**Chapter 2**

**Applications of Integration**

**2.8 Exponential Growth and Decay**

**Section Exercises**

***True or False*? If true, prove it. If false, find the true answer.**

349. If you invest , an annual rate of interest of  yields more money in the first year than a  continuous rate of interest.

Answer: True

351. If given a half-life of *t* years, the constant for  is calculated by 

Answer: False;

**For the following exercises, use **

353. If bacteria increase by a factor of  in  hours, how many hours does it take to increase by?

Answer:  hours

355. If a relic contains  as much radiocarbon as new material, can it have come from the time of Christ (approximately  years ago)? Note that the half-life of radiocarbon is  years.

Answer: No. The relic is approximately  years old.

357. The populations of New York and Los Angeles are growing at  and  a year, respectively. Starting from  million (New York) and  million (Los Angeles), when are the populations equal?

Answer:  years

359. The effect of advertising decays exponentially. If  of the population remembers a new product after  days, how long will  remember it?

Answer:  days  hours  minutes

361. If at  and  at  when does 

Answer:

363. What continuous interest rate has the same yield as an annual rate of

Answer:

365. You are trying to save  in  years for college tuition for your child. If interest is a continuous how much do you need to invest initially?

Answer:

367. You are trying to thaw some vegetables that are at a temperature of  To thaw vegetables safely, you must put them in the refrigerator, which has an ambient temperature of  You check on your vegetables  hours after putting them in the refrigerator to find that they are now  Plot the resulting temperature curve and use it to determine when the vegetables reach 

Answer:  hours  minutes

369. The spent fuel of a nuclear reactor contains plutonium-239, which has a half-life of  years. If  barrel containing of plutonium-239 is sealed, how many years must pass until only  of plutonium-239 is left?

Answer:  years

**For the next set of exercises, use the following table, which features the world population by decade.**

|  |  |
| --- | --- |
| **Years since 1950** | **Population (millions)** |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

371. [**T]** Find and graph the derivative of your equation. Where is it increasing and what is the meaning of this increase?

Answer: The population is always increasing.

373. [**T]** Find the predicted date when the population reaches billion. Using your previous answers about the first and second derivatives, explain why exponential growth is unsuccessful in predicting the future.

Answer: The population reaches billion people in 

**For the next set of exercises, use the following table, which shows the population of San Francisco during the 19th century.**

|  |  |
| --- | --- |
| **Years since 1850** | **Population (thousands)** |
|  |  |
|  |  |
|  |  |
|  |  |

1. [**T]** Find and graph the derivative of your equation. Where is it increasing? What is the meaning of this increase? Is there a value where the increase is maximal?

Answer: The population is always increasing.

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