y'ye göre çözülebilen Dif. D.

Ör $x(y')^2 - 2.y.y' + x = 0$ tekil ve genel çöz. bul?

$2yy' = x(y')^2 + x$ $(y'=p) \Rightarrow 2yp = xp^2 + x$

$\boxed{y = \frac{xp}{2} + \frac{x}{2p}}$ (y'e göre çektik x'e göre türev)

$$\frac{dy}{dx} = p = \frac{1}{2}\left(p + x.\frac{dp}{dx}\right) + \frac{1}{2}\left(\frac{p - x\frac{dp}{dx}}{p^2}\right)$$

$$\Rightarrow 2p = p + x\frac{dp}{dx} + \frac{1}{p^2}\left(p - x\frac{dp}{dx}\right)$$

$$\Rightarrow p^3 = p^2 x\frac{dp}{dx} + p - x\frac{dp}{dx} \Rightarrow p^3 - p = (p^2-1)x\frac{dp}{dx}$$

$$\Rightarrow \underbrace{(p^2-1)}_{\text{Tekil Ç.}}\underbrace{\left(p - x\frac{dp}{dx}\right)}_{\text{Genel Ç.}} = 0$$

Tekil Ç= $p^2-1 \Rightarrow p = \pm 1$

$y = \frac{xp}{2} + \frac{x}{2p}$ $p=1$ $y=x$

$p=-1$ $y=-x$

Genel Ç= $p = x\frac{dp}{dx} \Rightarrow \frac{1}{x}dx = \frac{1}{p}dp \Rightarrow \ln x + \ln c = \ln p$

$xc = p$

$cx = p$

$y = \frac{xp}{2} + \frac{x}{2p} \Rightarrow y = \frac{x^2c}{2} + \frac{1}{2c}$

Clairaut Dif. Denk. ($y = xy' + f(y')$)

Ör $y = xy' + (y')^3$ d.d. genel çöz. bul?

$y'=p$ olsun $\boxed{y = xp + p^3}$ (y'e göre çekilmiş x'e göre türev al.)

$y' = 1p + xp' + 3p^2p' \Rightarrow y' = p + xp' + 3p^2p' = p$

$\cancel{p} = \cancel{p} + xp' + 3p^2p' \Rightarrow xp' + 3p^2p' = 0 \Rightarrow \underbrace{p'}_{\text{Genel Ç.}}\underbrace{(x+3p^2)}_{\text{Tekil Ç.}} = 0$

$p'=0$ $y = xp + p^3$ $x + 3p^2 = 0$

$p = 0x + c$ $y = xc + c^3$ $p = \pm\sqrt{\frac{-x}{3}}$

$y = \pm x\sqrt{\frac{-x}{3}} + \left(\pm\sqrt{\frac{-x}{3}}\right)^3$

Ör $y = xy' + 1 + (y')^2$ dif. denk. genel çöz. bul?

$y'=p$ olsun $y = xp + 1 + p^2$

$y' = 1p + xp' + 0 + 2pp'$

$\cancel{p} = \cancel{p} + xp' + 2pp' \Rightarrow xp' + 2pp' = 0$

$\underbrace{p'}_{\text{Genel Ç.}}\underbrace{(x+2p)}_{\text{Tekil Ç.}} = 0$

$p'=0$ $y = xp + 1 + p^2$ $x + 2p = 0$

$p = 0x + c$ $y = xc + 1 + c^2$ $p = \frac{-x}{2}$

$p = c$

$y = \frac{-x^2}{2} + 1 + \frac{x^2}{4} \Rightarrow y = \frac{4-x^2}{4}$

Sabit Katsayılı Homojen Dif. Denk.

Ör $y''' - 6y'' + 11y' - 6y = 0$ $y(0)=0$ $y'(0)=1$ $y''(0)=0$ old. göre Problemi çöz?

$r^3 - 6r^2 + 11r - 6 = 0$ (3. dereceden old. için son sayının çarpanları yaz.)

