PHYSICS 24 SECTION
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# CROSS PRODUCT AND CURL

Some vector has been spreading rumors about the cross product. Gossip with your neighbor about which ones are true:

- $\vec{a} \times \vec{b} = \vec{b} \times \vec{a}$
- $\vec{a} \times (\vec{b} + \vec{c}) = \vec{a} \times \vec{b} + \vec{a} \times \vec{c}$
- $\vec{a} \times \vec{b} = \vec{a} \times \vec{c} \implies \vec{b} = \vec{c}$
- $(\vec{a} \times \vec{b}) \times \vec{c} = \vec{a} \times (\vec{b} \times \vec{c})$
- $k(\vec{a} \times \vec{b}) = (k\vec{a}) \times \vec{b} = \vec{a} \times (k\vec{b})$
- $|\vec{a} \times \vec{b}|^2 + (\vec{a} \cdot \vec{b})^2 = |a|^2 |b|^2$
- $\vec{a} \times (\vec{b} \times \vec{c}) + \vec{b} \times (\vec{c} \times \vec{a}) + \vec{c} \times (\vec{a} \times \vec{b}) = 0$

## THE CURL ... WHAT'S WITH THAT

Here's a fun exercise to jog your memory: given an electrostatic electric field $\vec{E}$, prove that $\vec{\nabla} \times \vec{E} = 0$.

Making connections:

What is the integral form of Gauss's Law? Does it remind you of any law pertaining to magnetism? Under what circumstances (geometries, symmetries, etc.) is it fruitful to invoke these laws? Failing these, which laws must we turn to?
What is the differential form of Gauss's Law? How did we get that?
Do you foresee an analogous differential form for the corresponding magnetic law?