1. Solve the system of equations:
\[
\begin{align*}
    x + y + z + w &= -4 \\
    2x + 3y + 4z + 5w &= -6 \\
    4x + 9y + 16z + 25w &= 26 \\
    8x + 27y + 64z + 125w &= 336
\end{align*}
\] 
(10%)

2. There exists a linear transformation \( T: R^2 \to R^3 \) such that \( T(6,17) = (53,-111,-37)^T \) and \( T(17,6) = (108,65,-106)^T \). Find \( T(2,3) \). (10%)

3. Given \( X = (2,1,3,2)^T \) and \( Y = (-2,4,1,2)^T \). Let \( \theta \) be the angle between \( X \) and \( Y \),
   a. find the square value of \( \sin \theta \)? (10%)
   b. find the normalization of vector projection of \( Y \) onto \( X \)? (10%)

4. Given \[
\begin{align*}
    x' &= 2x + 11y; \\
    y' &= 2x - 7y.
\end{align*}
\] Also, \( x(0) = 12 \), \( y(0) = 1 \).
   a. Find \( x(t) \)? (10%)
   b. Find \( y(t) \)? (10%)

5. Given a continuous function \( y(x), x \geq 0 \). Also, let \( f(x) = \begin{cases} 1, & x \geq 1; \\ 0, & 0 \leq x < 1. \end{cases} \) Solve
\( y'' + y = f(x) \) with \( y(0) = 1 \). (10%)

6. Given \( y'' + y = (4x + 4) \cdot \cos x \).
   a. Find the homogeneous solution, \( y_h(x) \)? (15%)
   b. Find the particular solution, \( y_p(x) \)? (15%)
1. (20%) Consider the two-terminal element with the \( i - v \) characteristic expressed by the piece-wise linear function as
\[
i(v) = 5|v - 1| + 2|v - 4| - |v - 6|
\]
where \( i \) is the current in ampere and \( v \) is the terminal voltage in volt.
(a) (5%) Plot the \( i - v \) curve of this element.
(b) (5%) Determine the static resistance at \( v = 2 \) V.
(c) (5%) Determine the dynamic resistance at \( v = 2 \) V.
(d) (5%) Determine the dynamic resistance at \( v = 5 \) V.

2. (10%) Given the circuit as shown in Fig. P2 and \( I_1 = 0.5 \) A, find the source voltage \( V_o \).

3. (15%) Sketch the straight-line approximation of the Bode plot for the following transfer function.
\[
H(s) = \frac{10^6(s+10)}{(s+10^3)(s+10^8)}
\]

4. (15%) Consider the parallel \( RLC \) circuit in Fig. P4. Assume that \( v(0) = 5 \) V, \( i(0) = 0 \) A, \( L = 1 \) H, \( C = 10 \) mF, and \( R = 6.25 \) Ω. Find \( v(t) \) for \( t \geq 0 \).

5. (20%) A load with 0.8 lagging power factor absorbs 60 W from a 100-V (effective voltage), 60-Hz power line. It is required to correct the power factor to 0.9 lagging.
(a) (7%) Find the effective original line current \( I_{eff, orig} \).
(b) (6%) Find the effective final line current \( I_{eff, final} \).
(c) (7%) Determine the value of the element to be added to achieve the required power factor correction.

6. (20%) Consider the circuit in Fig. P6. Use the superposition theorem to find the current \( i \).