Probability

Union	$P(A \cup B) = P(A) + P(B) - P(A \cap B)$
Conditional	$P(F \mid E) = \frac{P(F \cap E)}{P(E)}$
Permutation	${}^{n}P_{r} = \frac{n!}{(n-r)!}$, ${}^{n}C_{r} = \frac{n!}{(n-r)!r!}$
Mean	$\langle x \rangle = \frac{\sum n_i x_i}{N} = \sum P_i x_i$
Variance	$\sigma^2 = \langle (x - \langle x \rangle)^2 \rangle = \langle x^2 \rangle - \langle x \rangle^2$
Binomial	$P(r) = {}^{n}C_{r}\, p^{r} (1-p)^{n-r}$
	$\langle r \rangle = np$, $\sigma_r{}^2 = np(1-p)$
Cumulative Probability	$F(x) = P(X \le x)$
	$f(x) = \frac{dF}{dx}$, $\int f(x)dx = 1$
Gaussian	$f(t) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{1}{2\sigma^2}(t-\mu)^2}$
	$\langle t \rangle = \mu$, $\sigma_t{}^2 = \sigma^2$

Partial Derivatives

Basics	$\frac{\partial^2 f}{\partial x \partial y} = \frac{\partial^2 f}{\partial y \partial x}$, $\nabla f = (\frac{\partial f}{\partial x}, \frac{\partial f}{\partial y}, ...)$
Exactness	$df = \frac{\partial f}{\partial x} dx + \frac{\partial f}{\partial y} dy$, $\frac{df}{dt} = \frac{\partial f}{\partial x}\frac{dx}{dt} + \frac{\partial f}{\partial y}\frac{dy}{dt}$
Chain Rule	$\frac{\partial f}{\partial x} = \frac{\partial f}{\partial t}\frac{\partial t}{\partial x}$
Maxima	$f_{xx} > 0$, $f_{yy} > 0$, $f_{xx} f_{yy} > f_{xy}^2$
Minima	$f_{xx} < 0$, $f_{yy} < 0$, $f_{xx} f_{yy} > f_{xy}^2$

Fields And Gradients

Types	$\phi = \phi(x,y,z)$, $\underline{V} = \underline{V}(x,y,z) = \underline{\nabla}\phi$
Geometry	$\phi(\underline{x} + \underline{dx}) - \phi(\underline{x}) = \underline{\nabla}\phi . \underline{dx}$
	$\underline{\nabla}\phi$ is the normal to a plane of constant Φ
Line	$\int_{\Gamma} \underline{F}(\underline{x}(t)).d\,\underline{x} = \int_{\Gamma_T} (\underline{F}(\underline{x}(t)).\frac{d\,\underline{x}}{dt})dt$
Conservatism	For any closed curve $\int_A^A \underline{F}.d\,\underline{x} = 0$
	This is true for any F=$\underline{J}$Φ
Surface	$S = \phi(x,y,z) = C \Rightarrow \underline{n} = \underline{\nabla}\phi$, $d\,\underline{A} = \underline{\hat{n}}dA$
	$\int \underline{F}.d\,\underline{S} = \int (\underline{F}(\underline{\mathrm{x}}\ \text{restricted to S}).\underline{n})dS$
	$dS = r^2 \sin\theta d\theta d\phi$
Divergence	$div\,\underline{F} = \underline{\nabla}.\underline{F} = \frac{\partial F_x}{\partial x} + \frac{\partial F_y}{\partial y} + \frac{\partial F_z}{\partial z}$
Div. Theorem	$\int_D div\,\underline{F} dV = \int_S \underline{F}.d\underline{S}$ for S bounded D
Curl	$curl\,\underline{F} = \underline{\nabla} \wedge \underline{F} = \begin{vmatrix} \underline{i} & \underline{j} & \underline{k} \\ \frac{\partial}{\partial x} & \frac{\partial}{\partial y} & \frac{\partial}{\partial z} \\ F_x & F_y & F_z \end{vmatrix}$
Curl Theorem	$curl\,\underline{F} = 0 \Leftrightarrow \underline{F} = \underline{\nabla}\phi$
Stokes Theorem	$\int_S curl\,\underline{F}.d\underline{S} = \int_L \underline{F}.d\underline{l}$ for L bounded S