24.

$y = y'$ $y(0) = 3$

$y - y' = 0$

$y' - y = 0$

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

$= e^{\int -1\,dx}$

$\mu = c_1 e^{-x}$ c_1은 상수

$\mu(y' - y) = 0 \times \mu$

$y'\mu - \mu y = 0$

$-\mu = d\mu$

$y'\mu + d\mu y = 0$

$\int y'\mu + d\mu y = \int 0$

$y\mu = c_2$ (c_2는 상수)

$y = c_2 \mu^{-1}$

$y = c e^{x}$ (c는 상수)

$y(0) = 3$

$y(0) = c e^{0} = c = 3$

$y = 3e^{x}$ //

25.

$y' - 3xy = 0$ $y(0) = 3$

$y' = 3xy$

$\frac{dy}{dx} = 3xy$

$\int \frac{dy}{y} = \int 3x\,dx$

$\ln y = \frac{3}{2}x^2 + c_1$ (c_1은 상수)

$y = e^{\frac{3}{2}x^2 + c_1}$

$y = c e^{\frac{3}{2}x^2}$ (c은 상수)

$y(0) = c = 3$

$y = 3e^{\frac{3}{2}x^2}$ //

26.

$$2x^3y^2 + x^4 y y' = 0$$

$$dx\left(2x^3y^2 + x^4 y \frac{dy}{dx}\right) = 0 \cdot dx$$

$$2x^3y^2\,dx + x^4y\,dy = 0$$

$$P(x,y) = 2x^3y^2$$

$$Q(x,y) = x^4y$$

$$\frac{\partial P(x,y)}{\partial y} = 4x^3y$$

$$\frac{\partial Q(x,y)}{\partial x} = 4x^3y$$

$$\frac{\partial P(x,y)}{\partial y} = \frac{\partial Q(x,y)}{\partial x}$$

완전미분 방정식 조건 성립

$P(x,y) = \frac{\partial u}{\partial x}$ $Q(x,y) = \frac{\partial u}{\partial y}$ 라 할때

$$u = \int P(x,y)\,\partial x + h$$

$$u = \int 2x^3y^2\,\partial x + h$$

$$u = \frac{1}{2}x^4y^2 + h \cancel{(x)}$$

$$\frac{\partial u}{\partial y} = x^4y + \frac{\partial h}{\partial y}$$

$$\frac{\partial h}{\partial y} = Q(x,y) - x^4y$$

$\cancel{h = \int Q(x,y)\,\partial y}$

$$h = \int (Q(x,y) - x^4y)\,\partial y$$

$$= \int (x^4y - x^4y)\,\partial y$$

$$= \int 0\,\partial y$$

$h = c$ (c는 상수)

$$u = \frac{1}{2}x^4y^2 + c$$

~~20.~~

~~$y' + 3y = 2$~~

~~$\mu = e^{\int 3\,dx}$~~

~~$\mu = c_1 e^{3x}$ (c_1은 상수)~~

~~양변에 μ를 곱한다.~~

~~$\mu y' + 3\mu y = 2\mu$~~

27.

$y' + 3y = 2$

표준형

적분인자 $\mu = e^{\int 3dx} = c_1 e^{3x}$ (c_1 = 상수)

양 변에 μ를 곱한다.

$$\mu y' + 3\mu y = 2\mu$$

$$3\mu = \frac{d\mu}{dx}$$

$$\mu \frac{dy}{dx} + \frac{d\mu}{dx} y = 2\mu$$

$$\frac{d(\mu y)}{dx} = 2\mu$$

$$\mu y = \int 2\mu\, dx$$

$$c_1 y e^{3x} = \int 2c_1 e^{3x} dx$$

$$c_1 y e^{3x} = \frac{2c_1}{3} e^{3x} + c_2 \quad (c_2\text{는 상수})$$

$$y = \frac{2}{3} + \frac{c_2}{c_1} e^{-3x}$$

$$y = ce^{-3x} + \frac{2}{3} \quad (c\text{는 상수}) \quad //$$

28.

$$2y'' + 4y' + 2y = 0$$

$$y'' + 2y' + y = 0$$

$y = e^{\lambda x}$ 라 할때

$$\underbrace{(\lambda^2 + 2\lambda + 1)}_{0} \underbrace{e^{\lambda x}}_{\text{양}} = 0$$

$D = \sqrt{2^2 - 4} = 0$ 중근이다

$$\lambda^2 + 2\lambda + 1 = 0$$

$$(\lambda + 1)^2 = 0$$

$$\lambda = -1$$

$$y_1 = e^{-x} \xrightarrow{\text{내림차수법}} y_2 = xe^{-x}$$

$$y = c_1 e^{-x} + c_2 x e^{-x} \quad \begin{pmatrix} c_1\text{은 상수} \\ c_2\text{는 상수} \end{pmatrix}$$

29.

