Maxima and Minima in Applications

1. The number of births during the 1980s to women 35 years or older was about

$N(x) = -0.03x^3 + 1.3x^2 + 10x + 164$ thousand births x years after 1980.

The ratio of caesarean deliveries for women in the same age bracket and time period was about

$P(x) = -0.2x^2 + 3x + 20$ caesareans per 1000 births x years after 1980.

Write an explicit algebraic expression for the number C(x) of caesarean deliveries for women 35 years or older during the 1980s.

C(x) = $(-0.03x^3 + 1.3x^2 + 10x + 164)(-0.2x^2 + 3x + 20)$ caesareans x years after 1980

2. The percentage of women receiving epidural pain relief during childbirth can be modeled by

$p(x) = 0.73(1.2912^x) + 8$ percentx years after 1980.

At a hospital in southern Arizona the yearly number of women giving birth is described by

$b(x) = -0.3x^2 - 3.8x + 500$ women x years after 1980.

a. Give a formula for the number of women receiving epidural pain relief at that hospital x years after 1980. (Include units.)

$N(x) = 0.01(-0.3x^2 - 3.8x + 500)(0.73(1.2912^x) + 8)$ women

b. Find the rate of change of the number of women receiving epidural pain relief x years after 1980. (Include units.)

$$\frac{dN}{dx} = 0.01\left[\left(-0.3x^2 - 3.8x + 500\right)0.73\ln(1.2912)\left(1.2912^x\right) + (-0.6x - 3.8)\left(1.2912^x\right)\right] \text{ women/yr}$$

3. The number of states associated with the national PTA organization is approximately $m(x) = \dfrac{49}{1 + 36e^{-0.2x}}$ states x years after 1895. Find the rate of change of the number of states associated with the national PTA organization x years after 1895. (Include units.)

$$m(x) = 49\left(1 + 36e^{-0.2x}\right)^{-1/2} \qquad \frac{dm}{dx} = \frac{-49}{2}\left(1 + 36e^{-0.2x}\right)^{-3/2} \cdot 36\left(-0.2e^{-0.2x}\right) \text{ states/yr}$$

4. The total production costs for a company to produce x units per hour are $C(x) = 71(1.05^x)$ dollars.

a. Write a formula for the average cost when the company produces x units per hour. (Include units.)

$$\overline{C}(x) = \frac{C(x)}{x} = \frac{71(1.05^x)}{x} \text{ dollars/unit}$$

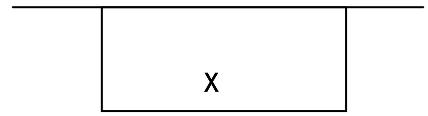
b. Find the rate of change of the average cost. (Include units.)

$$\frac{d\overline{C}}{dx} = \frac{x \cdot 71 \cdot \ln(1.05)\left(1.05^x\right) - 71\left(1.05^x\right)}{x^2} = x^{-1} \cdot 71 \cdot \ln(1.05)\left(1.05^x\right) - x^{-2} \cdot 71\left(1.05^x\right) \text{ dollars/unit/unit}$$

Maxima and Minima in Applications

5.2 Extrema in Applications

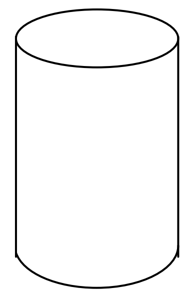
5. A rectangular-shaped garden has one side along the side of a house. The other three sides are to be enclosed with 80 feet of fencing. Use calculus to find the largest possible area of such a garden.



$A = LW = x(80 - 2x) = -2x^2 + 80x$

$\frac{dA}{dx} = -4x + 80 = 0$ so $x = 20$, $A = 20 \cdot 40 = 800$

6. Frozen juice cans are constructed with cardboard sides and metal top and bottom. A typical can holds 18 cubic inches. If the metal costs three times as much as the cardboard, what dimensions will minimize the cost of an 18-cubic-inch can?



