

Applications of Integration

1. From past records, a botanist knows that a certain species of tree has a rate of growth that can be modeled by $f(x) = 2/\sqrt{x}$, $1 \leq x \leq 4$, where x is the age of the tree in years and $f(x)$ is the growth rate in feet per year. Determine how much did the tree grow from the time when it was a year old to the time it was four years old.
2. Suppose that the velocity of an object is given by the function $v(t) = 0.3t$ where t is the time in seconds and v is the velocity in feet per second. Determine the total movement of the object between 10 and 20 seconds.
3. Suppose that the velocity of an object is given by the function $v(t) = \frac{t}{\sqrt{t^2+9}}$ where t is the time in seconds and v is the velocity in feet per second.
 - a) Determine the total movement of the object between 3 and 5 seconds.
 - b) Knowing that when $t = 4$ seconds, the position function $s(t) = 8$ feet, determine the position function $s(t)$.
4. The rate of change in the U.S. population can be modeled by $g(x) = 1.03e^{0.013x}$, $0 \leq x \leq 100$ where x represents the number of years since 1900 and g represents the rate of change in population measured in millions per year. Determine the total increase in the U.S. population from 1900 to 1950.
5. Geologists estimate that an oil field will produce oil at a rate given by $f(t) = 600e^{-0.1t}$ thousand barrels per month, t months into production. Estimate the total production for the first year of operation. Round to the nearest whole number.
6. A botanist knows that a certain species of oak tree grows at a rate of $\frac{4x^2+16x+9}{2x+4}$ feet per year, where x is the age of the tree in years. When restricting the light, the oak tree grows at a rate $\frac{2x^2+12x+9}{2x+4}$ feet per year in x years. How many fewer feet in growth will result from restricting the amount of light that tree receives when the tree is between 3 and 8 years old?

Solutions:

1. 4 ft
2. 45 ft
3. a) 1.59 ft b) $\sqrt{t^2 + 9} + 3$
4. 72.54 millions
5. 4193 thousands of barrels
6. 27.5 ft