LC Mathematics for Physicists 1A

MSci Physics w/ Particle Physics and Cosmology
University of Birmingham

Year 1, Semester 1

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Thu 02 Oct 2025 15:53

Lecture 1

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Lecture 2

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Lecture 3

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Lecture 4

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Lecture 7

Mon 13 Oct 2025 12:00

Lecture 8 - More Planes

8.1 Recap

Given the origin O, a point on the plane O' and a vector $\vec{a}$ between them, we can take two vectors $\vec{b}$ and $\vec{c}$ from this point (which are not parallel). Using some combination of these two vectors, we can reach any point on the plane:

$$\vec{r}(s,t) = \vec{a} + s\vec{b} + t\vec{c}$$

This is the parametric equation of a plane, and is very robust. We can describe a flat plane in any dimensional space using this.

We can also define the scalar equation of a plane. Given these same two vectors, we can define a normal vector $\vec{\hat{n}}$ which is perpendicular to any vector that sits within the plane. We can construct this by using the cross product:

$$\vec{n} = \vec{b} \times \vec{c}$$

Given some generic point P:

$$\vec{OP} = \vec{a} + \vec{O'P}$$

And:

$$\underline{r}(s,t) = \underline{a} + s\underline{b} + t\underline{c}$$

We have:

$$(\underline{b} \times \underline{c}) \cdot \underline{r} = (\underline{b} \times \underline{c}) \cdot \underline{a} + s(\underline{b} \times \underline{c}) \cdot \underline{b} + t(\underline{b} \times \underline{c}) \cdot \underline{c}$$

Which (as a vector dotted with itself is 0) simplifies to (using $\underline{b} \times \underline{c} = \underline{n}$):

$$\underline{n} \cdot (\underline{r} - \underline{a}) = 0$$

Mon 20 Oct 2025 12:01

Lecture 9

Mon 20 Oct 2025 12:00

Lecture 10 - More Algebraic Methods

Goal:

$$\text{Show That:} \quad \lim_{\theta \to \infty} \frac{\sin\theta}{\theta} = 1$$

As this result is needed to prove the derivative of $\sin\theta$