$2y'' + 4y' + 2y = 0$

$y = y_h + y_p$

$2y_h'' + 4y_h' + 2y_h = 0$

$2y_p'' + 4y_p' + 2y_p = x^2 + x + 1$

$2y_h'' + 4y_h' + 2y_h = 0$

$y_h'' + 2y_h' + y_h = 0$

$y_h = ce^{\lambda x}$

$(\lambda^2 + 2\lambda + 1)e^{\lambda x} = 0$

$\underbrace{(\lambda+1)^2}_{0} e^{\lambda x} = 0$

$\lambda = -1$

$y_{h1} = e^{-x}$

계수 내림법에 의해서

$y_{h2} = xe^{-x}$

$y_h = c_1 e^{-x} + c_2 x e^{-x}$ (c_1, c_2는 상수)

$2y_p'' + 4y_p' + 2y_p = x^2 + x + 1$

$y_p = a_1 x^2 + a_2 x + a_3$ (a_1, a_2, a_3는 상수)

$y_p' = 2a_1 x + a_2$

$y_p'' = 2a_1$

대입

$2 \cdot 2a_1 + 4(2a_1 x + a_2) + 2(a_1 x^2 + a_2 x + a_3) = x^2 + x + 1$

$2a_1 x^2 + (8a_1 + 2a_2)x + 4a_1 + 4a_2 + a_3 = x^2 + x + 1$

$2a_1 = 1 \qquad a_1 = \frac{1}{2}$

$8a_1 + 2a_2 = 1$

$2a_2 = 1 - 8a_1$

$a_2 = \frac{1}{2} - 4a_1$

$= \frac{1}{2} - 2$

$a_2 = -\frac{3}{2}$

$4a_1 + 4a_2 + a_3 = 1$

$a_3 = 1 - 4a_1 - 4a_2$

$= 1 - 4 \cdot \frac{1}{2} - 4(-\frac{3}{2})$

$= 1 - 2 + 6$

$a_3 = 5$

$y_p = \frac{1}{2}x^2 + (-\frac{3}{2})x + 5$

$y = c_1 e^{-x} + c_2 x e^{-x} + \frac{1}{2}x^2 - \frac{3}{2}x + 5$ //

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30.

$2y'' + 4y' + 2y = e^{3x}$

$y = y_h + y_p$ 라 가정

$2(y_h + y_p)'' + 4(y_h + y_p)' + 2(y_h + y_p) = e^{3x}$

$(2y_h'' + 4y_h' + 2y_h) + (2y_p'' + 4y_p' + 2y_p) = e^{3x}$

$2y_h'' + 4y_h' + 2y_h = 0$

$2y_p'' + 4y_p' + 2y_p = e^{3x}$

$2y_h'' + 4y_h' + 2y_h = 0$

$y_h'' + 2y_h' + y_h = 0$

$y_h = ce^{\lambda x}$ (c는 상수) 라 할때

$(\lambda^2 + 2\lambda + 1)e^{\lambda x} = 0$

$(\lambda + 1)^2 = 0$

$\lambda = -1$

$y_{h_1} = c_1 e^{-x}$ → 매개변수법 → $y_{h_2} = c_2 x e^{-x}$

$y_h = c_1 e^{-x} + c_2 x e^{-x}$ (c_1, c_2는 상수)

$2y_p'' + 4y_p' + 2y_p = e^{3x}$

$y_p = Be^{Ax}$ (A는 상수) (B는 상수)

$y_p' = BAe^{Ax}$

$y_p'' = BA^2 e^{Ax}$

$2BA^2 e^{Ax} + 4ABe^{Ax} + 2Be^{Ax} = e^{3x}$

$2B(A^2 + 2A + 1)e^{Ax} = e^{3x}$

$A = 3$

$2B(A^2 + 2A + 1) = 1$

$2B(3+1)^2 = 1$

$2B = \frac{1}{16}$

$B = \frac{1}{32}$

$y_p = \frac{1}{32} e^{3x}$

$y = c_1 e^{-x} + c_2 x e^{-x} + \frac{1}{32} e^{3x}$ //

31.

$x^2y'' + 5xy' + 4y = 0$

$y = x^p$ 라 할때

$y' = px^{p-1}$ $y'' = p^2x^{p-2}$

~~x^2px^{-1}~~

$x^2p^2x^{p-2} + 5xpx^{p-1} + 4x^p = 0$

$(p^2 + 5p + 4)x^p = 0$

$x \neq 0$ 아닌 경우에도 성립 할려면

$p^2 + 5p + 4 = 0$

$(p+4)(p+1) = 0$

$p = -4$ $p = -1$

$y = c_1x^{-4} + c_2x^{-1}$ (c_1, c_2는 상수) //

32.

