

YOUR NAME: _____

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Read each problem **very carefully** before starting to solve it. Each problem is worth 10 points. It is necessary to show **all** your work. Correct answers without explanations are worth 0 points. GOOD LUCK!!

1. Decompose into partial fractions $\frac{2s^2 + 3s + 10}{s^3 + s^2 - 2s}$.

2. Use Laplace transforms to solve the initial value problem

$$y'' + y' - 2y = 10, \quad y(0) = 2, \quad y'(0) = 1.$$

3. Find $\mathcal{L}\{f(t)\}$, if $f(t) = \begin{cases} 2t + 1, & \text{if } 0 \leq t < 2, \\ 3t, & \text{if } t \geq 2 \end{cases}$.

(**Hint:** Use step functions.)

4. Use Laplace transforms to solve the initial value problem

$$y'' + 9y = \delta(t - \pi) + \delta(t - 2\pi), \quad y(0) = 0, \quad y'(0) = 9.$$

5. Use Laplace transforms to solve the initial value problem

$$y'' + 4y' = g(t), \quad y(0) = 1, \quad y'(0) = 2.$$

Since the forcing function $g(t)$ is not specified, you may express the solution as a convolution integral.