EXPONENTIAL CHANGE

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ABSTRACT

- Exponential Change is a process that increases or decreases quantity over time. If a constant of proportionality is negative, then the quantity decreases over time which is known as exponential decay. If a constant of proportionality is positive, then the quantity increases over time. That is known as exponential growth. We find the formula for exponential change on page 436 of the book, "Thomas' Calculus: Early Transcendentals".

EXAMPLE QUESTION

- Endangered Species:
  - Biologists consider a species of animal or plant to be endangered if it is expected to become extinct within 20 years. If a certain species of wildlife is counted to have 1147 members at the present time, and the population has been steadily declining exponentially at an annual rate averaging 39% over the past 7 years, do you think the species is endangered? Explain your answer.

PROBLEM FORMULATION

We will use the formula, $y\,(t) = P_0\, e^{-k\,(t)}$

- In this formula $y\,(t)$ is the current population, P_0 is the initial population, k is the rate of increase, and t is the final time.

Substitute the values,

- $P_0 = 1147,\ k = 39\% = 0.39,\ t = 20$

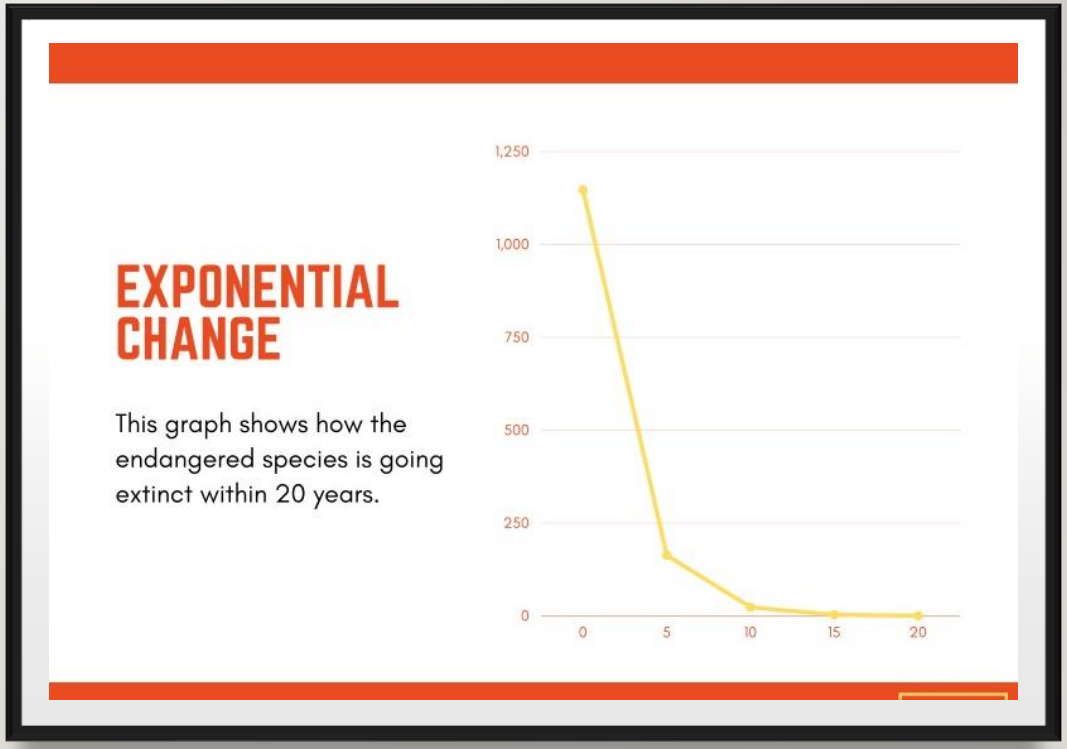
Therefore, the formula is $y\,(20) = 1147e^{-0.39\,(20)}$

- $y\,(20) = 0.4699660209$
- $y\,(20) = 0.47$
- $0.47 < 1$

The population at $t = 20$ is less than one, so the species is endangered.

RESULTS/CONCLUSION

- The problem states that if a species is expected to become extinct within 20 years, then it is an endangered species. 20 years was the time that was used for the formula to see what the population would be within that time frame. Within the 20-year time frame, not one member of the species would be left. The species would be completely extinct. Because the result was less than one (0.47 < 1), the species is in fact endangered.



A FEW ENDANGERED SPECIES

- Snow leopard
- Southern sea otter
- Vaquita
- Hawaiian Monk Seal

WORKS CITED

- Wikipedia contributors. "Exponential Growth." *Wikipedia*, 3 Apr. 2021, en.wikipedia.org/wiki/Exponential_growth.
- *Thomas's Calculus: Early Transcendentals*, by Maurice D. Weir et al., 14th ed., Pearson, 2016, pp. 435–436.