Week 3 Linear Algebra worksheet
MATH1014
Stewart §10.1, §10.2, §10.3, §10.4

(1) The magnitude of a velocity vector is called *speed*. Suppose that a wind is blowing from the direction $N45°W$ at a speed of 50 km/h. (This means that the direction from which the wind blows is $45°$ west of the northerly direction.) A pilot is steering a plane in the direction $N60°E$ (i.e., the direction in which the pilot is steering the plane is $60°$ degrees east of the northerly direction) at an airspeed (speed in still air) of 100 km/h. The true course of the plane is the direction of the sum of the velocity vectors of the plane and the wind. The ground speed of the plane is the magnitude of the resultant. Find the true course and the ground speed of the plane.

   (You may leave your answer in terms of an inverse trig function.)

(2) Suppose that $\mathbf{a}$ and $\mathbf{b}$ are nonzero vectors, and let $\mathbf{c} = ||\mathbf{a}||\mathbf{b} + ||\mathbf{b}||\mathbf{a}$. Let θ_a be the angle between $\mathbf{a}$ and $\mathbf{c}$, and let θ_b be the angle between $\mathbf{b}$ and $\mathbf{c}$.
   (a) Draw a few examples to get an idea of what situation this problem is describing.
   (b) Under what circumstances could $\mathbf{c} = \mathbf{0}$?
   (c) Assume $\mathbf{c} \neq \mathbf{0}$ and use the dot product identity to show that $\theta_a = \theta_b$.