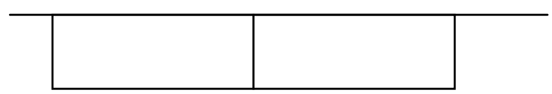
$V = \pi r^2 h = 18$ so $h = 18/(\pi r^2)$

$C = 2 \cdot 3 \cdot \pi r^2 + 2\pi r \cdot h = 2 \cdot 3 \cdot \pi r^2 + 2\pi r \cdot 18/(\pi r^2) = 6\pi r^2 + 36r^{-1}$

$C'(r) = 12\pi r - 36r^{-2} = 0$

$12\pi r = 36r^{-2}$ so $r^3 = 3/\pi$ and $r = 0.985$

7. A dog kennel owner needs to build a pair of identical dog runs adjacent to one of the kennel cages as shown. The combined area will be 240 sq ft. The walls will be 8 ft high. The ends and middle wall will be cinder block costing $.50/sq ft (so these walls cost $4 per linear foot). The side will be chain link, costing $3/sq ft (so the side costs $24 per linear foot). Find the length x of the end which minimizes the total cost.



$C(x) = 3 \cdot 4x + 24 \cdot L(x)$

$A = xL = 240$ so $L = 240/x$

$C(x) = 3 \cdot 4x + 24 \cdot 240x^{-1}$

$C'(x) = 12 - 5760x^{-2} = 0$

$12x^2 = 5760$

$x = 21.9$

Maxima and Minima in Applications

5.2 Extrema in Applications

8. A trucking company will set governors on its drivers' trucks. For these trucks, fuel consumption (in mi/gal) is C(s) = 8.9 – 0.07s, where s is the truck's speed (in mi/hr). The average wage for the truckers is \$15.50/hr. Diesel fuel costs \$2.10/gal. For a 400 mile trip, using speed s as the independent variable, find formulas for the following quantities:

a. Driving time required 400/s

b. Wages paid to the driver 15.50(400/s) = 6200/s

c. Gallons of fuel used $\frac{400}{8.9-0.07s}$

d. Total cost of fuel $\frac{(2.10)400}{8.9-0.07s}=\frac{840}{8.9-0.07s}$

e. Combined cost of wages and fuel $C(s)=\frac{6200}{s}+\frac{840}{8.9-0.07s}$

f. Find the speed that should be driven to minimize the combined costs.

$C(s) = 6200s^{-1} + 840(8.9 – 0.07s)^{-1}$

$C'(s) = -6200s^{-2} – 840(8.9 – 0.07s)^{-2}(-0.07) = 0$

$-6200(8.9 – 0.07s)^{2} – 840(-0.07)s^{2} = 0$

s = 53.17mi/hr

9. A publishing company estimates that when a new book by a best-selling American author hits the market, its sales are approximately

$n(x) = 70{,}000\sqrt{x}$ copies in the United States by the end of the x^{th} week and

$a(x) = -0.04x^2 + 125$ copies abroad. Write a formula for the rate of change of the total number of copies sold by the end of the x^{th} week. **Include units**.

$(n + a)' = 70{,}000\cdot(1/2)x^{-1/2} – 0.08x$ copies/week

10. Civilian deaths due to the influenza epidemic in 1918 can be modeled as $c(t)=\frac{94{,}000}{1+5{,}100e^{-1.1t}}$ deaths *t* weeks after August 31, 1918. Find a formula for the rate of change of the civilian deaths *t* weeks after August 31. **Include units**.

$-94{,}000(1 + 5{,}100\cdot e^{-1.1t})^{-2}(5{,}100\cdot e^{-1.1t})(-1.1)$ deaths/week

Maxima and Minima in Applications

5.2 Extrema in Applications

11. In South Carolina from 1980 to 1989, the number of students enrolled in grades 9 through 12 was approximately e(*t*) = 190,000 – 1,700*t* students *t* years after 1980. The number of dropouts for the same grades in South Carolina during those years was approximately d(*t*) = 11,000 – 540*t*.

a. Give a formula for the percentage of enrolled students who dropped out each year.

$P(t) = 100\frac{11000-540t}{190000-170t} = 100(11000 - 540t)(190000 - 170t)^{-1}$

b. Find the rate of change formula for the percentage of students who dropped out each year. **Include units**.

$P'(t) = 100[-(11000 - 540t)(190000 - 170t)^{-2}(-170) - 540(190000 - 170t)^{-1}]$ percent per year

12. A publishing company estimates that when a new book by a best-selling American author hits the market, its sales are approximately

$n(x) = 70{,}000\sqrt{x}$ copies in the United States by the end of the x^{th} week and

$a(x) = -0.04x^2 + 125$ copies abroad. Write a formula for the rate of change of the total number of copies sold by the end of the x^{th} week. **Include units**.

