td>0</td>
<td>$\frac{1}{2}$</td>
<td>$\frac{1}{\sqrt{2}}$</td>
<td>$\frac{\sqrt{3}}{2}$</td>
<td>1</td>
</tr>
<tr>
<td>$\cos(x)$</td>
<td>1</td>
<td>$\frac{\sqrt{3}}{2}$</td>
<td>$\frac{1}{\sqrt{2}}$</td>
<td>$\frac{1}{2}$</td>
<td>0</td>
</tr>
</tbody>
</table>
1. (10 pts) Solve the initial value problem
\[ y'' + y = 2e^x, \quad y(0) = 1, \quad y'(0) = -1. \]
2. (15 pts) Solve the initial value problem
\[ y'' - 5y' + 4y = e^x, \quad y(0) = 0, \quad y'(0) = 0. \]
3. (10 pts) Let \( y \) be the solution of the initial value problem
\[
y'' + 4y' + 13y = 0, \quad y(0) = 1, \quad y'(0) = -5.
\]
Find \( y\left(\frac{\pi}{12}\right) \).
4. (15 pts) Solve the initial value problem

\[ y'' + 6y' + 5y = 7e^{2x}, \quad y(0) = 0, \quad y'(0) = 0. \]
5. (15 pts) Find the general *real* solution to
    \[ y'' + 4y = 3\sin(2x). \]
6. (15 pts) Suppose a spring-mass system has a mass of 100g and a spring constant of $400\frac{kg}{sec^2}$. The mass is pulled 5cm down and then released (with initial velocity 0), starting the spring in motion. If the motion is critically damped, what is the damping constant of the system? How far will the mass be from the position where it was at rest after one second?