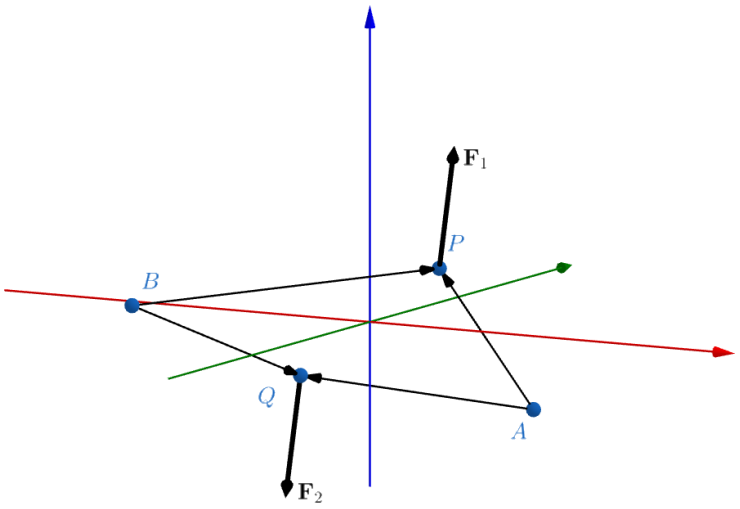
Problems.

1. A **couple** is defined as two parallel forces that have the same magnitude but opposite directions. The torque produced by a couple is called a **couple moment**. An important property of couple moments is that the couple moment is the same with respect to any point. This problem is to prove this property. That is, in the language of mathematics:

   Let $\mathbf{F}_1$ and $\mathbf{F}_2$ be two vectors in space such that $\mathbf{F}_2 = -\mathbf{F}_1$. Let P and Q be two fixed points. Supposed A and B are two arbitrary points, prove that

$$\overrightarrow{AP} \times \mathbf{F}_1 + \overrightarrow{AQ} \times \mathbf{F}_2 = \overrightarrow{BP} \times \mathbf{F}_1 + \overrightarrow{BQ} \times \mathbf{F}_2.$$



2. Using vectors, prove the Law of Sines: if $\mathbf{a}$, $\mathbf{b}$, and $\mathbf{c}$ are the three sides of the triangle shown in the figure, then

$$\frac{\sin A}{\|\mathbf{a}\|} = \frac{\sin B}{\|\mathbf{b}\|} = \frac{\sin C}{\|\mathbf{c}\|}.$$

(*Hint:* Use the relation between cross products and triangle areas.)