Math 214 Spring 2017
Linear Algebra HW 10 Solutions
Due Wednesday, April 12

For all these problems, justify your answers.

1. Let $\mathbf{u} = (2, 1, 3)$ and $\mathbf{v} = (6, 3, 9)$.

    (a) Find the angle between $\mathbf{u}$ and $\mathbf{v}$.

    (b) Find the projection of $\mathbf{u}$ onto $\mathbf{v}$.

    (c) Verify that $\text{proj}_{\mathbf{v}}\, \mathbf{u}$ is orthogonal to $\mathbf{u} - \text{proj}_{\mathbf{v}}\, \mathbf{u}$.

2. Let $\mathbf{u} = (2, -5, 4)$ and $\mathbf{v} = (1, 2, -1)$.

    (a) Find the angle between $\mathbf{u}$ and $\mathbf{v}$.

    (b) Find the projection of $\mathbf{u}$ onto $\mathbf{v}$.

    (c) Verify that $\text{proj}_{\mathbf{v}}\, \mathbf{u}$ is orthogonal to $\mathbf{u} - \text{proj}_{\mathbf{v}}\, \mathbf{u}$.

3. Let $\mathbf{u} = (4, 1)$ and $\mathbf{v} = (3, 2)$.

    (a) Find the angle between $\mathbf{u}$ and $\mathbf{v}$.

    (b) Find the projection of $\mathbf{u}$ onto $\mathbf{v}$.

    (c) Verify that $\text{proj}_{\mathbf{v}}\, \mathbf{u}$ is orthogonal to $\mathbf{u} - \text{proj}_{\mathbf{v}}\, \mathbf{u}$.

4. Let $\mathbf{u} = (3, 5)$ and $\mathbf{v} = (1, 1)$.

    (a) Find the angle between $\mathbf{u}$ and $\mathbf{v}$.

    (b) Find the projection of $\mathbf{u}$ onto $\mathbf{v}$.

    (c) Verify that $\text{proj}_{\mathbf{v}}\, \mathbf{u}$ is orthogonal to $\mathbf{u} - \text{proj}_{\mathbf{v}}\, \mathbf{u}$.

5. Find the point on the line $y = 2x$ that is closest to the point $(5, 2)$, and the distance between them.

6. Find the distance from the point $(1, 1, 1)$ to the plan $2x + 2y + z = 0$.

7. Write equations for the lines $2x + y = 5$ and $2x + y = 0$ in parametrized form and in normal form.

8. Write equations for the plane passing through $(2, 3, 1), (5, 4, 3), (3, 4, 4)$ in parametrized form and in normal form.

9. Find an algebraic equation for the plane normal to $\mathbf{N} = (-3, 6, 2)$ and passing through $(4, 2, -5)$.