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:

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

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

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

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, $l = 3w$. $4 - 4x = 2(3w) + 2w$,

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

Calculus Optimization Problems Solutions

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Calculus Optimization Problems Solutions:

Mathematical Modelling J. Caldwell,Y.M. Ram,2013-06-29 Over the past decade there has been an increasing demand for suitable material in the area of mathematical modelling as applied to science and engineering There has been a constant movement in the emphasis from developing proficiency in purely mathematical techniques to an approach which caters for industrial and scientific applications in emerging new technologies In this textbook we have attempted to present the important fundamental concepts of mathematical modelling and to demonstrate their use in solving certain scientific and engineering problems This text which serves as a general introduction to the area of mathematical modelling is aimed at advanced undergraduate students in mathematics or closely related disciplines e g students who have some prerequisite knowledge such as one variable calculus linear algebra and ordinary differential equations Some prior knowledge of computer programming would be useful but is not considered essential The text also contains some more challenging material which could prove attractive to graduate students in engineering or science who are involved in mathematical modelling In preparing the text we have tried to use our experience of teaching mathematical modelling to undergraduate students in a wide range of areas including mathematics and computer science and disciplines in engineering and science An important aspect of the text is the use made of scientific computer software packages such as MAPLE for symbolic algebraic manipulations and MA TLAB for numerical simulation **Handbook of Computer Animation** John Vince,2012-12-06 One of the challenges facing professionals working in computer animation is keeping abreast of the latest developments and future trends some of which are determined by industry where the state of the art is continuously being re defined by the latest computer generated film special effects while others arise from research projects whose results are quickly taken on board by programmers and animators working in industry This handbook will be an invaluable toolkit for programmers technical directors and professionals working in computer animation A wide range of topics are covered including Computer games Evolutionary algorithms Shooting and live action Digital effects Cubic curves and surfaces Subdivision surfaces Rendering and shading Written by a team of experienced practitioners each chapter provides a clear and precise overview of each area reflecting the dynamic and fast moving field of computer animation This is a complete and up to date reference book on the state of the art techniques used in computer animation **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   *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   *Abstracts of Papers Presented to the American Mathematical Society* American Mathematical Society,2008   **Microeconomics: A Computational Approach** Gerald E. Thompson,2016-07-08 This concise and comprehensive introduction to economics offers readers at all levels a more realistic approach to understanding the elements of resource and product markets including the role of business decisions technological change product differentiation uncertainty and the optimal location of activities With the book s easy to use software package for computations even non economists will become strongly motivated and can gain a proficiency in economic analysis as well as in practical and professional decision making skills End of chapter problems computer exercises programming examples and numerous diagrams further enhance the book s usefulness   *Empirical Production Analysis and Optimal Technological Choice for Economists* Judy A. Whitehead,1990   **Current Engineering Practice** ,1986   **Advances in Design Automation, 1990: Optimal design and mechanical systems analysis** Bahram Ravani,1990   **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   *Mathematical Reviews* ,2004   Business and Industry Symposium Maurice Ades,Thong Hang,Larry M. Deschaine,2004   **Promotional Decision Making: Practice and Theory** Patrick J. Robinson,David Johnston Luck,1964   **Systems Analysis for Civil**

Engineers Paul J. Ossenbruggen,1984-01-18 A systems analysis text which introduces fundamental methods of optimization including graphical and numerical methods and the principles of engineering economics to the planning analysis design and management of civil engineering systems Designed for undergraduates majoring in civil engineering Includes practical problems   *Numerical Methods in Engineering Practice* Amir Wadi Al-Khafaji,John R. Tooley,1986 A comprehensive and detailed treatment of classical and contemporary numerical methods for undergraduate students of engineering The text emphasizes how to apply the methods to solve practical engineering problems covering over 300 projects drawn from civil mechanical and electrical engineering   *International Aerospace Abstracts* ,1970   *Transactions of the ASAE.* American Society of Agricultural Engineers,1967   Proceedings ,1988   *The British National Bibliography* Arthur James Wells,1972

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