Inverse laplace transfolm :

$$\frac{5}{s} + \frac{1}{(s-4)} + \frac{2}{(s-3)}$$

Sol:

$$F(s) = L^{-1}\left\{ 5/s + \frac{1}{s-4} + \frac{2}{s-3} \right\}$$

$$= 5\, L^{-1}(1/s) + L^{-1}(1/s-4) + 2\, L^{-1}(1/s-3)$$

$$= 5(1) + e^{4t} + 2e^{3t}$$

$$F(s) = 5 + e^{-4t} + 2e^{3t}$$

$$8/s+2 + 1/3s-5 + 3/s^3.$$

Sol:

$$F(s) = 8\, L^{-1}(1/s+2) + \frac{1}{3} L^{-1}\left(\frac{1}{s-5/3} \right) + 3\, L^{-1}(1/s^3)$$

$$= 8e^{-2t} + \frac{1}{3} e^{5/3 t} + \frac{3}{2} L^{-1}\left(\frac{2}{s^3}\right)$$

$$= 8e^{-2t} + \frac{1}{3} e^{5/3 t} + \frac{3}{2} t^2.$$

Q $\frac{8}{3s^2+12} + \frac{3}{s^2-49}$

Sol: $F(s) = \frac{8}{3(s^2+4)} + \frac{3}{s^2-49}$

$= \frac{4}{3}\left[\frac{2}{s^2+4}\right] + \frac{\frac{3 \times 7}{7}}{s^2-49}$

$= \frac{4}{3} L^{-1}\left[\frac{2}{s^2+4}\right] + \frac{3}{7} L^{-1}\left[\frac{7}{s^2-49}\right]$

$= \frac{4}{3} \sin 2t + \frac{3}{7} \sinh(7t)$

Q $\frac{3s-4}{s^2+5}$

Sol: $F(s) = \frac{3s}{s^2+5} - \frac{4}{s^2+5}$

$= 3L^{-1}\left[\frac{s}{(s)^2+(\sqrt{5})^2}\right] - \frac{4}{\sqrt{5}} L^{-1}\left[\frac{\sqrt{5}}{(s)^2+(\sqrt{5})^2}\right]$

$= 3\cos(\sqrt{5}t) - \frac{4}{\sqrt{5}} \sin(\sqrt{5}t)$

Q $7/s^2-9$

Sol: $= L^{-1}(7/s^2-9)$

$= 7 L^{-1}\left(\frac{1}{(s^2-9)}\right)$

$= \frac{7}{3} \times L^{-1}\left(\frac{3}{s^2-9}\right) = \frac{7}{3} \sinh(3t$

Q $H(s) = \dfrac{s+3}{s^2-3s-10}$

Sol: $H(s) = \dfrac{s+3}{s^2-3s-10}$

$$= \frac{s+3}{s^2-5s+2s-10}$$

$$= \frac{s+3}{s(s-5)+2(s-5)}$$

$$= \frac{s+3}{(s+2)(s-5)}$$

$$\frac{s+3}{(s+2)(s-5)} = \frac{A}{(s+2)} + \frac{B}{(s-5)}$$

$$(s+3) = A(s-5) + B(s+2) \rightarrow (*)$$

Let $s = 5$ in $(*)$

$$(5+3) = A\cancelto{0}{(5-5)} + B(5+2)$$

$$8 = B(7) \Rightarrow B = 8/7$$

Let $s = -2$ in $(*)$

$$(-2+3) = A(-2-5) + B\cancelto{0}{(-2+2)}$$

$$1 = A(-7) \Rightarrow A = -1/7$$

$$H(s) = \frac{-1/7}{(s+2)} + \frac{8/7}{(s-5)}$$

$$= -1/7\, L^{-1}\left(\frac{1}{s+2}\right) + 8/7\, L^{-1}\left(1/s-5\right)$$

$$= -1/7\, e^{-2t} + \frac{8}{7} e^{5t}$$

Q $y'' - 5y' + 6y = 0$

$$y(0) = 1, \quad y'(0) = 2$$

Sol: $L[y''](s) - 5L[y'](s) + 6L[y](s) = 0$

$$s^2 L[y] - s\,y(0) - y'(0) - 5[sL[y] - y(0)] + 6L[y](s)$$

$$s^2 Y(s) - 2s - 2 - 5sY(s) + 10 + 6Y(s) = 0$$

$$Y(s)[s^2 - 5s + 6] - 2s - 2 + 10 = 0$$

$$[s^2 - 5s + 6]\,Y(s) = 2s - 8$$

$$Y(s) = \frac{2s - 8}{s^2 - 5s + 6}$$

$$Y(s) = \frac{4}{s+2} + \frac{-2}{s+3}$$

$$L^{-1}[Y(s)] = 4\,L^{-1}\left[\frac{1}{s+2}\right] + (-2)\,L^{-1}\left[\frac{1}{s-3}\right]$$

$$y(t) = 4e^{-2t} - 2e^{3t}$$