

Exponential Growth and Decay

Solve each exponential growth/decay problem.

- 1) For a period of time, an island's population grows at a rate proportional to its population. If the growth rate is 3.8% per year and the current population is 1543, what will the population be 5.2 years from now?
- 2) During the exponential phase, E. coli bacteria in a culture increase in number at a rate proportional to the current population. If the growth rate is 1.9% per minute and the current population is 172.0 million, what will the population be 7.2 minutes from now?
- 3) Radioactive isotope Carbon-14 decays at a rate proportional to the amount present. If the decay rate is 12.10% per thousand years and the current mass is 135.2 mg, what will the mass be 2.2 thousand years from now?
- 4) A savings account balance is compounded continuously. If the interest rate is 3.1% per year and the current balance is \$1077.00, in how many years will the balance reach \$1486.73?
- 5) A cup of coffee cools at rate proportional to the difference between the constant room temperature of 20.0°C and the temperature of the coffee. If the temperature of the coffee was 86.1°C 3.0 minutes ago and the current temperature of the coffee is 79.9°C , what will the temperature of the coffee be 29.0 minutes from now?
- 6) During the exponential phase, E. coli bacteria in a culture increase in number at a rate proportional to the current population. If the population doubles in 20.4 minutes, in how many minutes will the population triple?

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- 1) For a period of time, an island's population grows at a rate proportional to its population. If the growth rate is 3.8% per year and the current population is 1543, what will the population be 5.2 years from now?

$$1543e^{0.038 \cdot 5.2} \approx 1880$$

- 2) During the exponential phase, E. coli bacteria in a culture increase in number at a rate proportional to the current population. If the growth rate is 1.9% per minute and the current population is 172.0 million, what will the population be 7.2 minutes from now?

$$172e^{0.019 \cdot 7.2} \approx 197.2 \text{ million}$$

- 3) Radioactive isotope Carbon-14 decays at a rate proportional to the amount present. If the decay rate is 12.10% per thousand years and the current mass is 135.2 mg, what will the mass be 2.2 thousand years from now?

$$135.2e^{-0.121 \cdot 2.2} \approx 103.6 \text{ mg}$$

- 4) A savings account balance is compounded continuously. If the interest rate is 3.1% per year and the current balance is \$1077.00, in how many years will the balance reach \$1486.73?

$$\frac{\ln \frac{1486.73}{1077}}{0.031} \approx 10.4 \text{ yr}$$

- 5) A cup of coffee cools at rate proportional to the difference between the constant room temperature of 20.0°C and the temperature of the coffee. If the temperature of the coffee was 86.1°C 3.0 minutes ago and the current temperature of the coffee is 79.9°C, what will the temperature of the coffee be 29.0 minutes from now?

$$20 + 59.9e^{\frac{\ln \frac{59.9}{66.1}}{3} \cdot 29} \approx 43.1^\circ\text{C}$$

- 6) During the exponential phase, E. coli bacteria in a culture increase in number at a rate proportional to the current population. If the population doubles in 20.4 minutes, in how many minutes will the population triple?

$$\frac{20.4 \ln 3}{\ln 2} \approx 32.3 \text{ min}$$