$y'' + 4y' + 3 = 0$

$y = ce^{\lambda x}$ 라 할때

$(\lambda^2 + 4\lambda + 3)e^{\lambda x} = 0$

$\lambda^2 + 4\lambda + 3 = 0$

$(\lambda + 3)(\lambda + 1) = 0$

$\lambda = -3, -1$

$y = c_1e^{-3x} + c_2e^{-x}$ (c_1, c_2는 상수) //

33.

$y'' + 4y' + 5y = 0$

$y = ce^{\lambda x}$ 라 할때

$(\lambda^2 + 4\lambda + 5)e^{\lambda x} = 0$

$\lambda^2 + 4\lambda + 5 = 0$

$\lambda = -2 \pm \sqrt{2-5}$

$\lambda = -2 \pm 3i$

$y = c_1e^{-2x}e^{3ix} + c_2e^{-2x}e^{-3ix}$

(c_1, c_2는 임의상수)

$y = c_3e^{-2x}\cos 3x + c_4e^{-2x}\sin 3x$ (c_3, c_4는 상수) //

34.

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

$y = ce^{\lambda x}$ (c는 상수) 라 할 때

$(\lambda^2+3\lambda+2)e^{\lambda x} = 0$

$\lambda^2+3\lambda+2=0$

$(\lambda+2)(\lambda+1)=0$

$\lambda=-2 \quad \lambda=-1$

$y = c_1 e^{-x} + c_2 e^{-2x}$ (c_1, c_2는 상수) //

~~35.~~

~~$\mathcal{L}\{1\} = \frac{1}{s}$ //~~

~~36.~~

~~$\mathcal{L}\{t\}$~~

35.

$\mathcal{L}\{1\} = \int_0^\infty 1 e^{-st} dt$

$= \left[-\frac{1}{s} e^{-st} \right]_0^\infty$

$= 0 - \left(-\frac{1}{s}\right)$

$\mathcal{L}\{1\} = \frac{1}{s}$ //

36.

$\mathcal{L}\{t\} = \int_0^\infty t e^{-st} dt$

$fg = f'g + g'f$

$g'f = fg - f'g$

$= \underbrace{\left[-\frac{1}{s} t e^{-st} \right]_0^\infty}_{0} + \int_0^\infty \frac{1}{s} e^{-st} dt$

$= \left[-\frac{1}{s^2} e^{-st} \right]_0^\infty$

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

37.

$\mathcal{L}\{e^{2t}\} = \int_0^\infty e^{2t} e^{-st} dt$

$= \left[\frac{1}{2-s} e^{(2-s)t} \right]_0^\infty$

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

38.

$\mathcal{L}\{c$

$= \int_0^\infty$

$= \frac{1}{2}$

$=$

$=$

$\mathcal{L}\{\cos(\omega$

38.

$$\mathcal{L}\{\cos(\eta t)\} = \int_0^\infty \cos(\eta t)\, e^{-st}\, dt$$

$$= \int_0^\infty \frac{e^{\eta i t} + e^{-\eta i t}}{2}\, e^{-st}\, dt$$

$$= \frac{1}{2}\int_0^\infty e^{(\eta i - s)t}\, dt + \frac{1}{2}\int_0^\infty e^{(-\eta i - s)t}\, dt$$

$$= \frac{1}{2}\left[\frac{1}{\eta i - s} e^{(\eta i - s)t}\right]_0^\infty + \frac{1}{2}\left[\frac{1}{-\eta i - s} e^{(-\eta i - s)t}\right]_0^\infty$$

$$= \frac{1}{2}\,\frac{1}{s - \eta i} + \frac{1}{2}\,\frac{1}{s + \eta i}$$

$$= \frac{1}{2}\,\frac{s + \eta i + s - \eta i}{s^2 + \eta^2}$$

$$\mathcal{L}\{\cos(\eta t)\} = \frac{s}{s^2 + 49}$$

//

39.

$$\mathcal{L}\{\sin(2t)\} = \int_0^\infty \sin(2t) e^{-st}\,dt$$

	U	V'
=	$\sin(2t)$	e^{-st}
	$2\cos(2t)$	$-\frac{1}{s}e^{-st}$
	$-4\sin(2t)$	$+\frac{1}{s^2}e^{-st}$

$$\int_0^\infty \sin(2t) e^{-st}\,dt = \left[-\frac{1}{s}e^{-st}\sin(2t) - \frac{2}{s^2}e^{-st}\cos(2t)\right]_0^\infty - \int_0^\infty 4\sin(2t)\frac{1}{s^2}e^{-st}\,dt$$

$$\frac{s^2+4}{s^2}\int_0^\infty \sin(2t)e^{-st}\,dt = \frac{2}{s^2}$$

$$\int_0^\infty \sin(2t)\,e^{-st}\,dt = \frac{2}{s^2+4}$$

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

//

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41.

