1. Find the area of the region bounded by $y = \frac{1}{2}x$, $y = \sqrt{x-3}$, and the x-axis.

2. The region R in the first quadrant bounded by the parabolas $y = 2 - x^2$ and $y = x^2$ is revolved about the x-axis to produce a half-donut shaped solid. Find the volume of the solid in the following ways.
   a. Apply the disk method.
   b. Apply the shell method.

3. Find the volume of the solid of revolution generated by revolving each of the regions below about the specified axis.
   a. The region bounded by the graphs of $y = x^2$ and $y = x + 2$, about the line $x = 3$
   b. The same region as part (a), about the line $y = -1$.
   c. The region bounded by the graphs of $y = e^x$, $x = 0$ and $y = \pi$, about the x axis.

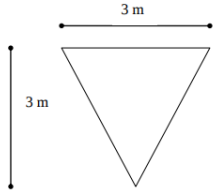
4. Find the arc length of the following curves.
   a. $y = \left(4 - x^{2/3}\right)^{3/2}$ for $0 \le x \le 2$.
   b. $y = \sqrt{1 - x^2}$ for $-\frac{1}{2} \le x \le \frac{1}{2}$

5. Find the surface area of the resulting surface of revolution generated by revolving each of the curves below about the specified axis.
   a. $f(x) = \sqrt{25 - x^2}$, for $0 \le x \le 5$, about the y-axis.
   b. $g(x) = \cos x$, for $-\frac{\pi}{2} \le x \le \frac{\pi}{2}$, about the x-axis.

6. Find the mass of a thin copper rod 1 meter long, made of an alloy with density $\rho(x) = (8 - 3x)^2$, where x is the distance (m) from the left end of the rod.

7. A tank is in the shape of a hemisphere, with the top of the tank a circle of radius 5 ft. If the tank is half-full of a liquid with density ρ, find the work required to pump the water to a level 1 ft above the top of the tank. (Leave your answer in terms of ρ and g.)

8. A water trough is 10 m long, with a triangular shaped cross-section. The length of this triangular cross-section is 3 m, and its height is also 3 m. How much work is required to pump the water out of the top of the tank? (Use $\rho g = 9800$.)



9. Find the hydrostatic force exerted on the face of a dam filled with water, whose shape is given by each description below.
    a. The face is shaped like a trapezoid. The length of the base is 12m, the length of the top is 18m with a height of 6m.
    b. The face is shaped like the lower-half of a circle of radius $4m$.

10. Evaluate the following integrals.
    a. $\displaystyle\int \frac{e^{2x}}{4+e^{2x}}\,dx$
    b. $\displaystyle\int \tan(5x)\,dx$
    c. $\displaystyle\int \frac{e^{\sqrt{x}}}{\sqrt{x}}\,dx$
    d. $\displaystyle\int 7^{2x}\,dx$
    e. $\displaystyle\int \frac{\cosh(\ln x)}{x}\,dx$
    f. $\displaystyle\int_0^1 \cosh^3(x)\sinh(x)\,dx$

11. Compute $\dfrac{d}{dx}$ of the following functions.
    a. $f(x) = x^{\tan x}$
    b. $f(x) = \left(\dfrac{1}{x}\right)^x$