# 1.2.4 Quiz: Interpreting Models

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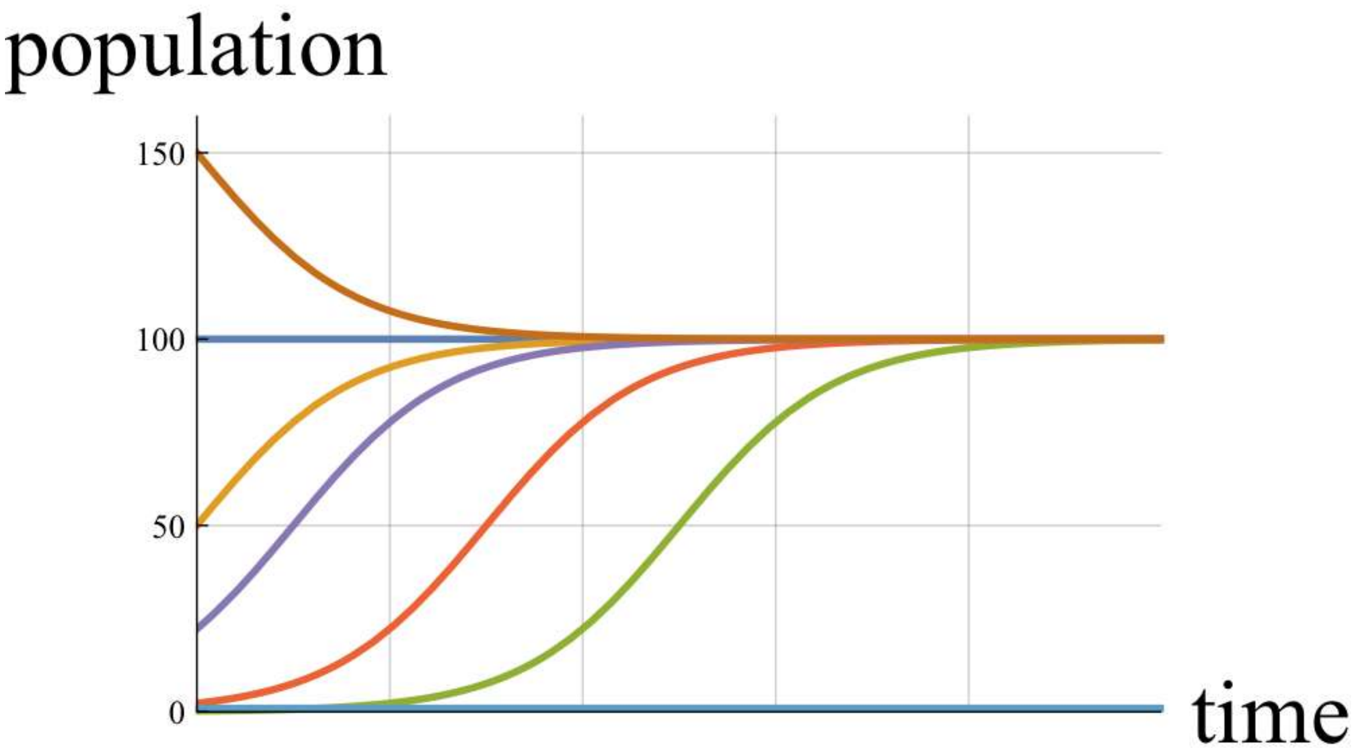


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## Question 1

1/1 point (graded)

Looking at the qualitative analysis plot above, we see there are different possible outcomes for the fish population, depending on the initial population. However, there are certain outcomes which are not possible, according to our model. Which of the following are not possible outcomes for the fish population over time?

- [x] continue to grow larger and larger without bound ✔
- [x] oscillate between a value slightly less than 100 and slightly more than 100 ✔
- [ ] increase toward the carrying capacity of 100
- [ ] decrease toward the carrying capacity of 100
- [x] decrease towards 0 (extinction) ✔
- [ ] remain at exactly 100
- [ ] remain at exactly 0

✔

**Explanation**

We see that solution curves are either equilibriums $P(t) = 100$ or $P(t) = 0$, or increase toward 100 (if $P_0 < 100$), or decrease toward 100 $(if P_0 > 100)$. This means that all other choices are not possible outcomes for the fish population over time.

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Answers are displayed within the problem

## Multiple Choice

1/1 point (graded)

Verhulst proposed that there are forces that limit population growth. He represented this mathematically with the differential equation

$$\frac{dP}{dt} = rP\left(1 - \frac{P}{K}\right).$$

If we use the distributive property to expand $rP\left(1 - \frac{P}{K}\right)$, we get two terms, a positive term $rP$ (the exponential growth model) and a negative term involving the carrying capacity $K$. This negative term can be thought of as the limiting force which prevents population from growing without bound. Which of the following is correct?

- The negative term is $-\frac{r}{K}P$, so the limiting force is proportional to the population $P$.
- The negative term is is $-\frac{r}{K}P^2$, so the limiting force proportional to the square of the population, $P^2$. ✔
- The negative term is $-\frac{r}{KP}$, so the limiting force is inversely proportional to the population $P$.
- The negative term is $-\frac{r}{K}$, so the limiting force does not depend on the population.

**Explanation**

The limiting force (the negative term) is $-\frac{r}{K}P^2$, so this negative term is proportional to the square of the population $P$. Loosely speaking, we can think of $P^2$ as a measure of interaction between members of the population. Since members compete with each other for resources, this has a negative effect on the population $P$.

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