$f(x) = e^x$

$$f(x) = f(0) + \sum_{n=1}^{\infty} \frac{f^{(n)}(0)}{n!} x^n$$

$$f(x) = 1 + \sum_{n=1}^{\infty} \frac{1}{n!} x^n$$

42.

함수는 무한번 미분 가능 해야 한다.

43

$y'' + 3y' + 2y = 0 \quad y(0) = 1 \quad y'(0) = 1$

$$s(sY(s) - y(0)) - y'(0) + 3(sY(s) - y(0)) + 2Y(s) = 0$$

$$(s^2 + 3s + 2)Y(s) = sy(0) + y'(0) + 3y(0)$$

$$Y(s) = \frac{s+1+3}{s^2+3s+2} = \frac{s+4}{s^2+3s+2}$$

$$Y(s) = \frac{s+4}{(s+2)(s+1)}$$

$$Y(s) = \frac{3}{s+1} - \frac{2}{s+2}$$

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

44.

$y' + 4y = 3 \quad y(0) = 1$

$$sY(s) - y(0) + 4Y(s) = 3$$

$$(s+4)Y(s) = 4$$

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

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

45.

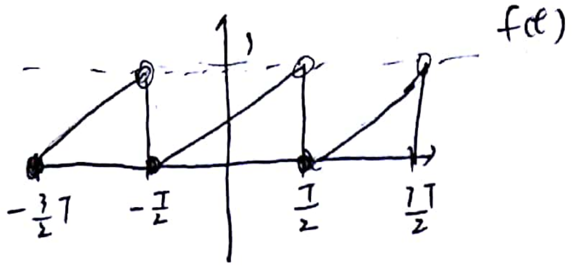
$$\mathcal{L}\{f(t)\} = e^{-3s} \cdot 9 \cdot \frac{s}{s^2+3}$$

$$F(s) = 9e^{-3s} \frac{s}{s^2+3}$$

$$f(t) = 9\cos(3(t-3))$$

$$f(t) = 9\cos(3t-9)$$

4 b



$$f(t) = \frac{1}{T}\left(t - \frac{2n-1}{2}T\right) \quad \underbrace{\left(\frac{(2n-1)T}{2} \leq t < \frac{(2n+1)T}{2}\right)}_{구간} \quad n 은 정수$$

$$f(x) = a_0 + \sum_{n=1}^{\infty} a_n \cos\left(\frac{2n\pi}{T}x\right) + b_n \sin\left(\frac{2n\pi}{T}x\right)$$

$$f(t) = \frac{1}{T}t + \frac{1}{2} \quad -\frac{T}{2} \leq t < \frac{T}{2} \quad 일부구간$$

$$a_0 = \frac{1}{T}\int_{-\frac{T}{2}}^{\frac{T}{2}} f(t)\,dt$$

$$= \frac{1}{T}\int_{-\frac{T}{2}}^{\frac{T}{2}} \left(\frac{1}{T}t + \frac{1}{2}\right)dt$$

$$= \frac{1}{T}\left[\frac{1}{2T}t^2 + \frac{1}{2}t\right]_{-\frac{T}{2}}^{\frac{T}{2}}$$

$$= \frac{1}{\cancel{T}}\,\frac{1}{2}\cancel{T}$$

$$a_0 = \frac{1}{2}$$

$$b_n = \frac{2}{T}\int_{-\frac{T}{2}}^{\frac{T}{2}} f(t)\sin\left(\frac{2n\pi}{T}t\right)dt$$

$$= \frac{2}{T}\int_{-\frac{T}{2}}^{\frac{T}{2}} \left(\frac{1}{T}t + \frac{1}{2}\right)\sin\left(\frac{2n\pi}{T}t\right)dt$$

$$= \frac{2}{T}\int_{-\frac{T}{2}}^{\frac{T}{2}} \frac{1}{T}t\sin\left(\frac{2n\pi}{T}t\right)dt + \frac{1}{T}\int_{-\frac{T}{2}}^{\frac{T}{2}} \sin\left(\frac{2n\pi}{T}t\right)dt$$

u $\quad v'$

$t \quad \sin\left(\frac{2n\pi}{T}t\right)$

$1 \quad -\frac{T}{2n\pi}\cos\left(\frac{2n\pi}{T}t\right)$

$0 \quad -\left(\frac{T}{2n\pi}\right)^2\sin\left(\frac{2n\pi}{T}t\right)$

$$b_n = \frac{2}{T^2}\left[\frac{-T}{2n\pi}t\cos\left(\frac{2n\pi}{T}t\right) + \frac{T^2}{4n^2\pi^2}\sin\left(\frac{2n\pi}{T}t\right)\right]_{-\frac{T}{2}}^{\frac{T}{2}} + \frac{1}{T}\left[-\frac{T}{2n\pi}\cos\left(\frac{2n\pi}{T}\right)\right]_{-\frac{T}{2}}^{\frac{T}{2}}$$