↳ 1 2 3 6 −1 −2 −3 −6

(en büyük dereceli katsayının değeri 1 bölmeye gerek yok)

1 yazdık $\Rightarrow 1 - 6 + 11 - 6 = 0 \Rightarrow (r-1)$

$$r^3-6r^2+11r-6 \;\Big|\; \frac{r-1}{r^2-5r+6}$$

$(r-1)(r-2)(r-3) = 0$

$r_1 = 1$ $r_2 = 2$ $r_3 = 3$

$$y = c_1 e^{t} + c_2 e^{2t} + c_3 e^{3t}$$

Ör $y^{(4)} - 4y^{(3)} + 5y'' - 4y' + 4y = 0$ dif. denk. genel çöz. bul?

$r^4 - 4r^3 + 5r^2 - 4r + 4 = 0$

1, 2, 4, −1, −2, −4

1 için $1-4+5-4+4 \neq 0$ 2 için $= 16-32+20-8+4 = 0$

$(r-2)$ çarpanı var

$$r^4-4r^3+5r^2-4r+4 \;\Big|\; \frac{r-2}{r^3-2r^2+r-2}$$

0

$(r-2)(r-2)(r^2+1) = 0$

$r_1 = 2$ $r_2 = 2$ $r^2 = -1$

$r_3 = +i$ $r_4 = -i$

$$y = c_1 e^{2t} + c_2 e^{2t}.t + c_3 e^{0t}\cos(1t) + c_4 e^{0t}\sin(1t)$$

Sabit Katsayılı Homojen Olmayan Dif. Denklemler

Ör $y'' - 3y' + 2y = \sin 3x$ denk. genel çöz. nedir?

$y'' - 3y' + 2y = 0$

$r^2 - 3r + 2 = 0$

$y_1 = c_1 e^{2x} + c_2 e^{x}$

$y'' - 3y' + 2y = \sin 3x$

$y_2 = A\sin 3x + B\cos 3x$

$y_2' = 3A\cos 3x - 3B\sin 3x$

$y_2'' = -9A\sin 3x - 9B\cos 3x$

$-9A\sin 3x - 9B\cos 3x - 3(3A\cos 3x - 3B\sin 3x) + 2(A\sin 3x + B\cos 3x) = \sin 3x$

$(-9A + 9B + 2A)\sin 3x + (-9B - 9A + 2B)\cos 3x = \sin 3x$

$$\left.\begin{array}{l} -9B - 9A + 2B = 0 \quad (\cos \text{ için}) \\ -9A + 9B + 2A = 1 \quad (\sin \text{ için}) \end{array}\right\} \quad A = \frac{-7}{130} \qquad B = \frac{9}{130}$$

$$y_2 = \frac{-7}{130}\sin 3x \quad \frac{9}{130}\cos 3x$$

$$y = c_1 e^{2x} + c_2 e^{x} \quad \frac{-7}{130}\sin 3x \quad \frac{9}{130}\cos 3x$$

Ör $y''' - 5y'' - y' + 5y = 10t - 63e^{-2t} + 29\sin 2t$ dif. denk. genel ç. bul?

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

$r^3 - 5r^2 - r + 5 = 0$

$y_1 = c_1 e^{5t} + c_2 e^{t} + c_3 e^{-t}$

$y''' - 5y'' - y' + 5y = 10t - 63e^{-2t}$

$y_2 = At + B + Ce^{-2t} + D\sin 2t + E\cos 2t$

$y_2' = A - 2Ce^{-2t} + 2D\cos 2t - 2E\sin 2t$

$y_2'' = 4Ce^{-2t} - 4D\sin 2t - 4E\cos 2t$

$y_2''' = -8Ce^{-2t} - 8D\cos 2t + 8E\sin 2t$

$-8Ce^{-2t} - 8D\cos 2t + 8E\sin 2t - 20Ce^{-2t} + 20D\sin 2t + 20E\cos 2t - A + 2Ce^{-2t}$
$-2D\cos 2t + 2E\sin 2t + 5At + 5B + 5Ce^{-2t} + 5D\sin 2t + 5E\cos 2t$

$=$

$10t - 63e^{-2t} + 29\sin 2t$

$A = 2$ $B = \frac{2}{5}$ $C = 3$ $D = 1$ $E = \frac{2}{5}$

$$G.Ç = c_1 e^{5t} + c_2 e^{t} + c_3 e^{-t} + 2t + \frac{2}{5} + 3e^{-2t} + \sin 2t + \frac{2}{5}\cos 2t$$

Lagrange Dif. Denklemi $y = x\,f(y') + g(y')$

Ör $y = x\,(y')^2 + y'$ dif. denk. Cöz.

