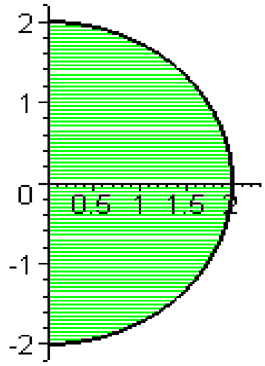
Q.1: Evaluate the double integral $\int_{-2}^{2}\int_{0}^{\sqrt{4-y^2}} \sqrt{x^2+y^2}dxdy.$

Sol: The region is

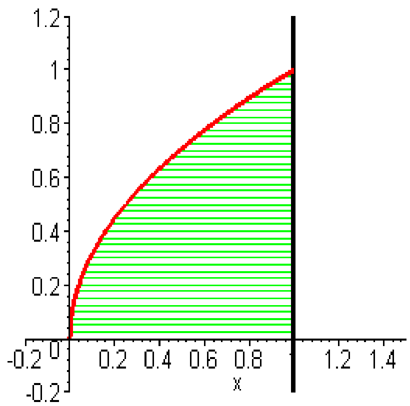


Transforming into polar coordinates, we get

$$\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}}\int_{0}^{2} \sqrt{r^2}rdrd\theta = \int_{-\frac{\pi}{2}}^{\frac{\pi}{2}}\int_{0}^{2} r^2drd\theta. = \frac{8}{3}\pi.$$

Q.2: Evaluate the triple integral $\iiint_E 6xydV$, where E lies under the plane $z = 1+x+y$ and above the region in the $xy-plane$ bounded by the curves by $y=\sqrt{x}, y=0$, and $x=1$.

Sol: The region in $xy-plane$ is



$$\iiint_E 6xydV = \int_0^1\int_0^{\sqrt{x}}\int_0^{1+x+y} (6xy)\,dzdydx = \int_0^1\int_0^{\sqrt{x}} 6xy\,(1+x+y)\,dydx$$

$$= \int_0^1\int_0^{\sqrt{x}} \left(6xy+6x^2y+6xy^2\right)dydx = \int_0^1 \left(3xy^2+3x^2y^2+2xy^3\right)\Big|_0^{\sqrt{x}}dx$$

$$= \int_0^2 \left(3x^2+3x^3+2x^{\frac{5}{2}}\right)dx = \frac{65}{28}.$$