**Vector Fields:** 2-D: $f(x,y) = P(x,y)i + Q(x,y)j = \langle P(x,y), Q(x,y)\rangle$
**Cyl Coord** $x = r\cos(\theta)$, $y = r\sin(\theta)$, z=z $r^2 = x^2 + y^2$, Jacobian = r
**Sph Coord** $x = \rho\sin(\varphi)\cos(\theta)$ $y = \rho\sin(\varphi)\sin(\theta)$ $z = \rho\cos(\varphi)$ Jacobian = $\rho^2\sin(\varphi)$ $0 \leq \theta \leq 2\pi$ $0 \leq \varphi \leq \pi$
**Center of Mass:** $m = \iint_D \rho(x,y)\,dA$, $M_y = \iint_D x\rho(x,y)\,dA$ , $M_x = \iint_D y\rho(x,y)\,dA$, $(\bar{x},\bar{y}) = \left(\frac{M_y}{m}, \frac{M_x}{m}\right)$
**Change of variables:** $J(u,v) = \left(\frac{\partial x}{\partial u}\frac{\partial y}{\partial v}\right) - \left(\frac{\partial y}{\partial v}\frac{\partial x}{\partial u}\right)$ **Green theorem** $\oint P\,dx + Q\,dy = \iint_D \left(\frac{\partial Q}{\partial x} - \frac{\partial P}{\partial y}\right) dA$
**Line Integral** $\int Pdx + Qdy = \int P(x,y)dx + \int Q(x,y)dy$ , $\int f(x,y)dx = \int f\big(x(t),y(t)\big)x'(t)dt + \int f\big(x(t),y(t)\big)y'(t)dt$
**FTVec Calc:** If F(x,y) =<P(x,y), Q(x,y)> is conservative, f(x,y) satisfies ∇f(x,y) = F(x,y), and C is parameterized by $\vec{r}(t) = \langle x(t), y(t)\rangle$ $a \leq t \leq b$, then $\int_c p\,dx - Q\,dy = f\big(\vec{r}(b)\big) - f\big(\vec{r}(a)\big)$

$\sin^{-1}(x) = \frac{1}{\sqrt{1-x^2}}$ , $\cos^{-1}(x) = \frac{-1}{\sqrt{1-x^2}}$ , $\tan^{-1}(x) = \frac{1}{1+x^2}$ , $\cot^{-1}(x) = \frac{-1}{1+x^2}$ , $\sec^{-1}(x) = \frac{1}{x\sqrt{x^2-1}}$ , $csc^{-1}(x) = \frac{-1}{x\sqrt{x^2-1}}$

$\int \sin^2(x)\,dx = \frac{1}{2}x - \frac{1}{4}\sin(2x) + C$ , $\int \cos^2(x)\,dx = \frac{1}{2}x + \frac{1}{4}\sin(2x) + C$