1. Find the singular point of the given differential equation and classify it as regular or irregular. Justify your classification. (10 pts)

\[ x^2 y'' + 2y' + 3y = 0 \]

your answer:

2. Solve the following initial value problem. Assume \( x > 0 \). (10 pts)

\[ x^2 y'' - 5xy' + 9y = 0 \quad y(1) = 3 \quad \text{and} \quad y'(1) = 2 \]

your answer:
3. Find the inverse Laplace transform of the following functions. \( (20 \text{ pts}) \)

(a) \[ F(s) = \frac{2e^{-2s}}{s^2 - 4} \]

(b) \[ F(s) = \frac{s + 4}{s^2 - 2s + 5} \]

your answer:
4. Find the Laplace transform of the following function. (10 pts)

\[ f(t) = \begin{cases} 
0 & t < 2 \\
(t - 2)^3 & t \geq 2
\end{cases} \]

your answer:

5. Use the Laplace transform to solve the initial value problem (20 pts)

\[ y'' + 2y' - 3y = 0, \quad y(0) = 1, \quad y'(0) = 2 \]

your answer:
6. Find the solution of the initial value problem

$$y'' + 9y = u_2(t), \quad y(0) = 1, \quad y'(0) = 2$$

your answer: