

Example Set#3

EVEN MORE OPTIMIZATION PROBLEMS

Note Title

1) DRAW A PICTURE

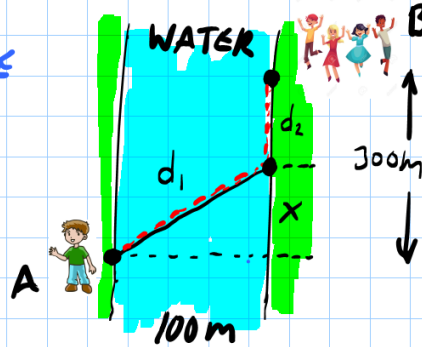
2) MINIMIZE WHAT?



TIME!

$$V = \frac{d}{t}$$

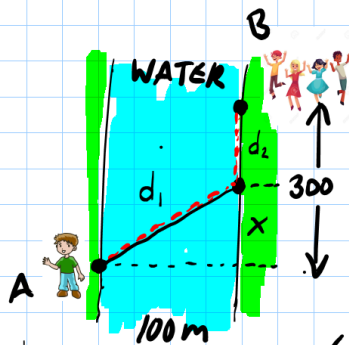
$$t = \frac{d}{V}$$



TOTAL TIME = SWIM TIME + RUN TIME

$$t = t_1 + t_2$$

$$t = \frac{d_1}{V_1} + \frac{d_2}{V_2}$$



$$t = \frac{d_1}{V_1} + \frac{d_2}{V_2}$$

$$t = \frac{d_1}{3} + \frac{d_2}{5}$$

SPEEDS

$$d_1^2 = 100^2 + x^2$$

$$t = \frac{\sqrt{100^2 + x^2}}{3} + \frac{(300 - x)}{5}$$

$$t = \frac{\sqrt{100^2 + x^2}}{3} + \frac{(300 - x)}{5}$$

NOW DO THE DERIVATIVE!

$$t = \frac{\sqrt{100^2 + x^2}}{3} + \frac{300 - x}{5}$$

$$t' = \frac{\frac{1}{2}(100^2 + x^2)^{-\frac{1}{2}} \cdot 2x}{3} - \frac{1}{5}$$

$$0 = \frac{2x}{3 \cdot 2 \sqrt{100^2 + x^2}} - \frac{1}{5}$$

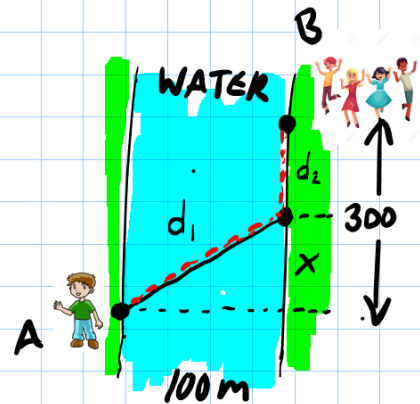
$$\frac{1}{5} = \frac{x}{3 \sqrt{100^2 + x^2}} \Rightarrow 3 \sqrt{100^2 + x^2} = 5x \quad \text{SQUARE BOTH SIDES}$$

$$9(100^2 + x^2) = 25x^2$$

$$9 \cdot 100^2 + 9x^2 = 25x^2$$

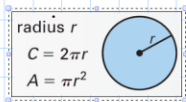
$$90000 = 16x^2$$

$$x = 75 \text{ m}$$



Window problem next page.

WINDOW



1 OBJECTIVE EQUATION:

AREA

AREA = SEMI CIRCLE + RECTANGLE

$$\text{AREA} = \frac{1}{2} \pi r^2 + 2rl$$

2 CONSTRAINT EQUATION:

PERIMETER MUST BE 28 FT

$$P = 2r + 2l + \frac{1}{2}(2\pi r)$$

$$28 = 2r + 2l + \pi r$$

$$28 = 2r + \pi r + 2l$$

$$28 - 2r - \pi r = \underline{\underline{2l}}$$

SUB 2L INTO AREA EQUATION

$$A = \frac{1}{2} \pi r^2 + r(28 - 2r - \pi r)$$

$$A = \frac{1}{2} \pi r^2 + 28r - 2r^2 - \pi r^2$$

$$A' = \pi r + 28 - 4r - 2\pi r$$

$$0 = \pi r + 28 - 4r - 2\pi r$$

$$0 = \pi r - 4r - 2\pi r + 28$$

$$0 = r(\pi - 4 - 2\pi) + 28$$

$$0 = r(-\pi - 4) + 28$$

$$-28 = (-\pi - 4)r$$

$$r = 3.92$$



$$r = 3.92 \text{ ft}$$

WHAT IS l

$$28 = 2r + \pi r + 2l \text{ (TRUE)}$$

$$28 = 2(3.92) + \pi(3.92) + 2l$$

$$l = 3.92 \text{ ft.}$$