What is the difference between a relative extremum and an absolute extremum?

Can a relative extremum be an absolute extremum? Is a relative extremum necessarily an absolute extremum?

nd the absolute extrema if they exist, as well as all values of x ere they occur, for each function, and specified domain. If u have one, use a graphing calculator to verify your answers.

$f(x) = x^3 - 6x^2 + 9x - 8; \quad [0, 5]$

$f(x) = x^3 - 3x^2 - 24x + 5; \quad [-3, 6]$

$f(x) = \frac{1}{3}x^3 + \frac{3}{2}x^2 - 4x + 1; \quad [-5, 2]$

$f(x) = \frac{1}{3}x^3 - \frac{1}{2}x^2 - 6x + 3; \quad [-4, 4]$

$f(x) = x^4 - 18x^2 + 1; \quad [-4, 4]$

$f(x) = x^4 - 32x^2 - 7; \quad [-5, 6]$

$f(x) = \frac{1-x}{3+x}; \quad [0, 3]$ **18.** $f(x) = \frac{8+x}{8-x}; \quad [4, 6]$

$f(x) = \frac{x-1}{x^2+1}; \quad [1, 5]$ **20.** $f(x) = \frac{x}{x^2+2}; \quad [0, 4]$

$f(x) = (x^2 - 4)^{1/3}; \quad [-2, 3]$

$f(x) = (x^2 - 16)^{2/3}; \quad [-5, 8]$

$f(x) = 5x^{2/3} + 2x^{5/3}; \quad [-2, 1]$

$f(x) = x + 3x^{2/3}; \quad [-10, 1]$

$f(x) = x^2 - 8\ln x; \quad [1, 4]$ **26.** $f(x) = \frac{\ln x}{x^2}; \quad [1, 4]$

$f(x) = x + e^{-3x}; \quad [-1, 3]$ **28.** $f(x) = x^2e^{-0.5x}; \quad [2, 5]$

aph each function on the indicated domain, and use the pabilities of your calculator to find the location and value of e absolute extrema.

$f(x) = \frac{-5x^4 + 2x^3 + 3x^2 + 9}{x^4 - x^3 + x^2 + 7}; \quad [-1, 1]$

$f(x) = \frac{x^3 + 2x + 5}{x^4 + 3x^3 + 10}; \quad [-3, 0]$

nd the absolute extrema if they exist, as well as all values of x ere they occur.

$f(x) = 2x + \frac{8}{x^2} + 1, \quad x > 0$

$f(x) = 12 - x - \frac{9}{x}, \quad x > 0$

$f(x) = -3x^4 + 8x^3 + 18x^2 + 2$

$f(x) = x^4 - 4x^3 + 4x^2 + 1$

$f(x) = \frac{x-1}{x^2 + 2x + 6}$ **36.** $f(x) = \frac{x}{x^2+1}$

$f(x) = \frac{\ln x}{x^3}$ **38.** $f(x) = x\ln x$

39. Find the absolute maximum and minimum of $f(x) = 2x - 3x^{2/3}$ **(a)** on the interval $[-1, 0.5]$; **(b)** on the interval $[0.5, 2]$.

40. Let $f(x) = e^{-2x}$. For $x > 0$, let $P(x)$ be the perimeter of the rectangle with vertices $(0, 0)$, $(x, 0)$, $(x, f(x))$ and $(0, f(x))$. Which of the following statements is true? *Source: Society of Actuaries.*

a. The function P has an absolute minimum but not an absolute maximum on the interval $(0, \infty)$.

b. The function P has an absolute maximum but not an absolute minimum on the interval $(0, \infty)$.

c. The function P has both an absolute minimum and an absolute maximum on the interval $(0, \infty)$.

d. The function P has neither an absolute maximum nor an absolute minimum on the interval $(0, \infty)$, but the graph of the function P does have an inflection point with positive x-coordinate.

e. The function P has neither an absolute maximum nor an absolute minimum on the interval $(0, \infty)$, and the graph of the function P does not have an inflection point with positive x-coordinate.

APPLICATIONS

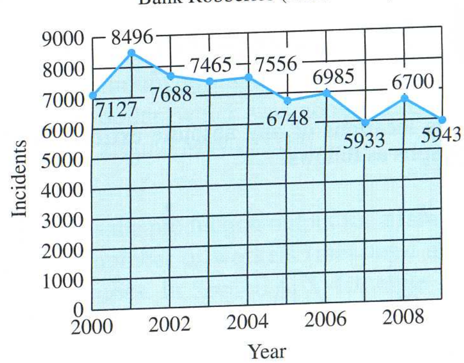
Business and Economics

41. Bank Robberies The number of bank robberies in the United States for the years 2000–2009 is given in the following figure. Consider the closed interval [2000, 2009]. *Source: FBI.*

a. Give all relative maxima and minima and when they occur on the interval.

b. Give the absolute maxima and minima and when they occur on the interval. Interpret your results.

Bank Robberies (2000–2009)

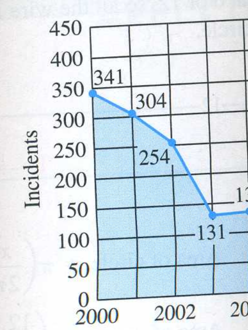


42. Bank Burglaries The number of bank burglaries (entry into or theft from a bank during nonbusiness hours) in the United States for the years 2000–2009 is given in the figure on the following page. Consider the closed interval [2000, 2009]. *Source: FBI.*

a. Give all relative maxima and minima and when they occur on the interval.

b. Give the absolute maxima an on the interval. Interpret you

Bank Burglar



43. Profit The total profit $P(x)$ (sale of x hundred thousand aut

$P(x) = -x^3 + 9x^2 +$

Find the number of hundred th to maximize profit. Find the m

44. Profit A company has found sale of x units of an auto part

$P(x) = -0.02x^3$

Production bottlenecks limit made per week to no more tha requires that at least 50 units b imum possible weekly profit t

Average Cost Find the minimu the given cost function on the gi

45. $C(x) = x^3 + 37x + 250$ on

a. $1 \le x \le 10$

46. $C(x) = 81x^2 + 17x + 324$

a. $1 \le x \le 10$

Cost Each graph gives the co level. Use the method of grap the production level that result produced.

47.