

TeX code compiled with `\documentclass{beamer}` using the Amsterdam theme.

`\begin{document} \begin{frame} \LARGE` Find two numbers whose difference is \$140\$ and whose product is a minimum. `\vspace{\stretch{1}}` Find the dimensions of a rectangle with perimeter \$60\$ meters whose area is as large as possible. `\end{frame} \begin{frame}` Consider the following problem: A box with an open top is to be constructed from a square piece of cardboard, \$3\$ feet wide, by cutting out a square from each of the four corners and bending up the sides. Find the largest volume that such a box can have. `\begin{enumerate}[a)] \item` Draw several diagrams to illustrate the situation, some short boxes with large bases and some tall boxes with small bases. Find the volumes of several such boxes. `\vskip 15pt \item` Draw a diagram illustrating the general situation. Let  $x$  denote the length of the side of the square being cut out. Let  $y$  denote the length of the base. `\vskip 15pt \item` Write an expression for the volume  $V$  in terms of  $x$  and  $y$ . `\vskip 15pt \item` Use the given information to write an equation that relates the variables  $x$  and  $y$ . `\vskip 15pt \item` Use part (d) to write the volume as a function of  $x$ . `\vskip 15pt \item` Finish solving the problem by finding the largest volume that such a box can have. `\end{enumerate} \end{frame} \begin{frame} \LARGE` A rectangular storage container with an open top is to have a volume of \$10\$ cubic meters. The length of this base is twice the width. Material for the base costs \$5\$ per square meter. Material for the sides costs \$3\$ per square meter. Find the cost of materials for the cheapest such container. (Round your answer to the nearest cent.) `\end{frame} \begin{frame} \Large` A manufacturer has been selling \$1000\$ flat-screen TVs a week at \$350\$ each. A market survey indicates that for each \$10\$ rebate offered to the buyer, the number of TVs sold will increase by \$100\$ per week. `\begin{enumerate}[a)] \item` Find the demand function (price  $p$  as a function of units sold  $x$ ). `\item` How large a rebate should the company offer the buyer in order to maximize its revenue? `\item` If its weekly cost function is  $C(x) = 60,000 + 120x$  how should the manufacturer set the size of the rebate in order to maximize its profit? `\end{enumerate} \end{frame} \begin{frame} \LARGE` A boat leaves a dock at \$1\$ PM and travels due south at a speed of \$20\$ km/h. Another boat has been heading due east at \$15\$ km/h and reaches the same dock at \$2\$ PM. How many minutes after \$1\$ PM were the two boats closest together? `\end{frame} \begin{frame} \LARGE` At which points on the curve  $y = 1 + 40x^3 - 3x^5$  does the tangent line have the largest slope? `\end{frame} \begin{frame} \LARGE` A piece of wire \$30\$ m long is cut into two pieces. One piece is bent into a square and the other is bent into an equilateral triangle. `\vskip 5pt \begin{enumerate}[a)] \item` How much wire should be used for the square in order to maximize the total area? `\vskip 15pt \item` How much wire should be used for the square in order to minimize the total area? `\end{enumerate} \end{frame} \begin{frame} \LARGE` A Norman window has the shape of a rectangle surmounted by a semicircle. (Thus the diameter  $x$  of the semicircle is equal to the width of the rectangle.) If the perimeter of the window is \$32\$ ft, find the value of  $x$  so that the greatest possible amount of light is admitted. `\vspace{\stretch{1}}` `\end{frame} \begin{frame}` A designer wants to introduce a new line of bookcases. He wants to make at least \$100\$ bookcases, but not more than \$2000\$ of them. He predicts the cost of producing  $x$  bookcases is  $C(x)$ . Assume that  $C(x)$  is a differentiable function. Which of the following must he do to find the minimum average cost,  $c(x) = \frac{C(x)}{x}$ ? `\begin{enumerate} \item[\bf I]` find the points where  $c'(x) = 0$  and evaluate  $c(x)$  there `\item[\bf II]` compute  $c''(x)$  to check which of the critical points in (I) are local maxima. `\item[\bf III]` check the values of  $c$  at the endpoints of its domain. `\end{enumerate} \begin{enumerate} \item I only \item II only \item I and III only \item I, II and III \end{enumerate} \end{frame} \begin{frame}` The rate (in appropriate units) at which photosynthesis takes place for a species of phytoplankton is modeled by the function  $P = \frac{120I}{I^2 + I + 4}$  where  $I$  is the light intensity (measured in thousands of foot-candles). For what light intensity is  $P$  a maximum? `\end{frame} \begin{frame}` What is the maximum vertical distance between the line  $y = x + 6$  and the parabola  $y = x^2$  for  $-2 \leq x \leq 3$ ? `\end{frame} \begin{frame}` Find the area of the largest rectangle that can be inscribed in the

ellipse  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

An oil refinery is located 1 km north of the north bank of a straight river that is 1 km wide. A pipeline is to be constructed from the refinery to storage tanks located on the south bank of the river 6 km east of the refinery. The cost of laying pipe is \$400,000 km over land to a point P on the north bank and \$800,000 km under the river to the tanks. To minimize the cost of the pipeline, how far downriver from the refinery should the point P be located?

From:

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