1)a) $f(t) = U(t) \to F(s) = 1/s$ d) $\cos \omega t \, u(t) \to \dfrac{s}{s^2 + \omega^2}$

b) $f(t) = t \, u(t) \to F(s) = 1/s^2$

c) $\text{sen } \omega t \, u(t) \to \dfrac{\omega}{s^2 + \omega^2}$

2)a) $e^{-at} \text{sen } \omega t \, u(t) \to \dfrac{\omega}{(s^2 + \omega^2)(s+a)}$

b) $e^{-at} \cos \omega t \, u(t) \to \dfrac{s}{(s^2 + \omega^2)(s+a)}$

c) $t^3 \to \dfrac{3!}{s^4}$

8) $\dfrac{d^3 y}{dt^3} + 3\dfrac{d^2 y}{dt^2} + 5\dfrac{dy}{dt} + y = \dfrac{d^3 x}{dt^3} + 4\dfrac{d^2 x}{dt^2} + 6\dfrac{dx}{dt} + 8x$

$= \dfrac{s^3 Y + 3s^2 Y + 5sY + Y}{s^3 X + 4s^2 X + 6sX + 8x} \to \dfrac{Y(s)}{X(s)} = \dfrac{s^3 + 3s^2 + 5s + 1}{s^3 + 4s^2 + 6s + 8}$

9) $\dfrac{X(s)}{F(s)} = \dfrac{7}{s^2 + 5s + 10} \to s^2 X(s) + 5sX(s) + 10X(s) = 7F(s)$

$\mathcal{L}^{-1}\{s^2 x(s) + 5sx(s) + 10x(s) = 7F(s)\} \to$

$\dfrac{d^2 x(t)}{dt^2} + 5\dfrac{dx(t)}{dt} + 10x(t) = 7f(t)$

b) $X(s) = \dfrac{15}{F(s)} \dfrac{15}{(s+10)(s+11)} = \dfrac{15}{s^2 + 21s + 110} \to \mathcal{L}^{-1}\{s^2 x(s) + 21sx(s) + 110x(s) = 15F(s)\}$

$\dfrac{d^2 x(t)}{dt^2} + 21\dfrac{dx(t)}{dt} + 11x(t) = 15f(t)$

c) $X(s) = \dfrac{s+3}{s^3+11s^2+12s+18}$ $\to \mathcal{L}^{-1}\{s^3 X(s)+11 s^2 X(s)+12s x(s)+18 X(s) = s F(s)+3F(s)\}$

$\dfrac{d^3 x(t)}{dt^3} + 11\dfrac{d^2 x(t)}{dt^2} + 12\dfrac{dx(t)}{dt} + 18 x(t) = \dfrac{d f(t)}{dt} + 3 f(t)$

10) $\dfrac{C(s)}{R(s)} = \dfrac{s^5+2s^4+4s^3+s^2+4}{s^6+7s^5+3s^4+2s^3+s^2+5}$

$\mathcal{L}^{-1}\{s^5 R(s)+2s^4 R(s)+4s^3 R(s)+s^2 R(s)+4R(s) = s^6 C(s)+7s^5 C(s)+3s^4 C(s)+2s^3 C(s)+s^2 C(s)+$

$5 C(s)\}$

$\dfrac{d^5 r(t)}{dt^5} + 2\dfrac{d^4 r(t)}{dt^4} + 4\dfrac{d^3 r(t)}{dt^3} + \dfrac{d^2 r(t)}{dt^2} + 4 r(t) = \dfrac{d^6 c(t)}{dt^6} + 7\dfrac{d^5 c(t)}{dt^5} + 3\dfrac{d^4 c(t)}{dt^4} +$

$2\dfrac{d^3 c(t)}{dt^3} + \dfrac{d^2 c(t)}{dt^2} + 5 c(t)$

11) $\dfrac{C(s)}{R(s)} = \dfrac{s^4+3s^3+2s^2+s+1}{s^5+4s^4+3s^3+2s^2+3s+2}$ $\to r(t)=3t^3 \to R(s)=\dfrac{6}{s^4}$

$\mathcal{L}^{-1}\left\{\dfrac{6}{s^4}\cdot(s^4+3s^3+2s^2+s+1) = C(s)\cdot(s^5+4s^4+3s^3+2s^2+3s+2)\right\} =$

$\mathcal{L}^{-1}\left\{6+\dfrac{18}{s}+\dfrac{12}{s^2}+\dfrac{6}{s^3}\cdot\dfrac{6}{s^4} = C(s)\cdot(s^5+4s^4+3s^3+2s+3s+2)\right\}$