Q8

$$x(n) = \alpha e^{j\omega_0 n} + \beta e^{j\omega_1 n} + \gamma e^{j\omega_2 n}$$

for $x(n) * h(n) = 0$

The $H(\omega) = 0$ for $\omega = \omega_0, \omega_1$ and ω_2

as

$$\alpha e^{j\omega_0 n} \longrightarrow H(\omega_0)\, \alpha e^{j\omega_0 n}$$

$$\beta e^{j\omega_1 n} \longrightarrow H(\omega_1)\, \beta e^{j\omega_1 n}$$

$$\gamma e^{j\omega_2 n} \longrightarrow H(\omega_2)\, \gamma e^{j\omega_2 n}$$

Now for getting the minimal length of $h(n)$

(I have assumed that the question asks about minimal length as in general, the length of $h(n)$ could be anything, not affected by only 3 points)

We take $H(\omega) = 1$ for $\omega \neq \omega_0, \omega_1, \omega_2$

$= 0$ for $\omega = \omega_0, \omega_1, \omega_2$

This is done because the IDTFT of $H(\omega) = 1$ is $\delta(n)$

Also the IDTFT of this $H(\omega) = \frac{1}{2\pi} \int_{-\pi}^{\pi} H(\omega) e^{j\omega n} d\omega$

(3 points → will not affect the integral)

$$= \frac{e^{jn\pi} - e^{-jn\pi}}{2\pi} = 0 \text{ for } n \neq 0$$

$$= \frac{2\pi}{2\pi} = 1 \quad \text{for } n = 0$$

So the minimal length of the $h(n)$ is 1 as $\delta(n) = 1$ only at $n = 0$ and is 0 elsewhere

The corresponding $H(\omega)$ is →