Name: _____

Find the indicated Laplace transforms and inverse Laplace transforms.

1. $\mathcal{L}\{2t^3e^{-2t}\}$

2. $\mathcal{L}\{e^{4t}\sin 5t\}$

3. $\mathcal{L}\{t\sin 2t\}$

4. $\mathcal{L}^{-1}\left\{\dfrac{s}{(s-1)(s+1)(s+2)}\right\}$

5. $\mathcal{L}^{-1}\left\{\dfrac{s+1}{s^2-6s+10}\right\}$

6. $\mathcal{L}^{-1}\left\{\dfrac{5}{(s-1)^2}\right\}$

7. Find $\mathcal{L}\{f(t)\}$ given $f(t) = \begin{cases} t+1 & \text{for } 0 < t < 1 \\ 2 & \text{for } 1 < t < 2 \\ 0 & \text{for } t > 2 \end{cases}$

8. Use the Laplace transform method to solve the initial value problem:
$y' + y = 2$ and $y(0) = -1$.

Bonus: Find $\mathcal{L}\{U_2^2\}$.