$y' = p$ olsun $\boxed{y = xp^2 + p}$

(x'e göre türev) $y' = 1.p^2 + x.2pp' + p' \Rightarrow \boxed{p = p^2 + 2xpp' + p'}$

$x' + v(p)x = q(p)$

$p - p^2 = \frac{dp}{dx}(2xp+1) \Rightarrow (p-p^2)\frac{dx}{dp} = 2xp + 1$

$(p-p^2)x' - 2xp = 1$ (x' Katsayı 1 olmalı)

$\Rightarrow x' + \frac{2}{p-1}x = \frac{1}{p(1-p)}$

Lineer Dif. Denklemi

$x' + P(y)x = Q(x)$

$\mu(x) = e^{\int \frac{2}{p-1}dp} = e^{2\ln|p-1|} = (p-1)^{2\ln e} = (p-1)^2$

$\int [(p-1)^2 . x]' = \int \frac{1-p}{p} \Rightarrow (p-1)^2 . x = \ln|p| - p + c$

$x = \frac{\ln|p| - p + c}{(p-1)^2}$

Genel Cözüm $\Rightarrow$ $x = \frac{\ln|p| - p + c}{(p-1)^2}$ $y = \left(\left(\frac{\ln|p| - p + c}{(p-1)^2}\right)p^2 + p\right.$

Tekil Cözüm $\Rightarrow$ $f(p) - p = 0$ yapan değer

$p^2 - p = 0$

$p = 0 \quad | \quad p = 1$

$y = 0 \quad | \quad y = x + 1$

Ör $y = x(1+y') + (y')^2$ genel Cözümü nedir?

$y' = p$ olsun $y = x(1+p) + p^2 = x + xp + p^2 = y$

$y' = 1 + p + xp' + 2pp'$

$\cancel{p} = 1 + \cancel{p} + xp' + 2pp' \Rightarrow 0 = 1 + p'(x + 2p)$

$\frac{dp}{dx} = \frac{-1}{x+2p}$

$\frac{dx}{dp} = -x - 2p \Rightarrow x' + x = -2p$

$\mu(x) = e^{\int 1x\,dx} = e^p$

$\int e^p x' + x\,e^p = \int -2p\,e^p \Rightarrow x.e^p = -2(pe^p - e^p) + c$

$x.e^p = -2pe^p + 2e^p + c$

$x = -2p + 2 + c\,e^{-p}$

$y = x(1+p) + p^2 \Rightarrow y = (-2p + 2 + ce^{-p})(1+p) + p^2$

$\Rightarrow y = -2p + 2 + ce^{-p} - 2p^2 + 2p + cpe^{-p} + p^2$

$\Rightarrow y = -p^2 + c(1+p)e^{-p}$

Tekil C $\Rightarrow$ $f(p) - p = 0$

$1 + p - p \neq 0$ Tekil Cözüm yok

Cauchy - Euler $(x^n y'' + x^{n-1} y' + x^{n-2} y = 0)$

Ör $x^2 y'' - 4xy' + 4y = \underbrace{x^2}_{f(x)}$ dif. genel çöz. bulunuz.

$y = x^r$ $\qquad (r^2 - r) x^r - 4r x^r + 4x^r = 0$

$y' = r x^{r-1}$ $\qquad x^r [r^2 - r - 4r + 4] = 0$ $\qquad \boxed{y_H = C_1 x^4 + C_2 x}$

$y'' = (r^2 - r) x^{r-2}$ $\qquad r_1 = 4 \quad r_2 = 1$

$y_1 = x^4 \qquad y_2 = x$

$$W = \begin{vmatrix} y_1 & y_2 \\ y_1' & y_2' \end{vmatrix} = \begin{vmatrix} x^4 & x \\ 4x^3 & 1 \end{vmatrix} = -3x^4$$

$$U_1 = -\int \frac{y_2 . f(x)}{W \quad a} dx$$

$$U_2 = \int \frac{y_1 \quad f(x)}{W \quad a} dx$$

$y_ö = U_1 Y_1 + U_2 Y_2$

$a = y''$ Katsayısı

$f(x) =$ denklemin Karşısı

$$U_1 = -\int \frac{x \quad x^2}{-3x^4 \quad x^2} = \frac{-1}{6} x^{-2}$$

$$U_2 = \int \frac{x^4 . x^2}{-3x^4 \quad x^2} = -\frac{1}{3} x$$

$$y_ö = \left(\frac{-1}{6} x^{-2} \right) x^4 + \left(\frac{-1}{3} x \right) x = \frac{-x^2}{2}$$

