

Exponential Growth and Decay

Solutions should show all of your work, not just a single final answer.

1. In 1859, 24 rabbits were released into the wild in Australia, where they had no natural predators. Their population doubled every 6 months.
 - (a) Determine $P(t)$, the function that gives the population at any time t measured in years, **and** find the differential equation that governs the rate of population change.
 - (b) After how many years, rounded to one decimal place, did the rabbit population reach 1,000,000?
 - (c) Determine the rate of population change after 3 years. Round your final answer to 4 decimal places.

2. The element Unobtainium has a half-life of 3 years.
 - (a) Determine $M(t)$, the function that gives the mass of Unobtainium at any time t measured in years, **and** find the differential equation that governs the rate of decay of the mass of Unobtainium.
 - (b) In how many years will 14 kg of Unobtainium shrink to 1 kg? Round your answer to one decimal place.

3. Starbucks serves coffee at 180° and the room temperature in Starbucks is 75° . The coffee cools to 120° after 10 minutes.
 - (a) Determine $T(t)$, the function that gives the temperature of the coffee at any time t measured in minutes.
 - (b) From the time when the temperature is 120° at $t = 10$, how much additional time will it take for the temperature of the coffee to reach 100° ? Round your answer to one decimal place.

4. T/F (with justification) If $\frac{dy}{dx} = y$, then $y = 0$ or $y = e^x$.