Answer both questions below. To get full credit, you must **justify your answers**;
just writing an answer, even if correct, will not earn full points.
If you used an online integral calculator, be sure to clearly cite it.

1. Find the area of the bounded region lying between the curves $y = x^2$ and $y = 4x - x^2$. Make sure you clearly write the relevant integral, and then calculate its exact value.

2. An architect has designed a building with a circular base in such a way that the height of the roof is the same at each point with the same $x$-coordinate. That is, cross-sections with a fixed $x$-coordinate are squares. If the diameter of the base is 100 feet, what is the volume of the building? Make sure you write a correct integral that represents the volume, then calculate its exact value.