$(n + a)' = 70{,}000\cdot(1/2)x^{-1/2} - 0.08x$ copies/week

13. Civilian deaths due to the influenza epidemic in 1918 can be modeled as $c(t) = \frac{94{,}000}{1+5{,}100e^{-1.1t}}$ deaths *t* weeks after August 31, 1918. Find a formula for the rate of change of the civilian deaths *t* weeks after August 31. **Include units**.

$-94{,}000(1 + 5{,}100\cdot e^{-1.1t})^{-2}(5{,}100\cdot e^{-1.1t})(-1.1)$ deaths/week

14. In South Carolina from 1980 to 1989, the number of students enrolled in grades 9 through 12 was approximately e(*t*) = 190,000 – 1,700*t* students *t* years after 1980. The number of dropouts for the same grades in South Carolina during those years was approximately d(*t*) = 11,000 – 540*t*.

a. Give a formula for the percentage of enrolled students who dropped out each year.

$P(t) = 100\frac{11000-540t}{190000-170t} = 100(11000 - 540t)(190000 - 170t)^{-1}$

b. Find the rate of change formula for the percentage of students who dropped out each year. **Include units**.

$P'(t) = 100[-(11000 - 540t)(190000 - 170t)^{-2}(-170) - 540(190000 - 170t)^{-1}]$ percent per year

Maxima and Minima in Applications

15. A street vendor sells roses at a price per dozen given by

$p(x) = 316(0.95^x)$ dollars per dozen when x dozen per week are sold.

a. Give a formula for her weekly revenue. **Include units.**

$R(x) = 316x(0.95^x)$ dollars (weekly)

b. Use calculus to find the weekly sales level which maximizes her weekly revenue. **Include units.**

$R'(x) = 316[x(0.95^x)\ln(0.95) + 1\cdot(0.95^x)] = 0$

$\sout{316}[x\sout{(0.95^x)}\ln(0.95) + 1\cdot\sout{(0.95^x)}] = 0$ $\quad x = -1/\ln(0.95) = 19.495$ dozen

16. The percentage of southern Australian grasshopper eggs that hatch as a function of temperature (for temperatures between 5°C and 30°C) is modeled by $P(t) = 0.015t^3 - 1.3t^2 + 30t - 100$ percent, where t is the temperature in °C. Use calculus to find the temperature which yields the greatest percentage of eggs hatching. **Include units**.

$P'(t) = 0.045t^2 - 2.6t + 30 = 0$

$t = (2.6 \pm \sqrt{(2.6^2 - 4*0.045*30)})/0.09 = \textcircled{15.93,}\ 41.846$ °C

17. A publishing company estimates that when a new book by a best-selling American author hits the market, its sales are approximately

$n(x) = 70{,}000\sqrt{x}$ copies in the United States by the end of the x^{th} week and

$a(x) = -0.04x^2 + 125$ copies abroad. Write a formula for the rate of change of the total number of copies sold by the end of the x^{th} week. **Include units**.

$n(x) + a(x) = 70{,}000x^{1/2} - 0.04x^2 + 125$

$(n + a)' = 35000\, x^{-1/2} - 0.08x$

18. Suppose that for production levels from 0 to 15 thousands of tons, a company's profit in millions of dollars is given by $P(x) = -0.2x^4 + 60x - 100$ where x is production in thousands of tons. Find the production level where the rate of change of the profit is zero.

$\frac{dP}{dx} = -0.8x^3 + 60 = 0$ **Ans**: <u>4.217 thousand tons</u>.

$x = (-60/-0.8)^{1/3} = 4.217$

19. The percentage of children living with their grandparents between 1970 and 2000 can be modeled by the equation $p(t) = [3 + 0.2e^{0.1t}]$ percent t years after 1970. Write a rate of change formula for p.

$p'(x) = (0.2)\,(0.1)e^{0.1t}$ percent per year

Maxima and Minima in Applications

5.2 Extrema in Applications

20. Dispatchers at a sheriff's office record the total number of calls received since 5am in 3-hour intervals. Total calls for a typical day can be modeled as $N(t) = \frac{7000}{1+30e^{-0.2t}}$ t hours after 5am. Find the rate of change formula for the model.

$N(t) = 7000(1 + 30e^{-0.2t})^{-1}$ calls

$N'(t) = -7000(1 + 30e^{-0.2t})^{-2} \cdot 30(-0.2)e^{-0.2t} = 42000(1 + 30e^{-0.2t})^{-2}e^{-0.2t}$ calls per hour

21. In October of 1999, Acme Corp. offered 5 million shares of public stock at $9 per share. Revenue for the two years preceding the stock offering can be modeled by the equation $R(q) = 7 + 0.05e^{0.9q}$ million dollars q quarters after the beginning of 1998. Write the rate of change formula of R.

