

1. Suppose the rate of change of the percentage of homes with TVs that have VCRs is  $p(t) = 3(0.8^t)$  percent  $t$  years after the year 2000 and 10 percent of homes with TVs also had VCRs in 2000.
  - a. Find a specific formula for the total percentage of homes with TVs that also have VCRs  $t$  years after the year 2000.
  - b. Find the total percentage of homes with TVs that also have VCRs in the year 2003.
  - c. Find the change in the percentage of homes with TVs that also have VCRs between the years 2000 and 2003.
2. Suppose the rate of change of the percentage of homes with TVs that have VCRs is  $p(t) = 0.03t^2 - 0.6t + 3$  percent  $t$  years after the year 2000 and 10 percent of homes with TVs also had VCRs in 2000.
  - a. Find the total percentage of homes with TVs that also have VCRs in the year 2003.
  - b. Find a specific formula for the total percentage of homes with TVs that also have VCRs  $t$  years after the year 2000.
  - c. Find the change in the percentage of homes with TVs that also have VCRs between the years 2000 and 2003.
3. Suppose a company's net worth in 1982 was 15 million dollars and its rate of growth  $t$  years after 1980 was  $r(t) = 0.2t - 0.03t^2$  million dollars per year.
  - a. Use a definite integral to give an expression for the company's net worth in 1990.
  - b. Calculate its net worth in 1990 to three decimal places.
  - c. Give an integral expression for the change in its net worth between 1982 and  $t$  years later.
4. Suppose the rate of change of the percentage of women choosing to have epidural analgesia during childbirth is  $p(t) = 2 + 0.03t$  percent  $t$  years after the year 2005 and 65 percent of child-bearing women chose epidurals in 2005, then.
  - a. Find the total percentage of child-bearing women who chose epidurals in 2007.
  - b. Write an integral expression for the total percentage of child-bearing women who chose epidurals in 2007.
  - c. Find the change in the percentage of child-bearing women who chose epidurals between 2005 and 2008.

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**Answers:****1.**

$$\text{a. } P(t) = \int_0^t 3(0.8^x) dx + 10 = 3 \frac{(0.8^x)}{\ln(0.8)} \Big|_0^t + 10 = \frac{3}{\ln(0.8)} [0.8^t - 1] + 10$$

$$\text{b. } P(3) = \frac{3}{\ln(0.8)} [0.8^3 - 1] + 10 = 16.5607$$

**c.** 6.5607**2.**

$$\text{a. The change is } \int_0^3 p(t) dt = \frac{0.03t^3}{3} - \frac{0.6t^2}{2} + 3t \Big|_0^3 = 6.57$$

P(3) = 16.57 percent

$$\text{b. } P(t) = \frac{0.03t^3}{3} - \frac{0.6t^2}{2} + 3t + C; P(0) = 10 = 0 + 0 + 0 + c, \text{ so } C = 10$$

$$P(t) = \frac{0.03t^3}{3} - \frac{0.6t^2}{2} + 3t + 10$$

**c.** 6.57 percent.**3.****a.**

$$15 + \int_2^{10} 0.2t - 0.03t^2 dt$$

**b.**

$$\left[ 0.1t^2 - 0.01t^3 \right]_2^{10} = \left[ 0.1 \cdot 10^2 - 0.01 \cdot 10^3 \right] - \left[ 0.1 \cdot 2^2 - 0.01 \cdot 2^3 \right] = -0.32$$

15 + -0.32 = 14.68 million dollars

$$\text{c. } \int_0^t 0.2x - 0.03x^2 dx$$

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4. Suppose the rate of change of the percentage of women choosing to have epidural analgesia during childbirth is  $p(t) = 2 + 0.03t$  percent  $t$  years after the year 2005 and 65 percent of child-bearing women chose epidurals in 2005, then.

a. 69.06

b.  $65 + \int_0^2 2 + 0.03x dx$

c.  $\int_0^3 2 + 0.03x dx$