3 a) $G(s) = \dfrac{2(s+2)}{s^2+2s-3} e^{-s}$.

NEW QUESTION (updated)

$$\Rightarrow G_{approx}(s) = \frac{2(s+2)}{s^2+2s-3} \cdot \frac{\left(1-\frac{s}{2}\right)}{\left(1+\frac{s}{2}\right)}$$

$$= \frac{2(2-s)}{s^2+2s-3}.$$

$$C.E = 1 + G_c G_p = 0$$

$$\Rightarrow 1 + K_c \frac{2(2-s)}{(s^2+2s-3)} = 0$$

-0.2 is a root!

$$\Rightarrow K_c = \frac{-\left[(-0.2)^2 + 2(-0.2) - 3\right]}{2(2+0.2)}$$

$$\Rightarrow G_{c1} = 0.76364$$

3 c) 2nd order approx: $L = \dfrac{2(s+2)\left(1-\frac{s}{2}+\frac{s^2}{8}\right)}{(s^2+2s-3)\left(1+\frac{s}{2}+\frac{s^2}{8}\right)}$

$$\Rightarrow L = \frac{64s^3 - 128s^2 + 1024}{32s^4 + 192s^3 + 416s^2 + 128s - 768}$$

Using rltool, the value of K_c for which the dominant poles has real part -0.2 is 0.7878.

Dominant poles : $-0.2 + 0.37j$