# Today's Plan:

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

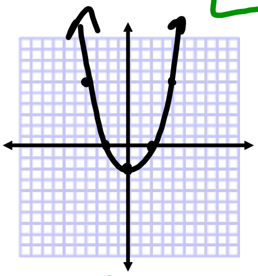
***Students will***: Complete practice problems over previous concepts at the boards, put up homework problems on the board and make necessary corrections to their own work, take notes over new material and complete practice problems over new concepts.

***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.

Find the point on $y = {}^1/_2 x^2 - 2$ that is closest to the origin. (0,0)



$y = \frac{1}{2}x^2 - 2$

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

$2y + 4 = x^2$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

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

$d = \sqrt{x^2 + y^2}$

$d(y) = \sqrt{2y + 4 + y^2}$

$d(y) = (y^2 + 2y + 4)^{\frac{1}{2}}$

$d'(y) = \frac{1}{2}(y^2 + 2y + 4)^{-\frac{1}{2}}(2y + 2)$

$d'(y) = \dfrac{y+1}{\sqrt{y^2 + 2y + 4}}$  $y + 1 = 0$  $y = -1$

critical #: $y = -1$

| Domain Interval | $y+1$ | $\sqrt{y^2+2y+4}$ | $d'(y)$ | $d(y)$ |
|---|---|---|---|---|
| $(-\infty, -1)$ | − | + | − | decreasing |
| $(-1, \infty)$ | + | + | + | increasing |

→ min @ $y = -1$

$y = \frac{1}{2}x^2 - 2$

$-1 = \frac{1}{2}x^2 - 2$

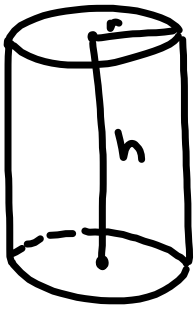
$1 = \frac{1}{2}x^2$

$\pm\sqrt{2} = \sqrt{x^2}$

$x = -\sqrt{2}, \sqrt{2}$

$(-\sqrt{2}, -1), (\sqrt{2}, -1)$

A cylindrical can is to be made to hold 1 L ($1000cm^3$) of oil. Find the radius that will minimize the cost of metal to manufacture the can.




$V = \pi r^2 h$

$1000 = \pi r^2 h$

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

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

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

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

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

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

$0 = 4r^{-2}(\pi r^3 - 500)$

$\pi r^3 - 500 = 0$

$\pi r^3 = 500$

$\sqrt[3]{r^3} = \sqrt[3]{\frac{500}{\pi}} \cdot \frac{\sqrt[3]{\pi^2}}{\sqrt[3]{\pi^2}}$

$r = \frac{\sqrt[3]{500\pi^2}}{\pi} = \frac{5\sqrt[3]{4\pi^2}}{\pi}$

Critical #s:

$r = 0, \frac{5\sqrt[3]{4\pi^2}}{\pi}$

$SA''(r) = 4\pi + 4000r^{-3}$

$SA''\left(\frac{5\sqrt[3]{4\pi^2}}{\pi}\right) = 4\pi + \frac{4000}{\left(\frac{5\sqrt[3]{4\pi^2}}{\pi}\right)^3}$

$SA''\left(\frac{5\sqrt[3]{4\pi^2}}{\pi}\right) > 0$

$\therefore$ min @ $r = \frac{5\sqrt[3]{4\pi^2}}{\pi}$

# Assignment:

## Optimization Review

## #1-4

* QUIZ on Tuesday *

# Optimization Review:

1) $x = 2\sqrt{2}$

$y = 2\sqrt{2}$

$Area = 16u^2$

2) $x = 750\,ft$

$y = 1500\,ft$

3) $x = \dfrac{7}{2}$

$y = \dfrac{\sqrt{14}}{2}$

4) $x = 4 + 2\sqrt{3}$

$profit = \$\left(48\sqrt{3} + 80\right)$ thousand