This week on the problem set we will review the basics of vectors and calculus of vector valued functions and functions with multiple inputs. This should be familiar to you from Math 32A or other equivalent calculus courses you have taken. Make sure you can do these types of routine questions. Problems 8 will give you some practice with double integrals.

1. Calculate the following dot products of vectors.
   (a) $(1, 2, 3) \cdot (3, 2, 1)$
   (b) $(1, 1) \cdot (1, -1)$
   (c) $(1, 0, 1) \cdot (0, 4, 0)$
   (d) $(-1, 2, 1) \cdot (2, 1, -1)$
2. Are the following vectors orthogonal to each other?
   (a) $(1, 0, 0)$ and $(0, 0, 1)$
   (b) $(1, 1)$ and $(2, 2)$
   (c) $(1, 0, 3, -2, 1, 1)$ and $(0, -3, 1, 2, 2, -1)$
   (d) $(-1, 2, 1)$ and $(2, 1, -1)$
3. Calculate the following cross products.
   (a) $(1, 2, 3) \times (3, 2, 1)$
   (b) $(1, 1, 1) \times (1, -1, 1)$
   (c) $(1, 0, 1) \times (0, 4, 0)$
   (d) $(-1, 2, 1) \times (-2, 4, 2)$
4. Does the vector $(-1, -4, 1)$ lie in the plane spanned by the vectors $(1, 0, -2)$ and $(0, 4, 1)$?
5. Calculate the tangent lines at $t = 0$ to the curves described by the following vector valued functions.
   (a) $f(t) = (\cos t, t, \sin t)$
   (b) $f(t) = (t, t^2, t^3)$
6. Calculate the tangent planes at $(0, 0)$ to the graph of the following functions.
   (a) $f(x, y) = \sin x + \sin y$
   (b) $g(x, y) = x^2 + y^2 - 2y + 1$
7. Calculate the following partial/directional derivatives for $f(x, y) = \sin x + \sin y$.
   (a) $\partial_x f$
   (b) $\partial_{\mathbf{u}} f$ for $\mathbf{u} = (1, 1)$
   (c) $\partial_{\mathbf{u}} f$ for $\mathbf{u} = (-1, -1)$
   (d) $\partial_{\mathbf{u}} f$ for $\mathbf{u} = (1, -1)$
8. From 16.1 in the textbook: 7, 8, 9, 15, 17, 19, 23, 39, 41, 47.