Laplace Transformation

$$\mathcal{L}\{f(t)\} = \int_0^\infty e^{-st} f(t)\ dt \tag{1}$$

There will be a formula sheet on the final for these forumlae:

$$\mathcal{L}\{1\} = \frac{1}{s} \tag{2}$$
$$\mathcal{L}\{t\} = \frac{1}{s^2} \tag{3}$$
$$\mathcal{L}\{t^n\} = \frac{n!}{s^{n+1}} \tag{4}$$
$$\mathcal{L}\{e^{at}\} = \frac{1}{s-a} \tag{5}$$
$$\mathcal{L}\{sin(kt)\} = \frac{k}{s^2+k^2} \tag{6}$$
$$\mathcal{L}\{cos(kt)\} = \frac{s}{s^2+k^2} \tag{7}$$

Not every function has a Laplace Transform.

Definition: A function is said to be of exponential order c if there exist constants c, $M > 0$, and $T > 0$, such that $|f(t)| \leq Me^{ct}$.

Theorem: If $f(t)$ is piecewise continuous on $[0, \infty)$ and of exponential order c for $t \geq T$, then $\mathcal{L}\{f(t)\}$ exists for $s > c$.

$$\mathcal{L}\{a+b+c\} = \mathcal{L}\{a\} + \mathcal{L}\{b\} + \mathcal{L}\{c\} \tag{8}$$