1. Find the volume of the 3 dimensional region under $z = 1 + x$ and above the region of the $xy$-plane which is bounded by the curves $x = 0$, $y = 4$ and $y = x^2$. 

(15)
2. Find the volume of the 3 dimensional region which is enclosed by the surfaces \( y = x^2 \), \( y = x \), \( z = 6 \) and \( z = y \).
(10) 3. Evaluate $\int_{0}^{4} \int_{\sqrt{x}}^{2} \frac{1}{1 + y^3} \, dy \, dx$ by first reversing the order of integration.
(15) 4. A mass distribution occupies the 3 dimensional region which is above \( z = x^2 + y^2 \) and below the plane \( z = 4 \). If the mass density function is \( \delta = \sqrt{x^2 + y^2} \) units of mass/unit volume, calculate the total mass.
5. A mass distribution occupies the 3 dimensional region which is above the cone \( z = \sqrt{x^2 + y^2} \) and below the plane \( z = 4 \). If the mass density function is \( \delta = z \) units of mass/unit volume, use a triple integral in spherical coordinates to calculate the total mass.
6. Find the surface area of that part of the surface \( z = 1 + x^2 \) which lies above the region of the \( xy \)-plane which is enclosed by the curves \( y = x \), \( y = 0 \) and \( x = 2 \).
(15) 7. Calculate the surface area of the parametrized surface $x = \frac{1}{2} t^2$, $y = 2t$, $z = s$, $0 \leq s \leq 2$, $0 \leq t \leq 1$. Use a formula from the integral tables to evaluate the integral.