$R'(t) = 0.05e^{0.9q}(0.9) = 0.045e^{0.9q}$ million dollars per quarter

22. The number of students enrolled in grades nine through twelve in a certain state for each school year 1980-81 through 1989-90 can be modeled as $-9{,}000t + 200{,}000$ students for the school year beginning t years after fall semester 1980. The number of dropouts for those same grades in that state is approximately $10{,}000(0.9^t)$ dropouts t years after fall semester 1980. Find a model for the percentage of high school students who dropped out each year. Find the rate of change formula of the percentage of high school students who dropped out each year.

$P(t) = 100\frac{10{,}000(0.9^t)}{-9{,}000t + 200{,}000}$ per cent

$= 1{,}000{,}000(0.9^t)(-9{,}000t + 200{,}000)^{-1}$ percent

P'(t)

$= 10^6[(0.9^t)(-1)(-9{,}000t + 200{,}000)^{-2}(-9{,}000) + (-9{,}000t + 200{,}000)^{-1}(0.9^t)\ln(0.9)]$

$= 10^6[9{,}000(0.9^t)(-9{,}000t + 200{,}000)^{-2} + \ln(0.9)(-9{,}000t + 200{,}000)^{-1}(0.9^t)]$ percent per year

23. On the basis of data from a study conducted by the University of Colorado School of Medicine at Denver, the percentage of women receiving epidurals during childbirth between 1981 and 1997 can be modeled by the equation $p(x) = [0.7(1.3)^x + 8]$ percent x years after 1980. Suppose that at a hospital in Altoona, PA the yearly number of women giving birth declined as described by:

$b(x) = -0.07x^2 - 3x + 800$ women giving birth x years after 1980.

Give the equation and its derivative for the number N(x) of women receiving regional analgesia while giving birth at the Arizona hospital.

$N(x) = [0.7(1.3)^x + 8](-0.07x^2 - 3x + 800)/100$ women receiving epidurals x years after 1980

$N'(x) = 0.01\{[0.7(1.3)^x + 8](-0.14x^2 - 3) + [0.7(1.3)^x \ln(1.3)](-0.07x^2 - 3x + 800)\}$

$= [0.007(1.3)^x + 8](-0.14x^2 - 3) + [0.007(1.3)^x \ln(1.3)](-0.07x^2 - 3x + 800)$ women per year

Maxima and Minima in Applications

24. On the basis of data from a study conducted by the University of Colorado School of Medicine at Denver, the fraction of women receiving epidural pain relief during child birth at small hospitals between1981 and 1997 can be modeled by

$f(t) = 7.3(1.2912^t) + 80$ women receiving epidurals per 1000 women giving birth, t years after 1980.

Suppose that a small hospital in southern Arizona has seen the yearly number of women giving birth decline as described by the equation

$b(t) = -0.00003t^2 - 0.004t + 0.539$ thousand women giving birth t years after 1980

Give a formula for the number N(t) of women receiving epidural pain relief at that small hospital in southern Arizona. Give units for the output and input. Include scaling and alignment.

N(t) =	$f(t)\cdot b(t) = (7.3(1.2912^t) + 80)\cdot(-0.00003t^2 - 0.004t + 0.539)$ epidurals t years after 1980.

25. The number of births during the 1980s to women 35 years or older was about

$N(x) = -0.03x^3 + 1.3x^2 + 10x + 164$ thousand births x years after 1980.

The ratio of cesarean deliveries for women in the same age bracket and time period was about

$P(x) = -0.2x^2 + 3x + 20$ cesareans per 1000 births x years after 1980.

Write an explicit algebraic expression for the number C(x) of cesarean deliveries for women 35 years or older during the 1980s.

C(x) =	$(-0.03x^3 + 1.3x^2 + 10x + 164)\cdot(-0.2x^2 + 3x + 20)$ cesareans x years after 1980

26. The percentage of children living with their grandparents between 1970 and 2000 can be modeled by the equation

$p(t) = [3 + 0.2e^{0.09t}]$ percent t years after 1970.

a. Write a rate of change formula for p.