$$= \frac{2}{T^2}\left[\frac{-T}{2n\pi}\frac{T}{2}\cos(n\pi) - \frac{T}{2n\pi}\frac{T}{2}\cos(n\pi)\right]$$

$$= \frac{2}{T^2}\ \frac{-T^2}{4n\pi}\cos(n\pi)$$

$$b_n = \frac{-1}{2n\pi}\cos(n\pi) = \frac{-(-1)^n}{2n\pi}$$

$$a_n = \frac{2}{T}\int_{-\frac{T}{2}}^{\frac{T}{2}} f(t)\cos\left(\frac{2n\pi}{T}t\right)dt = \frac{2}{T}\int_{-\frac{T}{2}}^{\frac{T}{2}}\left(\frac{1}{T}t+\frac{1}{2}\right)\cos\left(\frac{2n\pi}{T}t\right)dt$$

$$= \frac{2}{T}\int_{-\frac{T}{2}}^{\frac{T}{2}}\frac{1}{T}t\cos\left(\frac{2n\pi}{T}t\right)dt + \frac{1}{T}\int_{-\frac{T}{2}}^{\frac{T}{2}}\cos\left(\frac{2n\pi}{T}t\right)dt$$

$$= \frac{2}{T^2}\int_{-\frac{T}{2}}^{\frac{T}{2}} t\cos\left(\frac{2n\pi}{T}t\right)dt$$

u	v
t	$\cos\left(\frac{2n\pi}{T}t\right)$
1	$+\ \frac{T}{2n\pi}\sin\left(\frac{2n\pi}{T}t\right)$
0	$-\left(\frac{T}{2n\pi}\right)^2\cos\left(\frac{2n\pi}{T}t\right)$

$$= \frac{2}{T^2}\left[-\frac{T}{2n\pi}t\sin\left(\frac{2n\pi}{T}t\right) - \left(\frac{T}{2n\pi}\right)^2\cos\left(\frac{2n\pi}{T}t\right)\right]_{-\frac{T}{2}}^{\frac{T}{2}}$$

$$= \frac{2}{T^2}\left[-\frac{T^2}{4n\pi}\sin(n\pi) + \frac{T^2}{4n\pi}\sin(n\pi)\right]$$

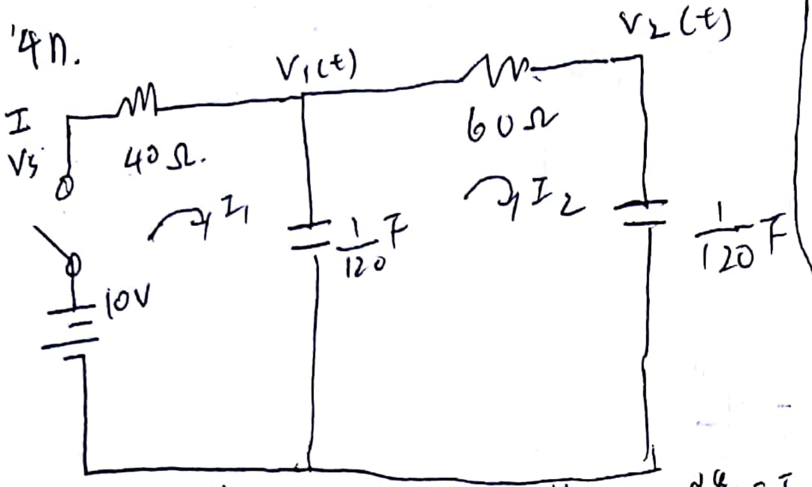
$$a_n = 0$$

$$\cancel{f(t) = a_0 + \sum_{n=1}^{\infty}}$$

$$f(t) = \frac{1}{2} + \sum_{n=1}^{\infty}\frac{-(-1)^n}{2n\pi}\sin\left(\frac{2n\pi}{T}t\right)$$

//

'4 n.



$I(t) = I_1(t)$ $\quad \frac{dq_1(t)}{dt} = I(t)$ $\quad \frac{dq_1}{dt} = I_1$ $\quad \frac{dq_2}{dt} = I_2$

