b) $9.81 \cdot K_d = 2.79$

$$2.79 \cdot 0.7 = 1.953$$

In RLTool, I placed the poles such that the gain dropped to 1.9472, and readjusted the zero so that even at 70% gain, the poles are still placed so they satisfy the damping factor requirement. K_d remains the same, but K_p changes

$$\frac{K_p}{0.284} = 0.9801 \qquad K_d = 0.284$$
$$K_p = 0.278$$

c) In the simulink model, for $K_i = 0$, $K_d = 0.284$ and $K_p = 0.278$, $e_x = 0.36$ and $e_y = 0$ for any constant x and y references.

d)
$$\frac{E(s)}{d_x(s)} = \frac{9.81 \cdot \frac{1}{s^2}}{1 + 9.81\left(K_p + \frac{K_i}{s} + sK_d\right)\frac{1}{s^2}} = \frac{9.81\,s}{s^3 + 9.81K_d s^2 + 9.81K_p s + 9.81K_i}$$

for $d_x(s) = \frac{1}{s}$ (unit step) for $K_i = 0$

$$E(t=\infty) = \lim_{s \to 0} \cancel{s} \cdot \frac{9.81}{s^2 + 9.81K_d s + 9.81K_p} \frac{1}{\cancel{s}}$$
$$= \frac{1}{K_p}$$

for $K_i \neq 0$

$$E(t=\infty) = \lim_{s \to 0} \cancel{s} \cdot \frac{9.81\,s}{s^3 + 9.81K_d s^2 + 9.81K_p s + K_i} \cdot \frac{1}{\cancel{s}}$$
$$= 0 \quad \checkmark$$

$K_i \neq 0$ does eliminate the impact of d_x / d_y, and causes the errors to go to zero. graphs are for $K_i = 0.1$, and $x_{ref}, y_{ref} = 0$