#1) Suppose \( f \) and \( g \) are both of exponential order:

- Show that \( \alpha f + \beta g \) is of exponential order, where \( \alpha \) and \( \beta \) are constants.
- Show that \( fg \) is of exponential order.

#2) Given that \( \mathcal{L}\{f'(t)\}(s) = s\mathcal{L}\{f\}(s) - f(0) \), show that
\[
\mathcal{L}\{f^{(n)}\}(s) = s^n\mathcal{L}\{f\}(s) - s^{n-1}f(0) - s^{n-2}f'(0) - \ldots - sf^{(n-2)}(0) - f^{(n-1)}(0)
\]

#3) Find \( \mathcal{L}\{\sin \beta t\}(s) \) for constant \( \beta \).

#4) Find \( \mathcal{L}\{\cos \beta t\}(s) \) for constant \( \beta \).

#5) Let \( f : \mathbb{R} \to \mathbb{R} \) be defined as follows:
\[
f(t) = \begin{cases} 
t & 0 \leq t \leq 1 \\
1 & 1 < t \leq 2 \\
0 & 2 < t 
\end{cases}
\]
Find \( \mathcal{L}\{f\}(s) \).

#6) Find \( \mathcal{L}\{t^n\}(s) \) for positive integer \( n \). (by induction probably)

#7) Using the laplace transform, change the following IVP into an algebraic equation and solve for \( Y(s) = \mathcal{L}\{y\}(s) \):
\[
y'' - 3y' + 2y = te^t, \text{ for } y(0) = 0, y'(0) = 1
\]