Genel Çözüm $= C_1 x^4 + C_2 x - \dfrac{x^2}{2}$

Ör $x^2 \dfrac{d^2y}{dx^2} - 2x \dfrac{dy}{dx} + 2y = x^3$

$y = x^r$ $\qquad (r^2 - r) x^r - 2r x^r + 2 x^r = 0$

$y' = r x^{r-1}$ $\qquad x^r [r^2 - r - 2r + 2] = 0$

$y'' = (r^2 - r) x^{(r-2)}$ $\qquad r^2 - 3r + 2$ $\qquad y_H = C_1 x^2 + C_2 x$

$(r-2) \quad (r-1)$

$y_1 = x^2 \qquad y_2 = x$

$$W = \begin{vmatrix} x^2 & x \\ 2x & 1 \end{vmatrix} \quad x^2 - 2x^2 = -1x^2$$

$$U_1 = -\int \frac{y_2 \quad f(x)}{W . a}$$

$$U_2 = \int \frac{y_1 \quad f(x)}{W . a}$$

$$U_1 = -\int \frac{x . \ x^3}{-x^2 \quad x^2} \quad -1 \quad = +x$$

$$U_2 = \int \frac{x^2 . x^3}{-x^2 \quad x^{\cancel{2}}} = -x = \frac{-x^2}{2}$$

$$y_ö = (+x)(x^2) + \left(\frac{-x^2}{2} \right) x$$

Genel Çözüm $= C_1 x^2 + C_2 x + x^3 + \left(-\dfrac{x^3}{2} \right)$

Laplace Kuralları

$$\mathcal{L}\{f(t)\} = \int_0^\infty f(t)\, e^{-st}\, dt = F(s)$$

1) Sabit Sayı

$$\mathcal{L}\{a\} = \frac{a}{s}$$

2) "t"

$$\mathcal{L}\{t\} = \frac{1}{s^2}$$

▽ $\mathcal{L}\{a \cdot f(t)\} = a.\ \mathcal{L}\{f(t)\}$

$$\mathcal{L}\{f(t) \pm g(t)\} = \mathcal{L}\{f(t)\} + \mathcal{L}\{g(t)\}$$

3) Polinom

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

4) Euler

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

5) Sin

$$\mathcal{L}\{\sin at\} = \frac{a}{s^2+a^2}$$

6) Cos

$$\mathcal{L}\{\cos at\} = \frac{s}{s^2+a^2}$$

7) ★★★

$$\mathcal{L}\{e^{at}.\, t\} = \frac{1}{(s-a)^2}$$

$$\mathcal{L}\{e^{at}.\, t^n\} = \frac{n!}{(s-a)^{n+1}}$$

$$\mathcal{L}\{e^{at}.\, \sin(bt)\} = \frac{b}{(s-a)^2+b^2}$$

$$\mathcal{L}\{e^{at}.\, \cos(bt\} = \frac{(s-a)}{(s-a)^2+b^2}$$

8 ★★

$$\mathcal{L}\{t^n \sin(at)\} = (-1)^n \frac{d^n}{ds^n}\left(\frac{a}{s^2+a^2}\right)$$

$$\mathcal{L}\{t^n \cos(at)\} = (-1)^n \frac{dn}{ds^n}\left(\frac{s}{s^2+a^2}\right)$$

▽ s Yerine $(s-a)$ yazılır.

