M311 Calculus III Recitation

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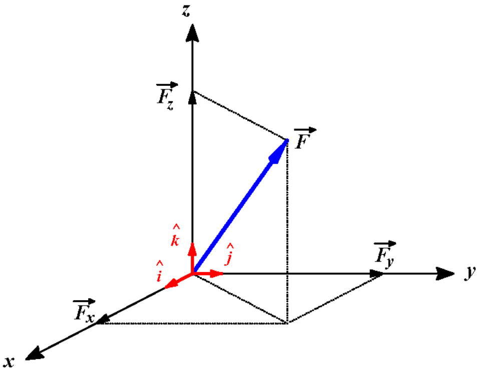
$$\vec{F} = \vec{F_x} + \vec{F_y} + \vec{F_z}$$



Suppose $a = \langle 2, 3, 0\rangle$ and $b = \langle -1, 0, 1\rangle$. Then

$$\begin{aligned} |a + 2b| &= |\langle 2, 3, 0\rangle + 2\langle -1, 0, 1\rangle| \\ &= |\langle 2, 3, 0\rangle + \langle -2, 0, 2\rangle| \\ &= |\langle 0, 3, 2\rangle| \\ &= \sqrt{0^2 + 3^2 + 2^2} \\ &= \sqrt{13} \end{aligned}$$

Dot products are a special case of matrix multiplication. Suppose $a = \langle 2, 3, 0 \rangle$ and $b = \langle -1, 0, 1 \rangle$. Then

$$a \cdot b = 2(-1) + 3(0) + 0(1) = -2$$

Compare to $(2, 3, 0)(-1, 0, 1)^T$ where these are now thought of as matrices and T denotes transpose.

Dot Product
Important properties and uses

- Dot product gives a computationally conducive way to get a handle on angles between vectors.
- $a \cdot b = |a||b| \cos\theta$ where θ is the angle between the two vectors.
- In particular, since $\cos\theta = 0$ if and only if $\theta = \pi/2 + k\pi$, we can conclude that $a \perp b \Leftrightarrow a \cdot b = 0$.
- Note: dot product takes two vectors and gives a number.
- In the previous example, since the dot product was nonzero, we can conclusively say that the vectors were not orthogonal.