Brief Theory of Probability, Part 1
Survey of main ideas and equations

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1 Vector algebra

1.a Coordinate Transformation

1.a.a cylindical

$$x = \rho \cos \varphi$$
$$y = \rho \sin \varphi$$
$$z = z$$

reverse

$$\rho = \sqrt{x^2 + y^2}$$
$$\cos \varphi = \frac{x}{\rho}$$
$$\sin \varphi = \frac{y}{\rho}$$

1.a.b spherical

$$x = \rho \sin \varphi \cos \theta$$
$$y = \rho \sin \varphi \sin \theta$$
$$z = \rho \cos \varphi$$

reverse

$$\rho = \sqrt{x^2 + y^2 + z^2}$$
$$\cos \varphi = \frac{z}{\rho}$$
$$\cos \theta = \frac{x}{r}$$
$$\sin \theta = \frac{y}{r}$$

1.b Dot product
- commutative
- positive definite
- distributive
- cauchy-schwarz inequality

1.c cross product
- anticommutative $\vec{u} \times \vec{v} = -(\vec{v} \times \vec{u})$
- distributive $\vec{u} \times (\vec{v} + \vec{w}) = \vec{u} \times \vec{v} + \vec{u} + \vec{w}$
- scalar mulipication
- triple scalar product $\vec{u} \cdot (\vec{v} \times \vec{w}) = (\vec{u} \times \vec{v} \cdot \vec{w})$
- triple vector product $\vec{a} \times (\vec{b} \times \vec{c}) = (\vec{b} \cdot \vec{a})\vec{c} - (\vec{c} \cdot \vec{a})\vec{b}$

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2 Vector calculus

2.a Are length

2.b Line integration

2.c Jacobian