

10.

Equilibrium points are computed

correctly : $N=0$, $N=1000-500h$.Stability

$$g(N) = 2N \left(1 - \frac{N}{1000} \right) - hN$$

$$= 2N - \frac{2N^2}{1000} - hN$$

$$\therefore g'(N) = 2 - \frac{N}{250} - h$$

At $N=0$,

$$g'(0) = 2 - \frac{(0)}{250} - h = 2-h$$

$$\text{If } h > 2, \text{ then } 2-h < 0$$

 $\Rightarrow$ locally stable equilibrium

$$\text{If } h < 2, \text{ then } 2-h > 0$$

 $\Rightarrow$ unstable equilibrium

Interpretation : If $h > 2$, then 0 is a stable equilibrium, which means a slight increase in population will decrease back to 0. If $h < 2$, then the population keeps growing if increased a little because 0 is an unstable equilibrium.

$$\text{At } N = 1000 - 500h$$

$$g'(N) = 2 - \left(\frac{1000 - 500h}{250} \right) - h$$

$$= 2 - (4 - 2h) - h$$

$$= -2 + h$$

~~Now~~ Now, if $h > 2$, then $-2 + h > 0$

$\Rightarrow$ unstable equilibrium

if $h < 2$, then $-2 + h < 0$

$\Rightarrow$ locally stable equilibrium