$V_s(t) = 40 I_1(t) + 120\int I_1(t)\,dt - 120\int I_2(t)\,dt$

$$V_s(t) = 40\frac{dq_1(t)}{dt} + 120 q_1(t) - 120 q_2(t)$$

$$0 = 240 q_2(t) - 120 q_1(t) + 60\frac{dq_2(t)}{dt}$$

~~$q_1(t) = 120 q_2(t)$~~

$$q_1(t) = 2q_2(t) + \frac{1}{2}\frac{dq_2(t)}{dt}$$

i) 닫혀있을때 $q_1(0) = 0$ $\quad q_2(0) = 0$

$q = q_1$

$10 = 40 q_1' + 120 q_1 - 120 q_2$

~~라플라스~~

$q_1 = 2q_2 + \frac{1}{2} q_2'$

라플라스 변환

$$\frac{10}{s} = 40 s(Q_1 - q_1(0)) + 120 Q_1 - 120 Q_2$$

$$\frac{10}{s} = 40(s+3)Q_1 - 120 Q_2$$

$$Q_1 = 2Q_2 + \frac{1}{2} s Q_2 - \frac{1}{2} q_2(0)$$

$$Q_1 = 2Q_2 + \frac{1}{2} s Q_2$$

$$Q_2 = \frac{2}{s+4} Q_1$$

$$\frac{10}{s} = 40(s+3)Q_1 - \frac{240}{s+4} Q_1$$

$$\frac{40(s+3)(s+4) - 240}{s+4} Q_1 = \frac{10}{s}$$

$$Q_1 = \frac{10s + 40}{s(40s^2 + 280s + 480 - 240)}$$

$$Q_1 = \frac{10}{40}\,\frac{s+4}{s(s^2 + 7s + 6)}$$

$$= \frac{1}{4}\,\frac{s+4}{s(s+1)(s+6)}$$

$$= \frac{1}{4}\left(\frac{\frac{2}{3}}{s} + \frac{-\frac{3}{5}}{s+1} + \frac{-\frac{1}{15}}{s+6}\right)$$

~~$= \frac{1}{12}\frac{1}{s} - \frac{3}{20}\frac{1}{s+1} - \frac{1}{15}\frac{1}{s+6}$~~

$$= \frac{2}{12}\frac{1}{s} - \frac{3}{20}\frac{1}{s+1} - \frac{1}{60}\frac{1}{s+6}$$

$$q_1(t) = \frac{2}{12} - \frac{3}{20}e^{-t} - \frac{1}{60}e^{-6t}$$

$$\boxed{q_1(t) = \frac{1}{6} - \frac{3}{20}e^{-t} - \frac{1}{60}e^{-6t}}$$

ii)

$q_2(t$

Q_2

ii)

~~$q_2(t)$~~

$$Q_2 = \frac{2}{s+4}\cdot\frac{1}{4\cdot 2}\frac{s+4}{s(s+1)(s+6)}$$

$$= \frac{1}{2}\left(\frac{\frac{1}{6}}{s}+\frac{-\frac{1}{5}}{s+1}+\frac{\frac{1}{30}}{s+6}\right)$$

$$= \frac{1}{12}\frac{1}{s}-\frac{1}{10}\frac{1}{s+1}+\frac{1}{30}\frac{1}{s+6}$$

~~$q_2(t) = \frac{1}{11} - \frac{1}{10}\frac{1}{s+1} + \frac{1}{30}\frac{1}{s+6}$~~

$$\boxed{q_2(t) = \frac{1}{12} - \frac{1}{10}e^{-t} + \frac{1}{60}e^{-6t}}$$ //

~~$I(t)$~~ =

열려있다 닫혔을때

$$\boxed{\begin{aligned} I_1(t) &= \frac{3}{20}e^{-t} + \frac{1}{10}e^{-6t}\ [A] \\ I_2(t) &= \frac{1}{10}e^{-t} - \frac{1}{10}e^{-6t}\ [A] \end{aligned}}$$ //

