

1. Find the *Laplace* Transforms of the following functions ($f(t)$, $t \geq 0$)

$$(a) t^2, \quad (b) \cos 6t, \quad (c) e^{3t}, \quad (d) te^{-t}$$

$$(e) 2 + t \sin 5t, \quad (f) u_4(t), \quad (g) f(t) = \begin{cases} 0, & \text{if } t < 4 \\ 1, & \text{if } 4 \leq t \end{cases}$$

2. Sketch the following functions and find their *Laplace* Transforms ($f(t)$, $t \geq 0$)

$$(a) f(t) = \begin{cases} 0, & \text{if } t < 2\pi \\ \cos 2t, & \text{if } 2\pi \leq t \end{cases}, \quad (b) f(t) = \begin{cases} \sin t, & \text{if } t < 2\pi \\ 0, & \text{if } 2\pi \leq t \end{cases}$$

$$(c) f(t) = \begin{cases} 1, & \text{if } 0 \leq t < 1 \\ -1, & \text{if } 1 \leq t < 2 \\ 0, & \text{elsewhere} \end{cases}, \quad (d) f(t) = \begin{cases} t, & \text{if } 0 \leq t < 1 \\ 2 - t, & \text{if } 1 \leq t < 2 \\ 0, & \text{elsewhere} \end{cases}$$

3. Find the inverse *Laplace* Transforms of

$$(a) \frac{1}{s+1}, \quad (b) \frac{1}{s^2+9}, \quad (c) \frac{s}{s^2-9}$$

$$(d) \frac{s}{s^2+4s+3}, \quad (e) \frac{4}{s^2+2s+1}, \quad (f) \frac{e^{-4s}}{s}$$

4. Sketch the following functions and find their *Laplace* Transforms ($f(t)$, $t \geq 0$)

$$(a) |\sin 3t|, \quad (b) f(t) = \begin{cases} 1, & \text{if } 0 \leq t < 1 \\ -1, & \text{if } 1 \leq t < 2 \end{cases}, \quad f(t+2) = f(t)$$

$$(c) f(t) = \begin{cases} t, & \text{if } 0 \leq t < 1 \\ 2 - t, & \text{if } 1 \leq t < 2 \end{cases}, \quad f(t+2) = f(t)$$

5. Find the inverse *Laplace* Transforms of

$$(a) \frac{1}{s^2+4s+8}, \quad (b) \frac{s}{s^2+4}e^{-s}$$

$$(c) \frac{s^2+1}{s^3+6s^2+11s+6}, \quad (d) \frac{2}{s} \left(\frac{1}{1+e^{-2s}} \right)$$

Note: $s^3 + 6s^2 + 11s + 6 = (s+1)(s+2)(s+3)$.