Name: _____   Section: _____

The following quiz is worth 4 points. Each problem will be worth 2 points. Be sure to read the problem carefully and answer every part of the problem. Be sure to show all of your work. Answers without support will not receive any credit.

1. The density of squirrels in a forest is the radial function $\rho(r) = 5400(r^2 + 2)^{-2}$ squirrels per square mile, where r is the distance (in miles) to the largest oak tree. Calculate the number of squirrels within 4 miles of the oak tree.

Let S be the number of squirrels. Using the radial density formula, we have

$$
\begin{aligned}
S &= 2\pi \int_0^4 r(5400)(r^2 + 2)^{-2} \\
&= -5400\pi(r^2 + 2)^{-1}\big|_0^4 \\
&= \frac{-5400\pi}{18} + \frac{5400\pi}{2} \\
&= -300\pi + 2700\pi \\
&= 2400\pi \text{ squirrels.}
\end{aligned}
$$

One point for writing the integral for S, and one point for solving the integral correctly.

2. Find the volume of the solid obtained by rotating the region enclosed by $y = 2$, $y = 8 - 3x$, and $x = 0$ around the x-axis using the disk and washer method.

The region's left endpoint is at $x = 0$, and the right endpoint is at $x = 2$. Using the disk and washer method, the rotated area at a given x is $\pi(8 - 3x)^2 - \pi(2)^2$. So the volume of the solid is

$$
\begin{aligned}
V &= \int_0^2 \left(\pi(8 - 3x)^2 - \pi(2)^2 \right) dx \\
&= \pi \int_0^2 \left(64 - 48x + 9x^2 - 4 \right) dx \\
&= \pi(60x - 24x^2 + 3x^3)\big|_0^2 \\
&= \pi(60(2) - 24(4) + 3(8)) \\
&= \pi(120 - 96 + 24) \\
&= 48\pi
\end{aligned}
$$

One point for determining the area at a given x, and one point for applying and solving the integral for the volume. The area at a given x does not need to be explicitly stated, but should be relatively apparent in their integral if it is not stated.