iii) 충분한 시간 동안 닫혀있다. 열렸을때

$q_1(0) = \frac{1}{6}$ $q_2(0) = \frac{1}{12}$

$$0 = 40q_1' + 120q_1 - 120q_2$$

~~$40(s+3)Q_1$~~

$$0 = 40sQ_1 - 40q_1(0) - 120Q_2 + 120Q_1$$

$$40\cdot\frac{1}{6} = 40(s+3)Q_1 - 120Q_2$$

$$0 = 240q_2(t) - 120q_1(t) + 60\frac{dq_2(t)}{dt}$$

$$0 = 240Q_2 - 120Q_1 + 60(sQ_2 - q_2(0))$$

~~$0 = (60s+240)Q_2$~~

$$120Q_1 + 60q_2(0) = 60(s+4)Q_2$$

$$Q_2 = \frac{2Q_1 + \frac{1}{12}}{s+4}$$

$$\frac{40}{6} = 40(s+3)Q_1 - 120\frac{(2Q_1+\frac{1}{12})}{s+4}$$

~~$1 = 6(s$~~

$$1 = (6s+18)Q_1 - \frac{36Q_1}{s+4} - \frac{\frac{3}{2}}{s+4}$$

$$s+4 = 6(s+3)(s+4)Q_1 - 36Q_1 - \frac{3}{2}$$

$$s+\frac{5}{2} = (6s^2+48s+72-36)Q_1$$

$$Q_1 = \frac{1}{6}\frac{s+\frac{5}{2}}{(s+6)(s+1)}$$

$$Q_1 = \frac{3}{12}\frac{1}{s+1} - \frac{1}{12}\cdot\frac{1}{(s+6)}$$

~~$q_1(t) = \frac{31}{2}e^{-t} - \frac{44}{15}e^{-6t}$~~

ii) 충분한 시간동안 닫혀있다 열렸을때

$q_1(0) = \frac{1}{6}$ $q_2(0) = \frac{1}{12}$

$0 = 40q_1' + 120q_1 - 120q_2$

$\cancel{0 = 240q}$

$0 = 40sQ_1 - 40q_1(0) + 120Q_1 - 120Q_2$

$0 = 240q_2 - 120q_1 + 60q_2'$

$= 240Q_2 - 120Q_1 + 60sQ_2 - 60q_2(0)$

$60(s+4)Q_2 = 120Q_1 + 60q_2(0)$

$Q_2 = \frac{2}{s+4}Q_1 + \frac{\frac{1}{12}}{s+4}$

$0 = 40sQ_1 - \frac{40}{6} + 120Q_1 - \frac{240}{s+4}Q_1 - \frac{10}{s+4}$

$\frac{40}{6} + \frac{10}{s+4} = 40(s+3)Q_1 - \frac{240}{s+4}Q_1$

$40(s+4) + 60 = 240(s+3)(s+4)Q_1 - 1440Q_1$

$2s + 8 + 3 = (12s^2 + 84s + 144 - 72)Q_1$

$Q_1 = \frac{2(s+\frac{11}{2})}{12(s+1)(s+6)}$

$Q_1 = \frac{6}{40}\frac{1}{s+1} + \frac{2}{120}\frac{1}{s+6}$

$Q_1 = \frac{3}{20}\frac{1}{s+1} + \frac{1}{60}\frac{1}{s+6}$

$q_1(t) = \frac{3}{20}e^{-t} + \frac{1}{60}e^{-6t}$

$Q_2 = \frac{3}{20}\frac{2}{(s+1)(s+4)} + \frac{\frac{1}{12}}{s+4} + \frac{1}{60}\frac{1}{(s+4)(s+6)}$

$= \frac{1}{10}\frac{1}{s+1} - \frac{1}{10}\frac{1}{s+4} + \frac{1}{12}\frac{1}{s+4} + \frac{1}{120}\frac{1}{s+4} - \frac{1}{120}\frac{1}{s+6}$

$Q_2 = \frac{1}{10}\frac{1}{s+1} - \frac{1}{120}\frac{1}{s+4} - \frac{1}{120}\frac{1}{s+6}$

$q_2(t) = \frac{1}{10}e^{-t} - \frac{1}{120}e^{-4t} - \frac{1}{120}e^{-6t}$

$I_1 = \frac{dq_1}{dt}$ $I_2 = \frac{dq_2}{dt}$

충분한시간 동안 닫혀 있다. 열렸을때

$I_1(t) = -\frac{3}{20}e^{-t} - \frac{1}{10}e^{-6t}$ [A]

$I_2(t) = -\frac{1}{10}e^{-t} + \frac{1}{30}e^{-4t} + \frac{1}{20}e^{-6t}$ [A]

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48.

$V(t) = \frac{1}{C} q(t)$

$V_1(t) = \frac{1}{C_1} q_1(t)$ $\quad V_2(t) = \frac{1}{C_2} q_2(t)$

$\cancel{= \frac{1}{120}}$

$\cancel{V_1(t) = 120}$

i) 열려있다가 닫혔을 때

$V_1(t) = 120\left(\frac{1}{6} - \frac{3}{20}e^{-t} - \frac{1}{60}e^{-6t}\right)$

$\boxed{V_1(t) = 20 - 18e^{-t} - 2e^{-6t} \, [V]}$

$V_2(t) = 120\left(\frac{1}{12}\right.$

48.

$V(t) = \frac{q(t)}{C}$

i) 열려있다 닫혔을 때

$V_1(t) = \frac{1}{C_1}(q_1 - q_2)$

$= 120\left(\frac{1}{6} - \frac{3}{20}e^{-t} - \frac{1}{60}e^{-6t} - \frac{1}{12} + \frac{1}{10}e^{-t} - \frac{1}{60}e^{-6t}\right)$

