8.Rev, #6. A cut by a plane perpendicular to the x-axis at x meets the doyghnut in an annulus with outer radius $3+\sqrt{1-x^2}$ and inner radius $3-\sqrt{1-x^2}$ for x in the range $-1 \leq x \leq 1$. The area of this annulus is $\pi\{(3+\sqrt{1-x^2})^2-(3-\sqrt{1-x^2})^2\} = 12\pi\sqrt{1-x^2}$. The volume is $\displaystyle\int_{-1}^{1} 12\pi\sqrt{1-x^2}\,dx = 12\pi \cdot \pi/2 = 6\pi^2$.

8.Rev, #9. The arclength of $y = e^x$ from $x = 1$ to $x = 2$ is given by the integral $\displaystyle\int_1^2 \sqrt{1+e^{2x}}\,dx = 4.785$ by Simpson's rule. The substitution $w^2 = 1+e^{2x}$ will lead eventually to the same result.

8.Rev, #15. An income stream of \$100 per year for 20 years, assuming 10% annual interest rate compounded continuously has a present value of

$$P = \int_0^{20} 100e^{-0.1t}\,dt = 100(\frac{-1}{0.1})(e^{-2}-e^0) = \$864.66.$$

The future value of this amount is $B = \$864.66e^{0.1\times 20} = \$6389.06$. The balance will reach \$5000 in y years if

$$5000 = \int_0^{y} 100e^{0.1(y-t)}\,dt = 1000(e^{0.1y}-1)$$

so $5+1 = e^{0.1y}$ and $0.1y = \ln 6$, so $y = 17.92$years.

8.Rev, #18. If Prob$\{0 \leq t \leq 6\} = 0.10$, then

$$0.1 = \int_0^{6} ce^{-ct}\,dt = 1-e^{-6c}$$

so $e^{-6c} = 0.9$, $-6c = \ln 0.9$, and $c = 0.0176$. Then Prob$\{6 \leq t \leq 12\} = \int_6^{12} ce^{-ct}\,dt = e^{-6c}(1-e^{-6c}) = 0.9(1-0.9) = 0.09$.

8.Rev, #25. The pressure at depth y below the surface is $62.4y$lb/ft^2. The bottom has area πft^2 and the force on the bottom, at depth 2ft, is $62.4\times 2\times\pi = 392$lb. The area of the cylindrical region of the side between depth y and $y+\Delta y$ is $2\pi\Delta y$ft^2 and the force on this region is approximately $62.4y2\pi\Delta y$lb. The total force on the side is

$$\int_0^2 62.4y2\pi\,dy = 784\text{lb}.$$

the total force on side and bottom is 1176 lb.

8.Rev, #26. The apple is about 3.5 inches high. Slicing horizontally we get shapes which are approximately disks, so teh volume is about $\pi\int_0^{3.5} r(y)^2\,dy$ where $r(y)$ is the approximate radius. From the graph of teh apple we have

y	0	0.5	1.0	1.5	2.0	2.5	3.0	3.5
$r(y)$	0.5	1.5	1.75	2.0	2.25	2.25	2.0	1.5

Using the trapezoid rule we find

$$V = 0.5\pi\{\frac{1}{2}0.5^2+1.5^2+1.75^2+2.0^2+\cdots+2.0^2+\frac{1}{2}1.5^2\} = 38.8\text{in}^3.$$

The weight is $38.8\times 0.03 = 1.16$lb and the cost is $1.16\times 80 = 93$cents.