Find two numbers whose difference is 150 and whose product is a minimum.

Let x = 1st #
Let y = 2nd #

$P = xy$

$x - y = 150$

$x - 150 = y$

$P = x(x - 150)$

$P = x^2 - 150x$

$P' = 2x - 150$

$0 = 2x - 150$

$150 = 2x$

$x = 75$

$x - y = 150$

$75 - y = 150$

$75 - 150 = y$

$-75 = y$

The 2 #'s are 75 & -75

Apr 28-7:29 PM

Calculus 120
Unit 4: Applications of Differentiation

May 9, 2019: Day #10

1. New Assignments

2. Missed Quiz

Jan 9-1:43 PM

Curriculum Outcomes

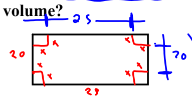
C8: Use Calculus techniques to sketch the graph of a function.

C9: Use Calculus techniques to solve optimization problems

C11: Use Calculus techniques to solve problems involving related rates.

Jan 24-9:32 AM

An open-top box is to be made by cutting squares of side length x from the corners of a 20 by 25 inch sheet of tin and bending up the sides. How large should the squares be to make the box hold as much as possible. What is the resulting maximum volume?



$V = l \times w \times h$

$V = (25 - 2x)(20 - 2x)\,x$

$V = (500 - 50x - 40x + 4x^2)\,x$

$V = 500x - 90x^2 + 4x^3$

$V' = 12x^2 - 180x + 500$

$0 = 12(x^2 - 15x + 41.7)$

$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$x = \frac{15 \pm \sqrt{(-15)^2 - 4(1)(41.7)}}{2(1)}$

$x = \frac{15 \pm \sqrt{225 - 166.8}}{2}$

$x = \frac{15 \pm \sqrt{58.2}}{2}$

$x = \frac{15 \pm 7.6}{2}$

$x = \frac{15 + 7.6}{2}$ or $\frac{15 - 7.6}{2}$

~~$x = 11.3$~~ or $x = 3.7$

Too Big

$V = (25 - 2x)(20 - 2x)(x)$

$V = (25 - 2(3.7))(20 - 2(3.7))(3.7)$

$V = (17.6)(12.6)(3.7)$

$V = 820.5 \text{ in}^3$

May 9-3:54 PM

You have been asked to design a one-litre (1000 cm³) oil can shaped like a right circular cylinder. What dimensions will use the least material? min S.A.

r = 5.4
h = 10.9

$V = \pi r^2 h$

$SA = 2\pi r^2 + 2\pi rh$

$\frac{1000}{\pi r^2} = \frac{\pi r^2 h}{\pi r^2}$

$\frac{1000}{\pi r^2} = h$

$SA = 2\pi r^2 + 2\pi r\left(\frac{1000}{\pi r^2}\right)$

$SA = 2\pi r^2 + \frac{2000}{r}$

$SA = 2\pi r^2 + 2000r^{-1}$

$SA' = 4\pi r - 2000r^{-2}$

$0 = 4\pi r - \frac{2000}{r^2}$

$\frac{2000}{r^2} = 4\pi r$

$4\pi r^3 = 2000$

$r^3 = \frac{2000}{4\pi}$

$r = \sqrt[3]{\frac{500}{\pi}}$

$r = 5.4$

$h = \frac{1000}{\pi(5.4)^2}$

$h = 10.9$

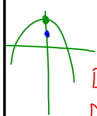
r = 5.4 cm and height is 10.9 cm

Apr 28-12:47 PM

Find the points on the parabola $y = 6 - x^2$ that are closest to the point (0, 3).

$y = -x^2 + 6$

$\left(\pm\frac{\sqrt{5}}{\sqrt{2}}, \frac{7}{2}\right)$ $(0, 6)$



Minimize Distance

$D = \sqrt{(x - x_1)^2 + (y - y_1)^2}$

$D = \sqrt{(x - 0)^2 + (y - 3)^2}$

$D = \sqrt{x^2 + (6 - x^2 - 3)^2}$

$D = \sqrt{x^2 + (3 - x^2)^2}$

$D = \sqrt{x^2 + (9 - 6x^2 + x^4)}$

$D = \sqrt{x^4 - 5x^2 + 9}$

$D = (x^4 - 5x^2 + 9)^{1/2}$

$D' = \frac{1}{2}(x^4 - 5x^2 + 9)^{-1/2}(4x^3 - 10x)$

$D' = \frac{4x^3 - 10x}{2\sqrt{x^4 - 5x^2 + 9}}$

$0 = \frac{4x^3 - 10x}{2\sqrt{x^4 - 5x^2 + 9}}$

$0 = 4x^3 - 10x$

$0 = 2x(2x^2 - 5)$

$0 = 2x(\sqrt{2}x - \sqrt{5})(\sqrt{2}x + \sqrt{5})$

$x = 0$ or $x = \frac{\sqrt{5}}{\sqrt{2}}$ or $x = -\frac{\sqrt{5}}{\sqrt{2}}$

$(2x + 1)$

$-\frac{1}{2}$

$f(0) = 6$

$f\left(\frac{\sqrt{5}}{\sqrt{2}}\right) = 6 - \left(\frac{\sqrt{5}}{\sqrt{2}}\right)^2$

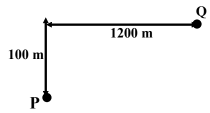
$= 6 - \frac{5}{2}$

$= \frac{12}{2} - \frac{5}{2}$

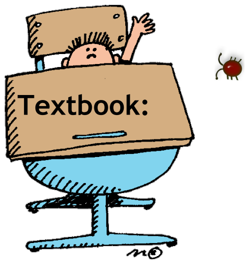
$= \frac{7}{2}$

Apr 28-9:20 AM

A cable television company is laying cable in an area with underground utilities. Two subdivisions are located on opposite sides of Willow Creek, which is 100 m wide. The company has to connect Points P and Q with cable, where Q is on the north bank, 1200 m east of P. It costs $40/m to lay cable underground and $80/m to lay cable underwater. What is the least expensive way to lay the cable.



May 2-10:56 AM



Assignment!

Jan 13-9:38 PM

Apr 26-3:37 PM

Attachments

2.1_74_AP.html

2.1_74_AP.swf

2.1_74_AP.html