Some answers to "Some questions to explore"

2. (a) The specific cylindrical shells formula

$$\int_a^b 2\pi x [f(x) - g(x)]\, dx$$

can be applied to vertically simple regions which are being rotated about the y-axis. Any other vertical axis of rotation would require a change in the *circumference* part of the integrand—i.e., $2\pi x$.

(b) The specific washer formula

$$\int_a^b \pi \left([f(x)]^2 - [g(x)]^2\right)\, dx$$

can be applied to vertically simple regions which are being rotated about the x-axis. Again, if the axis of rotation were some other horizontal line, this would change both the (outer radius)^2 term and the (inner radius)^2 one.

3. What makes volumes of rotation special is that cross-sections always involve circles, and thus a formula for some aspect of a circle, either the circumference or the area, appears in the integrand. In Section 6.2, we encountered problems in which a cross-section was not circular (such as Example 1, p. 342, and Exercises 1, 4, 6, 9, 11-14, 16-19 of that section.