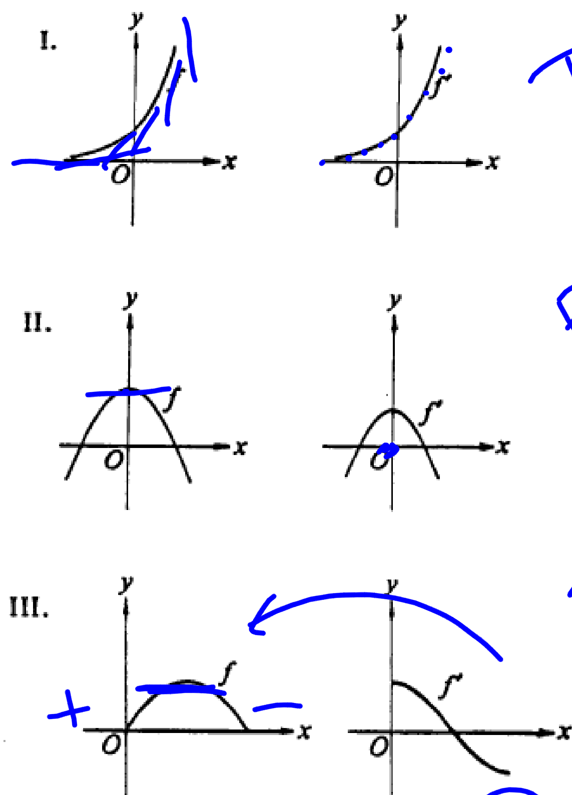
Which of the following pairs of graphs could represent the graph of a function and the graph of its derivative?



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(A) I only (B) II only (C) III only (D) I and III (E) II and III

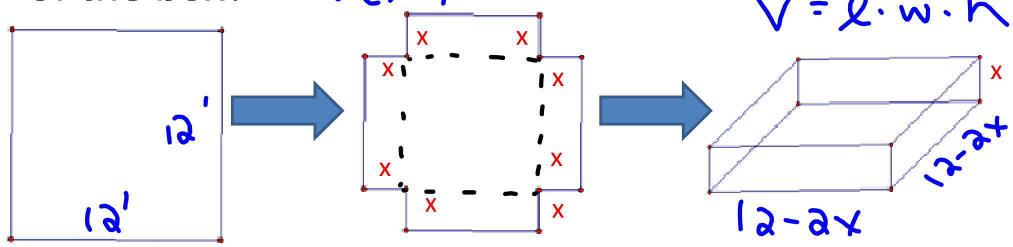
4-4 day 1 Optimization: Designing Containers

Learning Objectives:

I can use derivatives to identify to optimize quantities in real world situations.

Ex1. An open top box is to be made by cutting side lengths x from the corners of a 12 in by 12 in piece of cardboard and bending up the sides. How large should the squares be to make the box hold as much as possible? What is the maximum possible volume of the box? $V(x)$

$V = l \cdot w \cdot h$



D: (0,6)

$$\overset{8}{(12-2x)} \cdot \overset{8}{(12-2x)} \cdot \overset{2}{x}$$

$$V=(12-2x)(12-2x)\cdot x$$

Candidates
endpts: $x=0,6$
der undf: N/A
der $=0$: $x=2$

$$V=(144-48x+4x^2)\cdot x$$
$$V=144x-48x^2+4x^3$$
$$V'=12x^2-96x+144$$
$$0=12(x^2-8x+12)$$
$$0=12(x-2)(x-6)$$
$$x=2,6$$

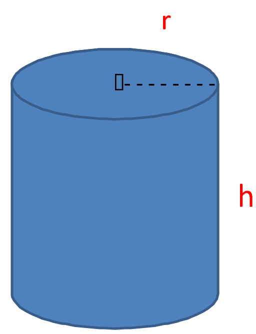
$$V''=24x-96$$
$x=2$ $V''= -$ ⌒ max

$\boxed{\text{x=2 in yields a max volume of } 128 \text{ in}^3}$

D: $(0,\infty)$

Ex1. You are designing a container to hold $\boxed{100\text{ in}^3}$ of liquid. You want to minimize the cost by building the container with the least material possible. What dimensions do that?

objective: Min SA



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

$SA = 2\cancel{\pi}\cancel{r}\left(\frac{100}{\cancel{\pi} r^{\cancel{2}}}\right) + 2\pi r^2$

$SA = \frac{200}{r} + 2\pi r^2$

$SA = 200r^{-1} + 2\pi r^2$

$SA' = -200r^{-2} + 4\pi r$

$SA' = -\frac{200}{r^2} + 4\pi r$

$V = \pi r^2 h$

$100 = \pi r^2 h$

$h = \frac{100}{\pi r^2}$

candidates

endpts: none

der=0:

der=undef: ~~r=0~~

$\left[0 = \frac{-200}{r^2} + 4\pi r\right] r^2$

$0 = -200 + 4\pi r^3$

$200 = 4\pi r^3$

$\frac{200}{4\pi} = r^3$

$\frac{50}{\pi} = r^3$ $\quad r = \sqrt[3]{\frac{50}{\pi}}$

$r \approx 2.5154$

$SA'' = 400r^{-3} + 4\pi$

$= \frac{400}{r^3} + 4\pi$

$S''(2.5154) = +$ $\cup$ min

$$\boxed{r = \sqrt[3]{\frac{50}{\pi}} \text{ and } h \approx \frac{100}{\pi\left(\sqrt[3]{\frac{50}{\pi}}\right)^2} \text{ yields a min SA}}$$

Oct 26-11:16 AM

Homework

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