1. Find the center of mass of a thin, flat plate covering the region enclosed by the parabola $y^2 = x$ and the line $x = 2y$ if the density function is $\delta(y) = 1 + y$. (Use horizontal strips.)
2. Find the centroid of a thin, flat plate covering the region enclosed by the x-axis, the line $x = 2$ and $x = -2$ and the parabola $y = x^2$.
3. Find the area of the surface generated by rotating $x = \sqrt{y},\ 2 \le y \le 6$ about the y-axis.
4. Find the area of the surface generated by rotating $y = \sqrt{2x+1},\ 0 \le x \le 3$ about the x-axis.
5. Find the length of the curve $y = x^{1/2} - (1/3)x^{3/2},\ 1 \le x \le 4$
6. Find the length of the curve $x = y^{2/3},\ 1 \le y \le 8$
7. Find the volume of the solid generated by revolving the region bounded on the left by the parabola $x = y^2 + 1$ and on the right by the line $x = 5$ about (a)the x-axis, (b) the y-axis and (c) the line $x = 5$.
8. A solid lies between planes perpendicular to the x-axis at $x = 0$ and $x = 1$. The cross sections of the solid perpendicular to the x-axis between these planes are circular disks whose diameters run from the parabola $y = x^2$ to the parabola $y = \sqrt{x}$.
9. Find the area of the region bounded by $y = x$, $y = 1/x^2$ and $x = 2$.
10. Find the area of the region bounded by $y = \sin(x)$, $y = x$ and $0 \le x \le \pi/4$.
11. Find the derivative of $y = \cosh^{-1}(2\sqrt{x+1})$
12. Find the derivative of $y = (\theta^2 + 2\theta)\tanh^{-1}(\theta + 1)$
13. Evaluate $\displaystyle\int \operatorname{sech}^2(x - \frac{1}{2})dx$
14. Evaluate $\displaystyle\int \frac{4dx}{(e^x + e^{-x})^2}$
15. Evaluate $\displaystyle\int \frac{\operatorname{sech}(\sqrt{t})\tanh(\sqrt{t})dt}{\sqrt{t}}$
16. Solve the differential equation: $e^{2x}y' + 2e^{2x}y = 2x$
17. Solve the differential equation: $\sin(t) - x\cos^2(t)\dfrac{dx}{dt} = 0,\ -\pi/2 < t < \pi/2$
18. Solve the differential equation: $\tan(\theta)\dfrac{dr}{d\theta} + r = \sin^2(\theta),\ 0 < \theta < \pi/2$