Quiz 5

Show your work, and write clearly. No textbooks, notes, or calculators.
You may refer to the following general formulas for volumes of solids of revolution.

Disks or Washers(6.2):
$y = f(x)$, $y = g(x)$, $x = a$, $x = b$; about the x-axis $(f(x), g(x) \geqslant 0)$

$$V = \pi \int_a^b |f(x)^2 - g(x)^2|\, dx$$

$x = f(y)$, $x = g(y)$, $y = a$, $y = b$; about the y-axis $(f(x), g(x) \geqslant 0)$

$$V = \pi \int_a^b |f(y)^2 - g(y)^2|\, dy$$

Shells (6.3):
$y = f(x)$, $y = g(x)$, $x = a$, $x = b$; about the y-axis $(a, b \geqslant 0)$

$$V = 2\pi \int_a^b x|f(x) - g(x)|\, dx$$

$x = f(y)$, $x = g(y)$, $y = a$, $y = b$; about the x-axis $(a, b \geqslant 0)$

$$V = 2\pi \int_a^b y|f(y) - g(y)|\, dy$$

1. Find the volume of the solid of revolution obtained by revolving the region between $y = x, y = 2x$, $x = 0$, and $x = 3$; about the x-axis. Do so in two different ways. You should get the same answer both ways.

   (a) (3 points) Use the method of washers.
   (b) (2 points) Use the method of cylindrical shells.

2. Find the volume of the solid of revolution obtained by revolving the same region, except now about the y-axis. Do so in two different ways. You should get the same answer both ways. (Note that it will be different than your answer to #1, though.)

   (a) (3 points) Use the method of washers.
   (b) (2 points) Use the method of cylindrical shells

Bonus (2 points): Find the volume of the solid of revolution obtained by revolving the region between $y = x^2 - x^3$ and $y = 0$ with $x \geqslant 0$ about the line $y = -1$, in any way you like.