$p'(t) = 0.2e^{0.09t}(0.09)$ percent per yr, t years after 1970

b. How rapidly was the percentage of children living with their grandparents growing in 1995?

$p'(25) = 0.2e^{0.09*25}(0.09) = 0.1707$ percent/yr

Maxima and Minima in Applications

27. Civilian deaths due to the influenza epidemic in 1918 can be modeled as $c(t) = \frac{93{,}000}{1 + 5000e^{-1.1t}}$ deaths t weeks after August 31, 1918.

a. Write a rate of change formula for the number of deaths after t weeks.

$c(t) = 93{,}000(1 + 5000e^{-1.1t})^{-1}$

$c'(t) = -93{,}000(1 + 5000e^{-1.1t})^{-2}(5000\ e^{-1.1t})(-1.1)$ deaths/wk after t weeks.

b. How rapidly was the number of deaths growing on September 28, 1918?

$c'(4) = -93{,}000(1 + 5000e^{-1.1*4})^{-2}(5000\ e^{-1.1*4})(-1.1) = 1613$ deaths/wk

28. The marketing division of a large firm models the effectiveness of an advertising campaign by $S(u) = 0.8\sqrt{u} + 2$, where S(u) represents sales in millions of dollars when the firm spends u thousand dollars on advertising. The firm plans to invest $u(x) = -2x^2 + 50x + 200$ thousand dollars each year t years from now.

a. Write a formula for the predicted sales x years from now.

$S = S(u(x)) = 0.8\sqrt{-2x^2 + 50x + 200} + 2$ million dollars of sales x yrs from now

b. Write a formula for the rate of change of predicted sales x years from now.

$S = S(u(x)) = 0.8\sqrt{-2x^2 + 50x + 200} + 2 = 0.8(-2x^2 + 50x + 200)^{1/2} + 2$

$\frac{dS}{dx} = 0.8\frac{1}{2}(-2x^2 + 50x + 200)^{-1/2}(-4x + 50)$ millions of dollars of sales per year, x years from now

29. A music store has determined that the number of CDs sold monthly is approximately $\text{Number} = 6000(0.9^x)$ CDs where x is the price in dollars. Each CD costs the store $7.00.

a. Give an equation for the revenue as a function of price.

$R(x) = x \cdot N(x) = 6000x(0.9^x)$ dollars of revenue per when x dollars are charged

b. Find a formula for the rate of change of revenue as a function of price.

$R'(x) = 6000[x\ln(0.9)(0.9^x) + (0.9^x)]$ dollars of revenue per CD sold when x CDs are sold

Maxima and Minima in Applications

5.2 Extrema in Applications

30. On the basis of data from a study conducted by the University of Colorado School of Medicine at Denver, the percentage of women receiving regional analgesia (epidural pain relief) during childbirth at small hospitals between 1981 and 1997 can be modeled by the equation

$p(x) = [0.7(1.2)^x + 8]$ percent x years after 1980.

Suppose that a small hospital in southern Arizona has seen the yearly number of women giving birth decline as described by the equation

$b(x) = -0.03x^2 - 4x + 500$ women giving birth x years after 1980.

a. Give the equation for the number of women receiving regional analgesia while giving birth at the Arizona hospital.

$N(x) = [0.7(1.2)^x + 8]\cdot[-0.03x^2 - 4x + 500]/100$ women receiving epidurals, x yrs after 1980

b. Give a formula for the rate of change of the number of women receiving regional analgesia while giving birth at the Arizona hospital.

$N'(x) = 0.01[(0.7(1.2)^x + 8)\cdot(-0.06x - 4) + 0.7\ln(1.7)(1.2^x)(-0.03x^2 - 4x + 500)]$ epidurals x yrs after 1980

31. The flow rate (in cubic feet per second, cfs) of a river in the first 14 hours after the beginning of a severe thunderstorm can be modeled by $C(h) = -0.9h^3 + 12h^2 + 123$.

a. When does the flow rate reach its maximum.

$C'(h) = -2.7h^2 + 24h = 0 = h(-2.7h + 24) = 0$ h = 0, 8.89 hrs after the beginning

b. What is the maximum flow rate?

C(8.89) = 439 cfs

32. The percentage of a variety of grasshopper eggs that hatch (as a function of temperatures ranging between 3°C and 13°C) can be modeled by $P(t) = -0.0064t^4 + 20t - 50$ percent.

a. Find the temperature at which the maximum percentage hatches.

