$\Rightarrow e^{3t} + 2e^{t} + 3te^{t}$

v) $\left[\dfrac{s-5}{s^2+4s+20}\right] = L^{-1}\left[\dfrac{s-5}{(s+2)^2+4^2}\right]$

$= L^{-1}\left[\dfrac{s+2}{(s+2)^2+4^2}\right] + L^{-1}\left[\dfrac{-7}{(s+2)^2+4^2}\right]$

$= e^{-2t}\cos 4t - \frac{7}{4}\sin 4t$

iii) $\frac{5s-8}{s(s-4)} = \frac{A}{s} + \frac{B}{s-4}$

$A(s-4) + Bs = 5s - 8$

at $s = 0$

$A(-4) + 0 = 5(0) - 8) = -8$

$-4A = -8$

$A = 2$

at $s = 4$

$0 + 4B = 5(4) - 8 = 12$

$4B = 12$

$B = 3$ $\longrightarrow \frac{2}{s} + \frac{3}{s-4}$

$= 2 + 3e^{4t}$

3) $\frac{s-5}{(s-3)(s-4)} = \frac{A}{s-3} + \frac{B}{s-4}$

$A(s-4) + B(s-3) = s-5$

at $s=4$

$B(1) = 4-5 = -1$

$B = -1$

at $s=3$

$A(-1) + 0 = -2$

$-A = -2$ $A = 2$

$\frac{2}{s-3} - \frac{1}{s-4}$

$\Rightarrow 2e^{3t} - e^{4t}$

$2s-6$ $= A$ $+ B$

c) $t^3 + 4t^2 + 5 = \frac{3!}{s^4} + \frac{4 \cdot 2!}{s^3} + \frac{5}{s}$

$= \frac{6}{s^4} + \frac{8}{s^3} + \frac{5}{s} = \frac{6 + 8s + 5s^3}{s^4}$

x) $[e^{3t}(t^2+4)]$

$L[t^2 e^{3t}] + L[4e^{3t}]$

$L[t^2] = \frac{2!}{s^{2+1}} = \frac{2}{s^3}$

$L[t^2 e^{3t}] = \frac{2}{(s-3)^3}$

$L[e^{3t}(t^2+4)] = \frac{2}{(s-3)^3} + \frac{4}{s-3}$

$= \frac{2 + 4(s-3)^2}{(s-3)^3} = \frac{2 + 4s^2 - 24s + 36}{(s-3)^3}$

$= 4s^2 - 24s + 38 / (s-3)^3$

v. $L[t \sin 3t] = \frac{3}{s^2+3^2} = \frac{3}{s^2+9}$

$-F'(s) = -\frac{d}{ds}\left[\frac{3}{s^2+9}\right]$

$u = 3$ $\quad du/ds = 0$

$v = s^2 + 9$ $\quad dv/ds = 2s$

using quotient rule

$\frac{v\,du/ds - u\,dv/ds}{v^2} = \frac{(s^2+9)(0) - 3(2s)}{(s^2+9)^2} = \frac{0 - 6s}{(s^2+9)^2} =$

$\frac{-6s}{(s^2+9)^2}$

vi) $L[e^{4t} \cos 2t]$

$(y^{(2)})_0 = (y^{0})_0 (-2) = -2(y^{(0)})_0$
$= -2(y)_0$

when $n=1$ $y^{(3)} = y^{(1)}(0) = 0$

when $n=2$ $y^{4} = y^{(2)}_0 (4) = 4 \times -2(y^{0})_0 = -8(y^{0})_0$

when $n=3$ $y^{(5)}_0 (10) = 10(y^{3})_0 = 10 \times 0 = 0$

when $n=4$ $y^{(6)}_0 = (y^{(4)})(18) = 18(y^{4})_0 = 18 \times -8(y^{0})$
$= -144(y^{0})$.

when $n=5$ $y^{7} = y^{5}\, 40$
$= 40 \times -144(y^{0}) = -5760(y^{0})$

$y = (y)_0 [1 - x^2 - x^4/3 - x^6/5 - x^8/7] + y'_0 (x)$

2.) $L[3e^{-4t} - 5e^{4t}]$

$\frac{3}{s} - \frac{5}{s} = 3(s-4) - 5(s+4) = \frac{3s - 12 - 5s - 20}{s^2 - 16}$

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Question 1

$(1-x^2)\,d^2y/dx^2 - 2x\,dy/dx + 2y = 0$

$(1-x^2)y'' - 2xy' + 2y = 0$

Sub 1

$u = y''$ $u^n = y^{(n+2)}$

$v = 1-x^2$ $v' = -2x$ $v = -2$

$y^{(n)} = y^{(n+2)} \cdot 1-x^2 + ny^{(n+1)} \cdot -2x + \frac{n(n-1)}{2} y^n \cdot -2$

$y^{(n)} = (1-x^2)y^{(n+2)} - 2nxy^{(n+1)} - n(n-1)y^n$

Sub 2