Ör. $f(t) = 5t + 2$ laplace dönüşümü bul.

$$\mathcal{L}\{5t+2\} = 5\,\mathcal{L}\{t\} + \mathcal{L}\{2\}$$

$$5.\frac{1}{s^2} + \frac{2}{s} = \frac{5}{s^2} + \frac{2}{s}$$

Örnek $f(t) = 2e^{-3t} + t^3 - 5t^2 + t + 1$ laplace dön. bul.

$$2\,\mathcal{L}\{e^{-3t}\} + \mathcal{L}\{t^3\} - 5\,\mathcal{L}\{t^2\} + \mathcal{L}\{t\} + \mathcal{L}\{1\}$$

$$2.\frac{1}{s+3} + \frac{3!}{s^4} - 5\,\frac{2!}{s^3} + \frac{1}{s^2} + \frac{1}{s}$$

$$= \frac{2}{s+3} + \frac{6}{s^4} - \frac{10}{s^3} + \frac{1}{s^2} + \frac{1}{s}$$

Örnek $f(t) = \sin 4t + 5\cos 3t$ laplace dön. bul.

$$\frac{4}{s^2+16} + 5.\ \frac{s}{s^2+9}$$

Örnek $f(t) = (t^2+4t-3)\, e^{2t}$ laplace dön. bul.

$$\mathcal{L}\{t^2 e^{2t}\} + 4\,\mathcal{L}\{t\, e^{2t}\} - 3\,\mathcal{L}\{e^{2t}\}$$

$$\frac{2!}{(s-2)^3} + 4\,\frac{1}{(s-2)^2} - 3\,\frac{1}{s-2}$$

Ters Laplace Dönüşümü

⇒ Basit Kesirlere Ayırma

↳ Paydadaki Çarpanlar 1. derece ise
↳ " " 2. " "
↳ " " tam kare "
↳ " " , tam " yapma

↳ Paydadaki çarpanlar 1. derece ise

$$\mathcal{L}^{-1}\left\{\frac{2s-3}{s^2+3s+2}\right\} = ?$$

$$\frac{2s-3}{(s+2)(s+1)} \Rightarrow \frac{A}{(s+2)} + \frac{B}{(s+1)} \qquad 2s-3 = As+A+Bs+2B$$

$(s+1)$ $(s+2)$

$A+B=2$ $A=7$
$A+2B=-3$ $B=-5$

$$\mathcal{L}\left\{\frac{7}{s+2}\right\} + \mathcal{L}\left\{\frac{-5}{s+1}\right\}$$

$$\boxed{7.e^{-2t} \quad -5.e^{-t}}$$

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

↳ Paydada Çarpanlar 2. derece ise

$$\mathcal{L}^{-1}\left\{\frac{2s+1}{(s-2)(s^2+9)}\right\} = ? \qquad \frac{A}{(s-2)} + \frac{Bs+C}{s^2+9}$$

1.derece

$$2s+1 = As^2+9A+Bs^2+Cs-2Bs-2C \qquad A=6/13 \quad B=-6/13 \quad C=14/13$$

$$\mathcal{L}^{-1}\left\{\frac{\frac{6}{13}}{s-2} + \frac{\frac{-6}{13}s+\frac{14}{13}}{s^2+9}\right\}$$

$$\frac{6}{13}e^{2t} \quad \frac{-6}{13}\cos 3t + \frac{14}{13}\,\frac{\sin 3t}{3}$$

↳ Paydada tam Kare Çarpan Var ise

$$\mathcal{L}^{-1}\left\{\frac{2s-3}{(s+4)(s-2)^2}\right\} = ? \qquad \frac{A}{s+4} + \frac{B}{s-2} + \frac{C}{(s-2)^2}$$

$$2s-3 = As^2-4As+4A+Bs^2+2Bs-8B+Cs+4C$$

$$A=-11/36 \qquad B=11/36 \qquad C=1/6$$

$$\mathcal{L}^{-1}\left\{\frac{-11/36}{s+4} + \frac{11/36}{s-2} + \frac{1/6}{(s-2)^2}\right\}$$

⚠ $\mathcal{L}\{e^{at}.t\} = \frac{1}{(s-a)^2}$

$$\frac{-11}{36}e^{-4t} + \frac{11}{36}e^{2t} + \frac{1}{6}e^{2t}.t$$

↳ Paydaya tam Kare yapma

$$\mathcal{L}^{-1}\left\{\frac{1}{s^2+2s+2}\right\}$$

$1+1$

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

⚠ $\mathcal{L}\{e^{at}\sin bt\} = \frac{b}{(s-a)^2+b^2}$ ⚠ $\mathcal{L}\{e^{at}\cos bt\} = \frac{(s-a)^2}{(s-a)^2+b^2}$

