This assignment is in two parts. The first part is due at the start of class on Day 4. It will not be collected, but you are expected to complete these exercises on vectors, just to practice basic skills. If you feel that you need more practice, do more problems, or talk to me.

12.4 Exercises 11-14, 21-22, 28, 32, 36, 54a, 59

The second part is due on paper at the start of class on Day 5. Submit polished solutions, including all necessary work and no unnecessary work, in the order assigned.

A. Suppose that $\vec{v}$ and $\vec{w}$ are nonzero and perpendicular. Find a vector $\vec{x}$, in terms of $\vec{v}$ and $\vec{w}$, such that $\vec{v} \times \vec{x} = \vec{w}$. Also, why is it important that $\vec{v}$ and $\vec{w}$ be perpendicular? (If they are not perpendicular, then can such an $\vec{x}$ still be found?) Also, why is it important that $\vec{v}$ and $\vec{w}$ be nonzero?

B. 12.4 Exercise 61 and 62

C. In class we've discussed application of dot and cross products to computer graphics. For example, we can test whether a triangle faces away from the camera, and we can compute the diffuse reflection of a light source on the triangle.

Another kind of lighting effect is a *specular highlight*. For example, suppose that it's a sunny day, and you see a red car, a red apple, and a red rubber ball. Each one appears mostly red, due to diffuse reflection. But each one may also have a bright white spot, where the sun's light is reflecting directly into your eye. That's specular reflection. It is probably "fuzzier" on the apple than on the car, because an apple is not as smooth as a car. And it is probably nearly nonexistent on the rubber ball, because rubber is not very shiny at all.

Using the same concepts as in class (dot products, cross products, normal vectors, etc.), invent an expression that describes the amount of specular reflection coming off a point on a triangle. Your expression should incorporate a number called "shininess", that captures the shininess of the underlying material (such as painted sheet metal, apple skin, or rubber).

(There is no one right answer to this question. But some answers are better than some others.)