

**Name:**

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Answer the following questions:

1. The equilibrium of dynamical systems exist when the derivative of individual states is equal to zero. Assuming that  $\alpha, \beta, \delta$  and  $\gamma$  are all positive constants, find the equilibrium of the prey-predator model:

$$\dot{x}(t) = \alpha x(t) - \beta x(t)y(t)$$

$$\dot{y}(t) = \delta x(t)y(t) - \gamma y(t).$$

2. Find the transfer function  $Y(s)/R(s)$  for the following active suspension system, given that the initial conditions are all zero.

$$\begin{aligned}m_1\ddot{x}(t) &= k_s(y(t) - x(t)) + b(\dot{y}(t) - \dot{x}(t)) - k_w(x(t) - r(t)) \\m_2\ddot{y}(t) &= -k_s(y(t) - x(t)) - b(\dot{y}(t) - \dot{x}(t))\end{aligned}$$