$P'(t) = -0.0256t^3 + 20 = 0$ t = (-20/-0.0256)^(1/3) = 9.21 °C

b. What is the maximum percentage of eggs that hatch?

P(9.21) = 88.15 percent

33. The percentage of children living with their grandparents between 1970 and 2000 can be modeled by the equation $p(t) = [3 + 0.216e^{0.09263t}]$ percent t years after 1970. Write a rate of change formula for p. How rapidly was the percentage of children living with their grandparents growing in 1995? **Include units**.

$p'(t) = 0.216e^{0.09263t}\cdot 0.09263$ percent/yr t years after 1970

Maxima and Minima in Applications

34. Civilian deaths due to the influenza epidemic in 1918 can be modeled as $c(t) = \frac{94{,}000}{1+5{,}100e^{-1.1t}}$ deaths *t* weeks after August 31, 1918. Find a formula for the rate of change of the civilian deaths *t* weeks after August 31. **Include units**.

$c(t) = 94000(1 + 5100e^{-1.1t})^{-1}$

$c'(t) = -94000(1 + 5100e^{-1.1t})^{-2}(5100e^{-1.1t})(-1.1)$

35. The number of homes in the US with TVs from 1970 to 1990 is modeled by

$N(t) = 5.7t – 52.8$ millions of homes, t years after 1970.

The percentage of homes with American TVs which had VCRs was about

$P(t) = 0.01(1.6^t)$ percent, t years after 1970.

Find a rate of change formula for the number of US homes with VCRs.

$y = (5.7t – 52.8)\cdot 0.01(1.6^t)/100$

$y' = 10^{-4}[(5.7t – 52.8)(1.6^t)]' = 10^{-4}[(5.7t – 52.8)(1.6^t)\ln(1.6) + 5.7(1.6^t)]$

36. For swimmers aged 8 to 32 years, the time it takes an average athlete to swim 100 yds freestyle is about

$T(a) = -0.004a^3 + 0.4a^2 – 12a + 170$ seconds, for swimmers from 8 to 32 of age a years.

Use calculus to find the age of swimmers with the lowest 100 yd time. Include units in your answer.

$T'(a) = -0.012a^2 + 0.8a – 12$

37. A vendor sells roses by the dozen. The number of dozen sold each week is about $N(p) = 317(0.95^p)$ dozen each week, at p dollars per dozen. Give an expression for the revenue the vendor takes in as a function of the price she sets.

$R(p) = 317p(0.95^p)$

Find the price per dozen which maximizes her revenue.

$R'(p) = 317[p(0.95^p)\ln(0.95) + 1\cdot(0.95^p)] = 0$

$p\ln(0.95) + 1 = 0$ $\quad$ $p = -1/\ln(0.95) = 19.4957$ dollars/dozen

38. The percentage of children living with their grandparents between 1970 and 2000 can be modeled by the equation $p(t) = [3 + 0.2e^{0.09t}]$ percent t years after 1970. Write a rate of change formula for p.

$p'(t) = 0.2e^{0.09t}(0.09)$ percent/year, t years after 1970

How rapidly was the percentage of children living with their grandparents growing in 1995? **Include units**.

$p'(25) = 0.17077$ percent/year

Maxima and Minima in Applications

39. Civilian deaths due to the influenza epidemic in 1918 can be modeled as $c(t) = \frac{94{,}000}{1 + 5{,}100e^{-1.1t}}$ deaths *t* weeks after August 31, 1918. Find a formula for the rate of change of the civilian deaths *t* weeks after August 31. **Include units**.

$c(t) = 94000(1 + 5100e^{-1.1t})^{-1}$

$c'(t) = -94000(1 + 5100e^{-1.1t})^{-2} \cdot 5100\ e^{-1.1t}(-1.1)$ deaths/week

40. The number of homes in the US with TVs from 1970 to 1990 is modeled by

$N(t) = 5.7t - 52.8$ millions of homes, t years after 1970.

The percentage of homes with American TVs which had VCRs was about

$P(t) = 0.01(1.6^t)$ percent, t years after 1970.

Find a rate of change formula for the number of US homes with VCRs.

$H(t) = (5.7t - 52.8)0.01(1.6^t)/100$

$\quad\ = 10^{-4}[(5.7t - 52.8)(1.6^t)]$

$H'(t) = 10^{-4}[(5.7t - 52.8)(1.6^t)\ln(1.6) + 5.7(1.6^t)]$