5.2

The general solution is: $y(t) = C_1 \cos\omega t + C_2 \sin\omega t + (E/B)t + C_3$

$$z(t) = C_2\cos\omega t - C_1 \sin\omega t + C_4$$

$$\dot{y}(t) = -\omega C_1 \sin\omega t + \omega C_2 \cos(\omega t) + E/B$$

$$\dot{z}(t) = -\omega C_1 \cos\omega t - \omega C_2 \sin\omega t$$

The IC's are

$y(0) = z(0) = 0$

$\Rightarrow y(0) = C_1 + C_3 = 0$

$z(0) = C_2 + C_4 = 0$

and $\dot{y}(0) = \dot{y}_0$; $\dot{z}(0) = \dot{z}_0$

$\Rightarrow \dot{y}(0) = -\omega C_2 + E/B = \dot{y}_0$

$\dot{z}(0) = -\omega C_1 = \dot{z}_0$

a) $y_0 = E/B$, $z_0 = 0$.

$\Rightarrow -\omega C_2 + E/B = E/B \Rightarrow C_2 = 0$ b/c $\omega \neq 0$

$\Rightarrow C_4 = 0$

$\dot{z}(0) = -\omega C_1 = 0 \Rightarrow C_1 = 0$

$\Rightarrow C_3 = 0$

$\Rightarrow y(t) = \left(\frac{E}{B}\right)t \qquad z(t) = 0$

b) $\dot{y}_0 = \frac{E}{2B}$, $\dot{z}_0 = 0$

$\dot{z}_0 = -\omega C_1 \Rightarrow C_1 = 0 \Rightarrow C_3 = 0$

$\dot{y}_0 = -\omega C_2 + \frac{E}{B} = \frac{E}{2B} \Rightarrow C_2 = \frac{E}{2B\omega}$

$\Rightarrow C_4 = -\frac{E}{2B\omega}$

$$y(t) = \frac{E}{2B\omega}\sin\omega t + \left(\frac{E}{B}\right)t \; ; \; z(t) = \frac{E}{2B\omega}\left(\cos\omega t + 1\right)$$

c) $\dot{y}_0 = \frac{E}{B}$; $\dot{z}_0 = \frac{E}{B}$

$\Rightarrow C_1 = -\frac{E}{B\omega}$; $C_2 = 0$; $C_2 = -C_4 \Rightarrow C_4 = 0$

$\Rightarrow C_3 = -C_1 = \frac{E}{B\omega}$

$$\Rightarrow \begin{cases} y(t) = \frac{-E}{B\omega}\cos\omega t + \left(\frac{E}{B}\right)t + \frac{E}{B\omega} \\ z(t) = \frac{E}{B\omega}\sin\omega t \end{cases}$$