Q #4

$$4y'' + 4y' + 17y = 0 \qquad y(0) = 1, \quad y'(0) = 2$$

$$4\frac{d^2}{dx^2}y + 4\frac{d}{dx}y + 17y = 0$$

$$\left(4\frac{d^2}{dx^2} + 4\frac{d}{dx} + 17\right)y = 0$$

$$4\frac{d^2}{dx^2} + 4\frac{d}{dx} + 17 = 0$$

let $\quad m = \frac{d}{dx}$

$$4m^2 + 4m + 17 = 0$$

For Quadratic formula $\left[a=4, \; b=4, \; c=17\right]$

$$m = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$m = \frac{-4 \pm \sqrt{16 - 272}}{8}$$

$$m = \frac{-4 \pm 16i}{8}$$

$$m = -\frac{1}{2} \pm 2i$$

$$y_c = e^{(-1/2)x}\left[c_1 \cos(2)x + c_2 \sin(2)x\right]$$

$$y_c = e^{-x/2}\left[c_1 \cos 2x + c_2 \sin 2x\right]$$

$y(0) = 1$ $\quad [x = 0 \;, \; y = 1]$

$$y = e^{-x/2}\left[c_1 \cos 2x + c_2 \sin 2x\right]$$

$$1 = e^{-(0)/2}\left[c_1 \cos 2(0) + c_2 \sin 2(0)\right]$$

$$1 = 1\left[c_1 \cos 0 + c_2 \sin (0)\right]$$

$$1 = c_1(1) + 0$$

$$\boxed{c_1 = 1}$$

$y'(0) = 2$

$\frac{d}{dx}$ for $\left\{ y = e^{-x/2}\left[c_1 \cos 2x + c_2 \sin 2x\right] \right.$

$\boxed{c_1 = 1}$ Product Rule

$$y' = e^{-x/2}\left[-2\sin 2x + 2c_2 \cos 2x\right] + \left(\cos 2x + c_2 \sin 2x\right] e^{-x/2}\left(\frac{-1}{2}\right)$$

$$2 = e^{0}\left[-2\sin 2(0) + 2c_2 \cos 2(0)\right] + \left\{\cos 2(0) + c_2 \sin 2(0)\right] e^{0}\left(-\frac{1}{2}\right)$$

$$2 = 1\left[-2\sin(0) + 2c_2 \cos(0)\right] + \left[\cos(0) + c_2 \sin(0)\right](1)\left(-\frac{1}{2}\right)$$

$$2 = 0 + 2c_2(1) + \left[1 + 0\right]\left(-\frac{1}{2}\right)$$

$$2 + \frac{1}{2} = 2c_2$$

$$5/2 = 2c_2 \qquad c_2 = 5/4$$

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$$y = e^{-x/2}\left[c_1 \cos 2x + c_2 \sin 2x\right]$$

$$y = e^{-x/2}\left[(1)\cos 2x + \frac{5}{4}\sin 2x\right]$$

$$y = e^{-x/2}\left[\cos 2x + \frac{5}{4}\sin 2x\right]$$