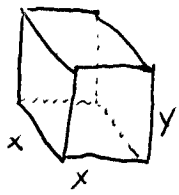
Math 16A: Short Calculus I
Fall 2017, Section 3
Homework Sheet 8
Due: Monday, November 27, 2017

Submit your solutions to the following problems in lecture on the due date above. Present your work in a clean and organized fashion, either on a printed copy of this document (preferred) or a separate sheet of paper. As stated in the syllabus, late submissions will **not** be accepted.

1. Suppose you want to build a jewelry box with a square bottom and open top. If you have 12 ft^2 of building material, what are the dimensions of the box with the maximum volume?



x = width A = surface area = 12
y = height V = volume

$12 = x^2 + 4xy$

$12 - x^2 = 4xy$

$y = \frac{12-x^2}{4x}$

$V = x^2 y$

$V = x^2\left(\frac{12-x^2}{4x}\right)$

$V = 3x - \frac{1}{4}x^3$

$V'(x) = 3 - \frac{3}{4}x^2 = 0$

$3 = \frac{3}{4}x^2$

$4 = x^2$

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

plug in crit #s and endpoints:

$V(2) = 6 - 2 = 4$

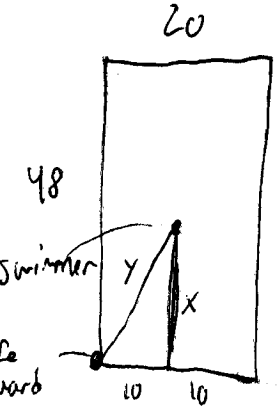
$V(0) = 0$

$V(\sqrt{12}) = 3\sqrt{12} - \frac{1}{4}(\sqrt{12})^3 = 0$

when $x = \sqrt{12}$, bottom of box has area 12 ft^2, so all material used.

dimensions:
$x = 2$
$y = \frac{12-4}{8} = 1$

2. Suppose you are swimming 20 ft/sec in a 20ft by 48ft pool, long-ways in the middle lane (i.e. 10 ft from each of the longer sides). There is a lifegard standing at the corner of the pool, watching you swim away. How fast is your distance from the lifeguard changing when you are halfway across the pool?



x = dist swimmer → wall
y = dist swimmer to lifeguard

halfway across pool:
$x = 24$
$10^2 + 24^2 = y^2$
$y = 26$

$10^2 + (x(t))^2 = (y(t))^2$

$0 + 2x(t)\frac{dx}{dt} = 2y(t)\frac{dy}{dt}$

$2(24)(20) = 2(26)\frac{dy}{dt}$

$\frac{dy}{dt} = \frac{2(24)(20)}{2(26)}$ ft/sec