Calculus III Formula Sheet – Briggs, Cochran – Updated Fall 2016

$W = \lvert\mathbf{F}\rvert\,\lvert\mathbf{d}\rvert\cos\theta = \mathbf{F}\cdot\mathbf{d}$	$\lvert\mathbf{u}\times\mathbf{v}\rvert = \lvert\mathbf{u}\rvert\,\lvert\mathbf{v}\rvert\sin\theta$
$\lvert\tau\rvert = \lvert\mathbf{r}\times\mathbf{F}\rvert = \lvert\mathbf{r}\rvert\,\lvert\mathbf{F}\rvert\sin\theta.$	$a_N = \kappa\lvert\mathbf{v}\rvert^2 = \frac{\lvert\mathbf{a}\times\mathbf{v}\rvert}{\lvert\mathbf{v}\rvert}$ and $a_T = \frac{d^2s}{dt^2} = \frac{\mathbf{a}\cdot\mathbf{v}}{\lvert\mathbf{v}\rvert}$
$L = \int_\alpha^\beta \sqrt{f(\theta)^2 + f'(\theta)^2}\,d\theta$	$\kappa = \frac{1}{\lvert\mathbf{v}\rvert}\left\lvert\frac{d\mathbf{T}}{dt}\right\rvert = \frac{\lvert\mathbf{T}'(t)\rvert}{\lvert\mathbf{r}'(t)\rvert}$
$\mathbf{N} = \frac{d\mathbf{T}/dt}{\lvert d\mathbf{T}/dt\rvert}$	$\kappa = \frac{\lvert\mathbf{a}\times\mathbf{v}\rvert}{\lvert\mathbf{v}\rvert^3}$
$\mathbf{B} = \mathbf{T}\times\mathbf{N} = \frac{\mathbf{v}\times\mathbf{a}}{\lvert\mathbf{v}\times\mathbf{a}\rvert}$	$\tau = -\frac{d\mathbf{B}}{ds}\cdot\mathbf{N} = \frac{(\mathbf{v}\times\mathbf{a})\cdot\mathbf{a}'}{\lvert\mathbf{v}\times\mathbf{a}\rvert^2} = \frac{(\mathbf{r}'\times\mathbf{r}'')\cdot\mathbf{r}'''}{\lvert\mathbf{r}'\times\mathbf{r}''\rvert^2}$
$x = \rho\sin\phi\cos\theta$ $y = \rho\sin\phi\sin\theta$ $z = \rho\cos\phi \qquad \rho^2 = x^2 + y^2 + z^2$	$\iiint_D f(\rho,\phi,\theta)\,dV = \int_\alpha^\beta\int_a^b\int_{g(\phi,\theta)}^{h(\phi,\theta)} f(\rho,\phi,\theta)\,\rho^2\sin\phi\,d\rho\,d\phi\,d\theta$
$m = \iint_R \rho(x,y)\,dA$	$\bar{x} = \frac{M_y}{m} = \frac{1}{m}\iint_R x\,\rho(x,y)\,dA$
$\bar{y} = \frac{M_x}{m} = \frac{1}{m}\iint_R y\,\rho(x,y)\,dA$	$L(x,y) = f_x(a,b)(x-a) + f_y(a,b)(y-b) + f(a,b)$
$\bar{x} = \frac{M_{yz}}{m} = \frac{1}{m}\iiint_D x\,\rho(x,y,z)\,dV.$ $\bar{y} = \frac{M_{xz}}{m} = \frac{1}{m}\iiint_D y\,\rho(x,y,z)\,dV$ $\bar{z} = \frac{M_{xy}}{m} = \frac{1}{m}\iiint_D z\,\rho(x,y,z)\,dV$	$\int_a^b \mathbf{F}\cdot\mathbf{r}'(t)\,dt = \int_a^b (f\,x'(t) + g\,y'(t) + h\,z'(t))\,dt$ $= \int_C f\,dx + g\,dy + h\,dz$ $= \int_C \mathbf{F}\cdot d\mathbf{r}$
$J(u,v) = \frac{\partial(x,y)}{\partial(u,v)} = \begin{vmatrix}\frac{\partial x}{\partial u} & \frac{\partial x}{\partial v}\\ \frac{\partial y}{\partial u} & \frac{\partial y}{\partial v}\end{vmatrix} = \frac{\partial x}{\partial u}\frac{\partial y}{\partial v} - \frac{\partial x}{\partial v}\frac{\partial y}{\partial u}.$	$\int_C \mathbf{F}\cdot\mathbf{n}\,ds = \int_a^b (f\,y'(t) - g\,x'(t))\,dt$
$\iint_S \mathbf{F}\cdot\mathbf{n}\,dS = \iiint_D \nabla\cdot\mathbf{F}\,dV$	$\oint_C \mathbf{F}\cdot d\mathbf{r} = \oint_C f\,dx + g\,dy = \iint_R \left(\frac{\partial g}{\partial x} - \frac{\partial f}{\partial y}\right)dA.$
$\oint_C x\,dy = -\oint_C y\,dx = \frac{1}{2}\oint_C (x\,dy - y\,dx)$	$\oint_C \mathbf{F}\cdot\mathbf{n}\,ds = \oint_C f\,dy - g\,dx = \iint_R \left(\frac{\partial f}{\partial x} + \frac{\partial g}{\partial y}\right)dA$
$\iint_S f(x,y,z)\,dS = \iint_R f(x(u,v),y(u,v),z(u,v))\,\lvert\mathbf{t}_u\times\mathbf{t}_v\rvert\,dA.$	$\iint_S f(x,y,z)\,dS = \iint_R f(x,y,g(x,y))\sqrt{z_x^2 + z_y^2 + 1}\,dA.$
$\iint_S \mathbf{F}\cdot\mathbf{n}\,dS = \iint_R \mathbf{F}\cdot(\mathbf{t}_u\times\mathbf{t}_v)\,dA$	$\oint_C \mathbf{F}\cdot d\mathbf{r} = \iint_S (\nabla\times\mathbf{F})\cdot\mathbf{n}\,dS$