Laplace İle Dif. Denklem Çözme

1. şart ⇒ Başlangıç değer problemi olmalı (o) $y(0)=\ldots$ $y'(0)=\ldots$

2. şart ⇒ y ve y' li ifadelerin katsayısının sabit olması gerekli

$$\mathcal{L}\{y\} = y(s)$$
$$\mathcal{L}\{y'\} = s(y(s)) - y(0)$$
$$\mathcal{L}\{y''\} = s^2 y(s) - s\,y(0) - y'(0)$$
$$\mathcal{L}\{y'''\} = s^3 y(s) - s^2(y(0)) - s\,y'(0) - y''(0)$$

Soru = $y' - 2y = e^{2t}$ $y(0)=1$ d. d. çöz.

$$\mathcal{L}\{y'-2y\} = \mathcal{L}\{e^{2t}\}$$
$$\mathcal{L}\{y'\} - 2\mathcal{L}\{y\} = \mathcal{L}\{e^{2t}\}$$

$sY(s) - y(0) - 2Y(s) = \frac{1}{s-2}$ $y(s)$ yalnız bırak

$s\,y(s) - 2y(s) = \frac{1}{s-2} + 1 \Rightarrow y(s)(s-2) = \frac{s-1}{s-2}$

$y(s) = \frac{(s-1)}{(s-2)^2}$ Ters Laplace

$$\mathcal{L}^{-1}\{\underbrace{y(s)}_{y}\} = \mathcal{L}^{-1}\left\{\frac{(s-1)}{(s-2)^2}\right\} \dashrightarrow \frac{A}{s-2} + \frac{B}{(s-2)^2}$$

$\boxed{s-1 = As - 2A + B}$ → $A=1$, $B=1$

$\forall\ \mathcal{L}\{e^{at}.t\} = \frac{1}{(s-a)^2}$

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

$$\boxed{y = e^{2t} + e^{2t}.t}$$

Örnek) $y'' - 2y' - 3y = 0$ $y(0)=0$, $y'(0)=2$ d.d. lap. ile çöz?

$$\mathcal{L}\{y''-2y'-3y\} = \mathcal{L}\{0\}$$
$$\mathcal{L}\{y''\} - 2\mathcal{L}\{y'\} - 3\mathcal{L}\{y\} = 0$$
$$s^2 Y(s) - s\,y(0) - y'(0) - 2(s\,Y(s) - y(0)) - 3Y(s) = 0$$
$$\Rightarrow s^2 Y(s) - 2s\,Y(s) - 3Y(s) = 2$$
$$Y(s)[s^2-2s-3] = 2$$
$$Y(s) = \frac{2}{s^2-2s-3}$$
$$\mathcal{L}^{-1}[y(s)] = \mathcal{L}^{-1}\left\{\frac{2}{s^2-2s-3}\right\}$$

$y = \mathcal{L}^{-1}\frac{A}{(s-3)} + \mathcal{L}^{-1}\frac{B}{s+1} \Rightarrow 2 = As + A + Bs - 3B$

$A = 1/2$ $B = -1/2$

$$y = \mathcal{L}^{-1}\left[\frac{1/2}{s-3}\right] + \mathcal{L}^{-1}\left\{\frac{-1/2}{s+1}\right\}$$

$$y = \frac{1}{2}e^{3t} - \frac{1}{2}e^{-t}$$

Soru = $y'' - 4y = 2e^{3t}$ $y(0) = 0$ $y'(0) = 0$ d. d. lap. ile çöz?

⑮

$$\mathcal{L}\{y''\} - 4\mathcal{L}\{y\} = 2\mathcal{L}\{e^{3t}\}$$

$$s^2 y(s) - s\,y(0) - y'(0) - 4\,y(s) = 2\,\frac{1}{s-3}$$

$$y(s)\,(s^2-4) = \frac{2}{s-3}$$

$$y(s) = \frac{2}{(s^2-4)(s-3)}$$

$$\underbrace{\mathcal{L}^{-1}\{y(s)\}}_{y} = \mathcal{L}^{-1}\left\{\frac{2}{(s^2-4)(s-3)}\right\}$$

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

$$2 = As^2 - As - 6A + Bs^2 - 5Bs - 6B + Cs^2 - 4C$$

$A = -5/4$

$B = 1/4$

$C = 1$

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

$$y = \frac{-5}{4}e^{2t} + \frac{1}{4}e^{-2t} + e^{3t}$$