$$\mathcal{L}^{-1}\left\{\frac{2}{s^5}\right\} = \frac{1}{12}t^4$$

$$\frac{2}{4!}\mathcal{L}\{t^4\} = \frac{4!}{s^{4+1}} \cdot \frac{2}{4!} = \frac{2}{s^5}$$

$$\mathcal{L}\left\{\frac{1}{12}t^4\right\} = \frac{2}{s^5}$$

$$\mathcal{L}\{t^n\} = \frac{n!}{s^{n+1}}$$

$$\mathcal{L}\{e^{at}\} = \frac{1}{s-a}$$

$$\mathcal{L}\{e^{at}f(t)\} = F(s-a)$$

$$\mathcal{L}\{\cos bt\} = \frac{s}{s^2+b^2}$$

$$\mathcal{L}\{\sin bt\} = \frac{b}{s^2+b^2}$$

$$\mathcal{L}\{tf(t)\} = -\frac{d}{ds}F(s)$$

WHERE $F(s) = \mathcal{L}\{f\}$

$$\mathcal{L}^{-1}\left\{\frac{6}{(s-1)^4}\right\} = t^3e^t$$

$$\mathcal{L}\{e^t t^3\} = \frac{3!}{(s-1)^4} = \frac{6}{(s-1)^4}$$

$$\mathcal{L}^{-1}\left\{\frac{1}{s^2+4s+8}\right\} = \mathcal{L}^{-1}\left\{\frac{1}{(s+2)^2+4}\right\} = \frac{1}{2}e^{-2t}\sin 2t$$

($-a$ under $(s+2)$, $\uparrow b^2$ under 4)

$$\frac{1}{2}\mathcal{L}\{e^{-2t}\sin 2t\} = \frac{2}{(s+2)^2+4}\cdot\frac{1}{2} = \frac{1}{(s+2)^2+4}$$

$$\mathcal{L}^{-1}\left\{\frac{s+1}{s^2+2s+10}\right\} = \mathcal{L}^{-1}\left\{\frac{s+1}{(s+1)^2+9}\right\} = e^{-t}\cos 3t$$

$$\mathcal{L}^{-1}\left\{e^{-t}\cos 3t\right\} = \frac{s+1}{(s+1)^2+9}$$

$$\mathcal{L}^{-1}\left\{\frac{2s+16}{s^2+4s+13}\right\} = \mathcal{L}^{-1}\left\{\frac{A(s+2)+B(3)}{(s+2)^2+9}\right\}$$

$$= \mathcal{L}^{-1}\left\{\frac{2(s+2)+12}{(s+2)^2+9}\right\} \quad (4(3))$$

$$= 2\mathcal{L}^{-1}\left\{\frac{s+2}{(s+2)^2+9}\right\} + 4\mathcal{L}^{-1}\left\{\frac{3}{(s+2)^2+9}\right\}$$

$$= 2e^{-2t}\cos 3t + 4e^{-2t}\sin 3t$$

$2s+16 = A(s+2)+B$ (3)

$s=-2$: $12 = 3B \rightarrow B=4$

COEF OF s : $2 = A$

b^2

$$\mathcal{L}^{-1}\left\{\frac{3s-15}{2s^2-4s+10}\right\} = \frac{1}{2}\mathcal{L}^{-1}\left\{\frac{3s-15}{s^2-2s+5}\right\}$$

$$= \frac{1}{2}\mathcal{L}^{-1}\left\{\frac{\overset{3}{\cancel{A}}(s-1)+\overset{-6}{\cancel{B}}(2)}{(s-1)^2+4}\right\}$$

$$3s-15 = A(s-1)+B(2)$$

$s=1$: $-12 = 2B \rightarrow B=-6$

COEF OF s: $3 = A$

$$= \frac{1}{2}\left(3e^t\cos 2t - 6e^t\sin 2t\right)$$

$$= \frac{3}{2}e^t\cos 2t - 3e^t\sin 2t$$

$$\mathcal{L}^{-1}\left\{\frac{1}{s^2-1}\right\} = \mathcal{L}^{-1}\left\{\frac{1}{(s+1)(s-1)}\right\} = \mathcal{L}^{-1}\left\{\frac{\overset{-\frac{1}{2}}{\cancel{A}}}{s+1} + \frac{\overset{\frac{1}{2}}{\cancel{B}}}{s-1}\right\}$$

$$= -\frac{1}{2}e^{-t} + \frac{1}{2}e^t = \frac{e^t - e^{-t}}{2}$$

$$= \sinh t$$

NOT ACCEPTABLE FOR THIS CLASS

$$1 = A(s-1)+B(s+1)$$

$s=1$: $1 = 2B \Rightarrow B = \frac{1}{2}$

$s=-1$: $1 = -2A \rightarrow A = -\frac{1}{2}$

MANDATORY SANITY CHECK:

$s=2$ $\quad \frac{1}{4-1} = \frac{1}{3}$ $\quad -\frac{\frac{1}{2}}{3} + \frac{\frac{1}{2}}{1} = -\frac{1}{6} + \frac{1}{2}$

$= \frac{-1+3}{6}$

$= \frac{2}{6} = \frac{1}{3}$ ✓

NOT $0, \pm 1$ OR ANYTHING ALREADY USED

$$\mathcal{L}^{-1}\left\{\frac{s^2-26s-47}{(s-1)(s+2)(s+5)}\right\} = \mathcal{L}^{-1}\left\{\frac{-4}{s-1}+\frac{-1}{s+2}+\frac{6}{s+5}\right\}$$

$$= -4e^{t} - e^{-2t} + 6e^{-5t}$$

$$s^2-26s-47 = A(s+2)(s+5)+B(s-1)(s+5)+C(s-1)(s+2)$$

$s=1$ $\quad 1-26-47 = A(3)(6) = -72 \rightarrow A=-4$

$s=-2$ $\quad 4+52-47 = B(-3)(3) = 9 \rightarrow B=-1$

$s=-5$ $\quad 25+130-47 = C(-6)(-3) = 108 \rightarrow C=6$

SANITY CHECK!

$s=-3$ $\quad \dfrac{9+78-47}{(-4)(-1)(2)} = \dfrac{40}{8} = 5$

$$\frac{-4}{-4}+\frac{-1}{-1}+\frac{6}{2} = 1+1+3=5 \checkmark$$