Math 35, Homework 1 on Sections 1.5, 2.3
due Wed, Feb 5 at the start of class.

---

(1) Let $\mathbf{u} = (1, -3, 0)$ and $\mathbf{v} = (2, 1, -2)$. Compute $||\mathbf{u}||$, $||\mathbf{v}||$, $\mathbf{u} \cdot \mathbf{v}$ and $\mathbf{u} \times \mathbf{v}$.

(2) Find the angle between the vectors $\mathbf{u}$ and $\mathbf{v}$ from question (1) to the nearest degree.

(3) Verify the Cauchy-Schwarz inequality and the triangle inequality for $\mathbf{u}$ and $\mathbf{v}$ from question (1).

(4) Compute AB, $\det A$, $\det B$, $\det(AB)$, $\det(A + B)$ for

$$A = \begin{bmatrix} 1 & -2 & 0 \\ 0 & 1 & 1 \\ 4 & -3 & 1 \end{bmatrix} \quad \text{and} \quad B = \begin{bmatrix} 2 & 0 & -1 \\ 0 & 0 & 1 \\ 1 & 5 & 1 \end{bmatrix}.$$

(5) Let $U = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$ and I the identity matrix $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$. Let $V = \dfrac{1}{\det U} \begin{bmatrix} d & -b \\ -c & a \end{bmatrix}$. Verify that V is the *inverse* of U. In other words check that

$$UV = I = VU.$$

(6) If $f(x, y) = -x + 2xy + e^{xy}$ find $\partial f / \partial x$ and $\partial f / \partial y$

(7) Suppose $g : \mathbb{R}^2 \to \mathbb{R}^3$ is given by $g(x, y) = (x/y, y/x, \log(xy))$. Compute the derivative of g at $\mathbf{x}_0 = (1, 1)$. In other words find $\mathbf{D}g(\mathbf{x}_0)$.

(8) Is the function g from question (7) differentiable at $(1, 1)$? Is it continuous at $(1, 1)$?

(9) Find the equation of the tangent plane to the surface $z = x^2 + y^3$ at $(3, 1, 10)$.

(10) Let $f(x, y, z) = 5xy \sin z$. Calculate $\nabla f(2, 1, 0)$.