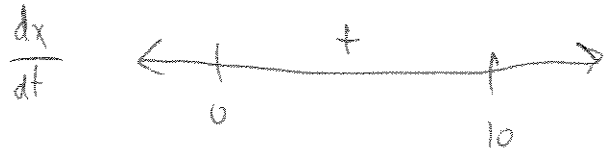
Bioeconomics Key

1. $\frac{dx}{dt} = rx - \frac{rx^2}{K} = rx\left(1 - \frac{x}{K}\right)$

$\frac{dx}{dt} = 0$ at $x = 0$, $x = K$.



(direct verification that $\frac{dx}{dt} > 0$ w/ $r = 0.1$, $K = 10$.

2. $\frac{dx}{dt} = rx - \frac{rx^2}{K} - qEx$

$\frac{dx}{dt} = 0$, $x\left(r - \frac{rx}{K} - qE\right) = 0$.

so $x = 0$ or $x = \frac{K(r - qE)}{r}$ (solve for x in second factor)

Yield: $pqxE = \frac{pq}{r} \cdot K(r - qE)E$

3. a. Solve

$$0 = 0.1x - \frac{0.1x^2}{10} - 0.5Ex$$

$$0 = 2(0.5)Ex - 0.2E$$

$x^* = 0$	$x^* = 10$	$x^* = 0.2$
$E^* = 0$	$E^* = 10$	$E^* = 0.196$

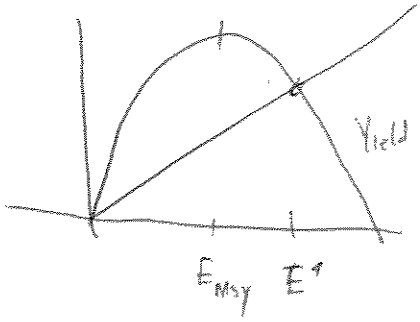
b. E_{MSY}:

$Y = \text{Yield} = \frac{qK}{r}(rE - qE^2)$

$Y = \frac{0.5 \cdot 10}{0.1}(0.1E - 0.5E^2)$

$Y' = 50(0.1 - E_{MSY})$

$E_{MSY} = 0.1$



c. So yes, H is being depleted because $E^* > E_{MSY}$

I would increase c, the cost it takes to utilize resource (increase user fees)

d. Increasing K would not decrease E^* (try K=20 and see what happens to E^*) Increasing the carrying capacity makes the resource "better", so more people want to fish it and Effort increases