$= 120\left(\frac{1}{12} - \frac{1}{20}e^{-t} - \frac{1}{30}e^{-6t}\right)$

$V_1(t) = 10 - 6e^{-t} - 4e^{-6t} \, [V]$

$V_2(t) = \frac{q_2(t)}{C_2}$

$= 120\left(\frac{1}{12} - \frac{1}{10}e^{-t} + \frac{1}{60}e^{-6t}\right)$

$V_2(t) = 10 - 12e^{-t} + 2e^{-6t} \, [V]$

열려 있다. 닫혔을 때

$V_{C_1}(t) = 10 - 6e^{-t} - 4e^{-6t} \, [V]$

$V_{C_2}(t) = 10 - 12e^{-t} + 2e^{-6t} \, [V]$

ii) 닫혀있다 열렸을때

$$v_1(t) = \frac{1}{C_1}(q_1 - q_2)$$

$$= 120\left(\overset{18}{\frac{3}{20}} e^{-t} + \overset{2}{\frac{1}{60}} e^{-6t} - \overset{12}{\frac{1}{10}} e^{-t} + \overset{1}{\frac{1}{120}} e^{-4t} + \frac{1}{120} e^{-6t}\right)$$

$$v_1(t) = 6e^{-t} + e^{-4t} + 3e^{-6t} \ [V]$$

$$v_2(t) = \frac{1}{C_2} q_2$$

$$= 120\left(\frac{1}{10} e^{-t} - \frac{1}{120} e^{-4t} - \frac{1}{120} e^{-6t}\right)$$

$$v_2(t) = 12e^{-t} - e^{-4t} - e^{-6t} \ [V]$$

~~충분히 닫혀있다가 열렸을때~~

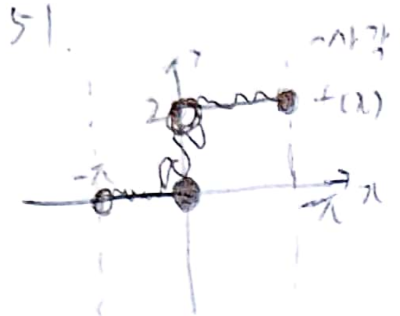
$\cancel{v_{C_1}(t) = 10} - 6$

충분히 닫혀 있다가 열렸을때

$$\boxed{\begin{aligned} v_1(t) &= 6e^{-t} + e^{-4t} + 3e^{-6t} \ [V] \\ v_2(t) &= 12e^{-t} - e^{-4t} - e^{-6t} \ [V] \end{aligned}}$$

//

51.



$$f(x)=\begin{cases} 0 & -\pi\le x<0 \\ 2 & 0\le x<\pi \end{cases}$$

$T=2\pi$

푸리에

$$f(x)=a_0+\sum_{n=1}^{\infty} a_n\cos\left(\frac{2n\pi}{T}x\right)+b_n\sin\left(\frac{2n\pi}{T}x\right)$$

$T=$ 주기

$$a_0=\frac{1}{T}\int_{-\frac{T}{2}}^{\frac{T}{2}} f(x)\,dx$$

$$=\frac{1}{2\pi}\int_{-\pi}^{\pi} f(x)\,dx$$

$$=\frac{1}{2\pi}\int_0^{\pi} f(x)\,dx+\underbrace{\frac{1}{2\pi}\int_{-\pi}^{0} f(x)\,dx}_{0}$$

$$=\frac{1}{2\pi}\int_0^{\pi} 2\,dx$$

$$=\frac{1}{2\pi}\left[2x\right]_0^{\pi}$$

$$=\frac{2\pi}{2\pi}$$

$$a_0=1$$

$$a_n=\frac{2}{T}\int_{-\frac{T}{2}}^{\frac{T}{2}} f(x)\cos\left(\frac{2n\pi}{T}x\right)dx$$

$$=\frac{2}{2\pi}\int_{-\pi}^{\pi} f(x)\cos\left(\frac{2n\pi}{2\pi}x\right)dx$$

$$=\frac{1}{\pi}\int_0^{\pi} 2\cos(nx)\,dx$$

$$\cancel{=\frac{1}{\pi}\left[\frac{2}{n\pi}\sin(n\pi x)\right]}$$

$$=\frac{1}{\pi}\left[\frac{2}{n}\sin(nx)\right]_0^{\pi}$$

$$a_n=0$$

$$b_n=\frac{2}{T}\int_{-\frac{T}{2}}^{\frac{T}{2}} f(x)\sin\left(\frac{2n\pi}{T}x\right)dx$$

$$=\frac{1}{\pi}\int_{-\pi}^{\pi} f(x)\sin(nx)\,dx$$

$$=\frac{1}{\pi}\int_0^{\pi} 2\sin(nx)\,dx$$

$$=\frac{1}{\pi}\left[-\frac{2}{n}\cos(nx)\right]_0^{\pi}$$

$$b_n=\frac{1}{\pi}\left(\frac{2}{n}-\frac{2}{n}\cos(n\pi)\right)=\frac{2}{n\pi}(1-\cos(n\pi))$$

$$f(x)=1+\sum_{n=1}^{\infty}\frac{2}{n\pi}(1-\cos(n\pi))\sin(nx)$$