

Homework 9: Due in class December 12

Reminder

Your submitted homework solutions should show not only your answers, but should show a clearly reasoned logical argument, written using **complete English sentences**, leading to that solution. Each mathematical symbol that you will encounter stands for one or more English words¹, and if you elect to use symbols, you must use them properly. In particular, please avoid the use of the “running equals sign”, as this is an abuse of notation and is unacceptable: http://www.wikiwand.com/en/Equals_sign#/Incorrect_usage. Write your solutions so that a student one course behind you in the sequence would understand them.

Problem 1. Which of the following are *always true*, and which are *not always true*? Give reasons for your answers.

(a) [2 points] $\vec{u} \cdot \vec{v} = \vec{v} \cdot \vec{u}$

(b) [2 points] $\vec{u} \times \vec{v} = \vec{v} \times \vec{u}$

(c) [2 points] $c(\vec{u} \times \vec{v}) = (c\vec{u}) \times \vec{v} = \vec{u} \times (c\vec{v})$ for any number c

(d) [2 points] $\vec{u} \cdot \vec{u} = |\vec{u}|^2$

(e) [2 points] $(\vec{u} \times \vec{v}) \cdot \vec{u} = \vec{v} \cdot (\vec{u} \times \vec{v})$

Problem 2. [5 points] A 10-lb. box sits on a 15 ft. ramp that makes a 30° angle with the horizontal. How much force is required to keep the box from sliding down the ramp?

Problem 3. [5 points] A cyclist applies 150 lb. of force, straight down, onto a pedal that extends 7 in. from the crankshaft, making a 30° angle with the horizontal. Find the magnitude of torque applied to the crankshaft.

¹See a list of mathematical symbols and their meanings here: http://en.wikipedia.org/wiki/List_of_mathematical_symbols