

Calculus Optimization Problems/Related Rates Problems Solutions

- 1) A farmer has 400 yards of fencing and wishes to fence three sides of a rectangular field (the fourth side is along an existing stone wall, and needs no additional fencing). Find the dimensions of the rectangular field of largest area that can be fenced.

$$2x + y = 400 \Rightarrow y = 400 - 2x$$

$$A(x) = x(400 - 2x) = 400x - 2x^2$$

$$A'(x) = 400 - 4x \quad 400 - 4x = 0 \Rightarrow x = 100$$

$$A''(x) = -4$$

By the 2nd derivative test, the dimensions would be 100 yd by 200 yd.

- 2) A metal box (without a top) is to be constructed from a square sheet of metal that is 20 cm on a side by cutting square pieces of the same size from the corners of the sheet and then folding up the sides. Find the dimensions of the box with the largest volume that can be constructed in this manner.

$$V(x) = x(20 - 2x)(20 - 2x) = 400x - 80x^2 + 4x^3$$

$$V'(x) = 400 - 160x + 12x^2$$

$$400 - 160x + 12x^2 = 0 \Rightarrow 4(100 - 40x + 3x^2) = 0 \Rightarrow 4(3x - 10)(x - 10) \Rightarrow x = \frac{10}{3}, 10$$

$$V''(x) = -160 + 24x \quad V''\left(\frac{10}{3}\right) = -160 + 80 < 0 \quad V''(10) = -160 + 240 > 0$$

By the 2nd derivative test, the dimensions would be $\frac{10}{3}$ cm by $\frac{40}{3}$ cm by $\frac{40}{3}$ cm

- 3) A rectangular field adjacent to a river is to be enclosed. Fencing along the river costs \$5 per meter, and the fencing for the other sides costs \$3 per meter. The area of the field is to be 1200 square meters. Find the dimensions of the field that is the least expensive to enclose.

Call the length of fence along the river x , and the length perpendicular to the river y .

$$C(x) = 5x + 3(2y + x) \quad xy = 1200 \Rightarrow y = \frac{1200}{x} \Rightarrow C(x) = 8x + \frac{7200}{x}$$

$$C'(x) = 8 - \frac{7200}{x^2} \quad 8 - \frac{7200}{x^2} = 0 \Rightarrow 8x^2 = 7200 \Rightarrow x^2 = 900 \Rightarrow x = 30$$

$$C''(x) = \frac{14400}{x^3} \quad C''(30) = \frac{14400}{30^3} > 0$$

By the 2nd derivative test, a field that is 30 m along the river by 40 m perpendicular to the river would be least expensive.

- 4) A 4-meter length of stiff wire is cut in two pieces. One piece is bent into the shape of a square and the other into a rectangle whose length is 3 times its width. Let x be the length of the side of the square.

a) Find a formula $A(x)$, the sum of the areas of the square and rectangle, in terms of the variable x .

The length of wire left for the rectangle is $4 - 4x$. In the rectangle, $l = 3w$. $4 - 4x = 2(3w) + 2w$,

$$\text{so } w = \frac{4 - 4x}{8} = \frac{1 - x}{2} \Rightarrow l = \frac{3 - 3x}{2}. \quad A(x) = x^2 + \left(\frac{3 - 3x}{2}\right)\left(\frac{1 - x}{2}\right)$$

Calculus Optimization Problems And Solutions

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Mathematical Programming with Data Perturbations Anthony V. Fiacco,2020-09-23 Presents research contributions and tutorial expositions on current methodologies for sensitivity stability and approximation analyses of mathematical programming and related problem structures involving parameters The text features up to date findings on important topics covering such areas as the effect of perturbations on the performance of algorithms approximation techniques for optimal control problems and global error bounds for convex inequalities

Fuzzy Systems and Data Mining II Shilei Sun, Antonio J. Tallón-Ballesteros, Dragan S. Pamucar, Feng Liu,2016-11-15 Fuzzy systems and data mining are now an essential part of information technology and data management with applications affecting every imaginable aspect of our daily lives This book contains 81 selected papers from those accepted and presented at the 2nd international conference on Fuzzy Systems and Data Mining FSDM2016 held in Macau China in December 2016 This annual conference focuses on 4 main groups of topics fuzzy theory algorithm and system fuzzy applications the interdisciplinary field of fuzzy logic and data mining and data mining and the event provided a forum where more than 100 qualified high level researchers and experts from over 20 countries including 4 keynote speakers gathered to create an important platform for researchers and engineers worldwide to engage in academic communication All the papers collected here present original ideas methods and results of general significance supported by clear reasoning and compelling evidence and as such the book represents a valuable and wide ranging reference resource of interest to all those whose work involves fuzzy systems and data mining

Scientific Computing with MATLAB Dingyu Xue, YangQuan Chen,2018-09-03 Scientific Computing with MATLAB Second Edition improves students ability to tackle mathematical problems It helps students understand the mathematical background and find reliable and accurate solutions to mathematical problems with the use of MATLAB avoiding the tedious and complex technical details of mathematics This edition retains the structure of its predecessor while expanding and updating the content of each chapter The book bridges the gap between problems and solutions through well grouped topics

and clear MATLAB example scripts and reproducible MATLAB generated plots Students can effortlessly experiment with the scripts for a deep hands on exploration Each chapter also includes a set of problems to strengthen understanding of the material

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Abstracts of Papers Presented to the American Mathematical Society American Mathematical Society, 2008

Empirical Production Analysis and Optimal Technological Choice for Economists Judy A. Whitehead, 1990

Business and Industry Symposium Maurice Ades, Thong Hang, Larry M. Deschaine, 2004

Advances in Design Automation, 1990: Optimal design and mechanical systems analysis Bahram Ravani, 1990

EES Series Report University of Arizona. Engineering Experiment Station, 1963

Systems & Control Encyclopedia Madan G. Singh, 1987 This comprehensive reference work provides information on what systems thinking comprises and how it is being used to understand and to attack a wide spectrum of diverse problems ranging from for example the control of servo mechanisms to applications of space technology

Proceedings of the ... International IEEE Conference on Tools for Artificial Intelligence, 1999

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Foundations of Optimum Design in Civil Engineering Andrzej Marek Brandt, 1989

Robotics G. R. Pennock, 1994

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The Australian Journal of Science, 1966

Nonsmooth Mechanics of Solids Jaroslav Haslinger, Georgios E. Stavroulakis, 2006-11-21

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