Today's Plan:

Learning Target (standard): I will solve real-world optimization application problems.

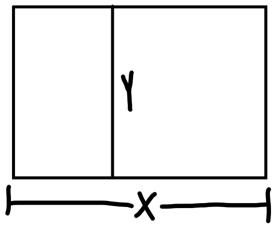
Students will: Complete practice problems over previous concepts at the boards, put up homework problems on the board and make necessary corrections to their own work, take notes over new material and complete practice problems over new concepts.

Teacher will: Provide practice problems over previous concepts, check homework problems for accuracy and provide students feedback, describe and provide examples of new concepts and assign students assessment problems over new concepts.

Assessment: Board work, homework check and homework assignment

Differentiation: Students will work at the board, go over and correct homework at their seats, actively engage in lecture over new concepts, practice new concepts with the aid of other students and the teacher and complete homework assignment.

A rectangular warehouse that is to have two rectangular rooms separated by one interior wall must have 5000 square feet of floor space. The cost of exterior walls is $150 per foot, and the cost of interior walls is $90 per foot. Find the dimensions of the least expensive warehouse.



$A = 5000\text{ ft}^2$

$5000 = xy$ $\quad y = \frac{5000}{x}$ $\quad \boxed{y = 5000x^{-1}}$

$C = 150(2x) + 150(2y) + 90y$

$C = 300x + 300y + 90y$

$C = 300x + 390y$

$C(x) = 300x + 390(5000x^{-1})$

$C(x) = 300x + 1950000x^{-1}$

$C'(x) = 300 - 1950000x^{-2}$

$0 = 300x^{-2}(x^2 - 6500)$ $\quad C''(x) = 3900000x^{-3}$

$x^2 - 6500 = 0$ $\quad C''(10\sqrt{65}) > 0$

$\sqrt{x^2} = \pm\sqrt{6500}$ $\quad$ min @ $x = 10\sqrt{65}$

$x = 10\sqrt{65}, -10\sqrt{65}$

Critical #s:

$x = \cancel{0}, 10\sqrt{65}, \cancel{-10\sqrt{65}}$

$y = \frac{5000}{10\sqrt{65}} = \frac{500}{\sqrt{65}} \cdot \frac{\sqrt{65}}{\sqrt{65}}$

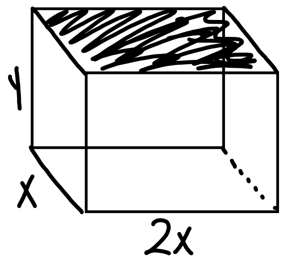
$= \frac{500\sqrt{65}}{65}$

$y = \frac{100\sqrt{65}}{13}$

$\therefore x = 10\sqrt{65}\text{ ft}$

$y = \frac{100\sqrt{65}}{13}\text{ ft}$

A rectangular storage container with an open top is to have a volume of 10m^3 and the length of its base is twice the width. Material for the base costs \$10 per square meter and material for the sides costs \$6 per square meter. Find the width of the box for the cheapest container.



$V = 10m^3$

$V = lwh$

$V = (2x)(x)y$

$V = 2x^2y$

$\boxed{10 = 2x^2y}$

$y = \frac{10}{2x^2}$

$\boxed{y = 5x^{-2}}$

$SA = 2(xy) + 2(2xy) + 2x^2$

$SA = 2xy + 4xy + \boxed{2x^2}$ base

$SA = 6xy + 2x^2$

$C = 6(6xy) + 10(2x^2)$

$C = 36xy + 20x^2$

$C(x) = 36x(5x^{-2}) + 20x^2$

$C(x) = 180x^{-1} + 20x^2$

$C'(x) = -180x^{-2} + 40x$

$0 = 20x^{-2}(-9 + 2x^3)$

$0 = 2x^3 - 9$

$2x^3 = 9$

$\sqrt[3]{x^3} = \sqrt[3]{\frac{9}{2}}$

$x = \frac{\sqrt[3]{9}}{\sqrt[3]{2}} \cdot \frac{\sqrt[3]{4}}{\sqrt[3]{4}}$

$x = \frac{\sqrt[3]{36}}{2}$

Critical #s:
$x = \cancel{0}, \frac{\sqrt[3]{36}}{2}$

$C''(x) = 360x^{-3} + 40$

$C''\left(\frac{\sqrt[3]{36}}{2}\right) > 0$ min @ $x = \frac{\sqrt[3]{36}}{2}$

$\therefore$ width is $\frac{\sqrt[3]{36}}{2}$ m

Assignment:

Applications of Extrema

#3 & 4

Applications of Extrema:

1) $V = 16\pi\sqrt{3}$ in^3

2) $x = 4\sqrt{2} \quad y = 4\sqrt{2}$

3) $V = \dfrac{500\sqrt{6\pi}}{9\pi}$ in^3

4) $h = \dfrac{2\sqrt[4]{675}}{3} \quad r = \dfrac{\sqrt[4]{2700}}{3}$

or

$h = \dfrac{2\sqrt{15\sqrt{3}}}{3}$

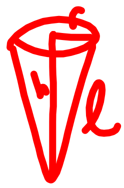
5) $r = 2 \quad h = 2$

6) $r = \dfrac{\sqrt[3]{\pi^2}}{\pi}$ ft

$h = \dfrac{\sqrt[3]{\pi^2}}{\pi}$ ft

7) $A = 294$ in^2

$SA = \pi r \ell$



$\ell^2 = h^2 + r^2$

$\ell = \sqrt{h^2 + r^2}$