Math 196-47, Mr. Church, Homework 8 (Corrected)

Due at the beginning of class on Monday, May 11.

Please staple your homework.

1. Exercise 6.1.2. [Recall that the dot appearing between two vectors $\vec{q} \cdot \vec{r}$ has the same meaning as the inner product $\langle \vec{q}, \vec{r} \rangle$.]

2. **(Corrected)** Exercise 6.2.6. (This previously said "Exercise 6.2.2"; that question will appear on Homework 9.)

3. Recall that if $\vec{v}$ is a vector in $\mathbb{R}^n$, $\vec{v}^\perp$ is defined to be the subspace of vectors perpendicular to $\vec{v}$:

$$\vec{v}^\perp = \left\{ \vec{w} \in \mathbb{R}^n \middle| \langle \vec{v}, \vec{w} \rangle = 0 \right\}$$

   (a) Let $\vec{a} = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$. Find a parametrization of the subspace $\vec{a}^\perp$, find a basis, and find its dimension. [Hint: find a system of linear equations whose solution set is $\vec{a}^\perp$.]

   (b) Let $\vec{v}$ be a nonzero vector in $\mathbb{R}^n$. We saw in class that $\vec{v}^\perp$ is a subspace. Find its dimension. [If you cannot give a rigorous justification, an intuitive one may receive partial credit.]

4. [This question will appear on Homework 9, due Wednesday, May 13.] Let $\vec{a}$, $\vec{b}$ and $\vec{c}$ be nonzero vectors in $\mathbb{R}^n$ that are pairwise orthogonal (that is, $\langle \vec{a}, \vec{b} \rangle = 0$, $\langle \vec{b}, \vec{c} \rangle = 0$, and $\langle \vec{a}, \vec{c} \rangle = 0$). Show that $\{\vec{a}, \vec{b}, \vec{c}\}$ are linearly independent.