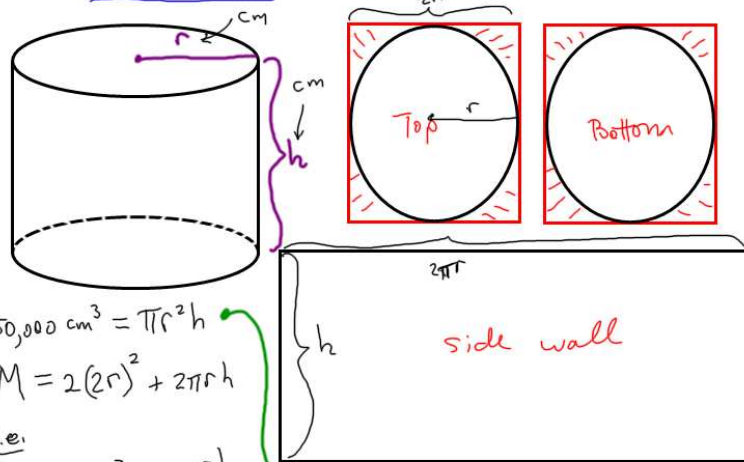


Info...

- **Test 3** is scheduled for November 1-5. The scheduler opens on October 18th.
- **EMCFs** and **Homework** are posted.
- **Homework** is due today, and an **Online Quiz** is due tonight.

Some *More* Max/Min
Word Problems...
(section 4.5)

Example: Many cylindrical containers must be constructed to hold 50 liters. The material for the containers will be cut from rectangular sheets of metal, and any scrap will be recycled, but considered lost to the project. Give the dimensions of the containers that require the least amount of material. Note: 1 liter = 1000 cm³.



$$50,000 \text{ cm}^3 = \pi r^2 h$$

$$M = 2(2r)^2 + 2\pi r h$$

i.e.

$$M = 8r^2 + 2\pi r h$$

$$h = \frac{50,000}{\pi r^2}$$

$$M(r) = 8r^2 + \frac{100,000}{r}, \quad 0 < r < \infty$$

↪ minimize this

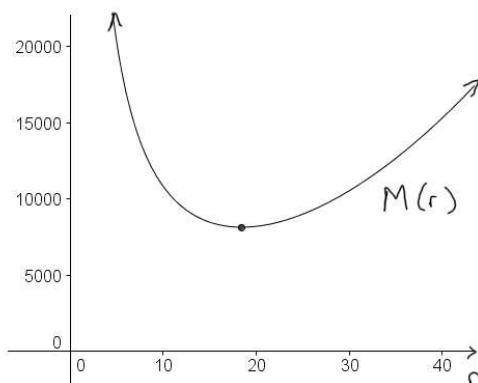
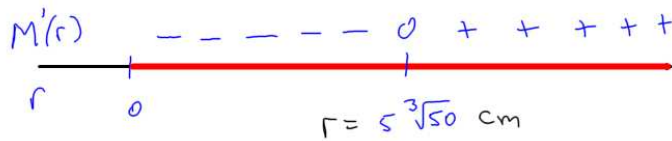
$$M'(r) = 16r - \frac{100,000}{r^2}, \quad 0 < r < \infty$$

C.N.: $M'(r) = 0$

$$\frac{16r^3 - 100,000}{r^2} = 0$$

$$16r^3 = 100,000 \Rightarrow r^3 = \frac{100,000}{16}$$

$$r = \frac{10\sqrt[3]{100}}{2\sqrt[3]{2}} = 5\sqrt[3]{50}$$

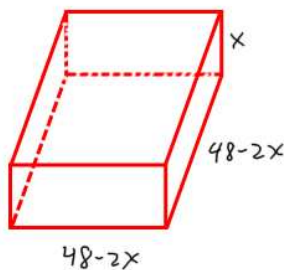
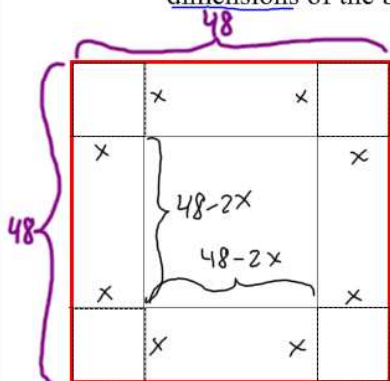


Global Min.
Absolute min

$$h = \frac{50,000}{\pi r^2}$$

$$= \frac{50,000}{\pi (5\sqrt[3]{50})^2} \text{ cm}$$

Example: A box with an open top is to be constructed from a square piece of material that is 48 inches on a side, by cutting equal squares from the corners and turning up the sides. Find the dimensions of the box with the greatest volume.



$$V = x(48-2x)^2, \quad 0 \leq x \leq 24$$

1. $V(0) = 0$, $V(24) = 0$

2. $V' = x \cdot (-4)(48-2x) + (48-2x)^2$
exists for all x .

c.n.: Set $V' = 0$

$$-4x(48-2x) + (48-2x)^2 = 0$$

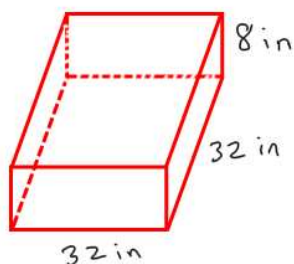
$$(48-2x)[-4x + 48-2x] = 0$$

$$\Leftrightarrow \begin{array}{l} 48-2x=0 \\ x=24 \end{array} \quad \text{or} \quad \begin{array}{l} 48-6x=0 \\ x=8 \end{array}$$

$$V(24) = 0 \quad V(8) = 8 \cdot (32)^2$$

$$V = x(48-2x)^2 = 8 \cdot (1024) = 8,192$$

3. Compare \Rightarrow Abs. max volume is $8,192 \text{ in}^3$



with the dimensions shown.
i.e. base 32×32 and height 8.