Class 3, Practice Problems

Mutivariable Calculus

January 20, 2020

11.3 Dot product

1. Let $\mathbf{u} = \mathbf{i} - 3\mathbf{j} + 7\mathbf{k}$ and $\mathbf{v} = 8\mathbf{i} - 2\mathbf{j} - 2\mathbf{k}$.

   a) Find $\mathbf{u} \cdot \mathbf{v}$.

   b) Find $\cos\theta$ where θ is the angle between $\mathbf{u}$ and $\mathbf{v}$.

2. Explain why each of the following expressions makes no sense.

   a) $\mathbf{u} \cdot (\mathbf{v} \cdot \mathbf{w})$

   b) $(\mathbf{u} \cdot \mathbf{v}) + \mathbf{w}$

   c) $\|\mathbf{u} \cdot \mathbf{v}\|$

   d) $k \cdot (\mathbf{u} + \mathbf{v})$.

3. Let $\mathbf{u} = \mathbf{i} + 2\mathbf{j}$ and $\mathbf{w} = 6\mathbf{i}$. Find $\|(\mathbf{u} \cdot \mathbf{w})\mathbf{w}\|$.

11.4 Cross product

1. Use a determinant to find the cross product: $\mathbf{i} \times (\mathbf{i} + \mathbf{j} + \mathbf{k})$.

2. True or false:

   (a) $\mathbf{i} \times \mathbf{j} = \mathbf{j} \times \mathbf{i}$.

   (b) For any vectors $\mathbf{u}$ and $\mathbf{v}$, $\mathbf{u} \times \mathbf{v} = \mathbf{v} \times \mathbf{u}$.

3. Find the area of the parallelogram that has $\mathbf{u}$ and $\mathbf{v}$ as adjacent sides, given that $\mathbf{u} = 2\mathbf{i} + \mathbf{j}$ and $\mathbf{v} = -\mathbf{i} + 2\mathbf{j} - 2\mathbf{k}$.