Math 1410 Assignment #2
University of Lethbridge, Spring 2017

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Due date: Tuesday, February 14th, by 4 pm.

Please review the **Guidelines for preparing your assignments** before submitting your work. You can find these guidelines, along with the required cover page, in the Assignments section on our Moodle site.

Assigned problems

1. Consider the triangle ΔPQR with vertices $P = (2, 0, -3)$, $Q = (5, -2, 1)$, and $R = (7, 5, 3)$.

   (a) Show that ΔPQR is a right-angled triangle. (Hint: this is a question about dot products.)

   (b) Compute the lengths of the three sides of ΔPQR and verify that the Pythagorean Theorem holds.

   (c) Determine the equation of the plane containing ΔPQR.

2. Let $\vec{u}$ and $\vec{v}$ be any two vectors in $\mathbb{R}^3$.

   (a) Show that $\|\vec{u} + \vec{v}\|^2 + \|\vec{u} - \vec{v}\|^2 = 2(\|\vec{u}\|^2 + \|\vec{v}\|^2)$.

   (b) What does part (b) tell you about parallelograms?

   Note: For parts (a) and (b) in Problem 2, it is **not** necessary (nor desirable) to write out $\vec{u}$ and $\vec{v}$ in terms of their components. Instead, work with the properties of the dot product given in Section 3.3 of the textbook.

3. Let ℓ be a line through the origin in $\mathbb{R}^3$, and let $\vec{p}$ and $\vec{q}$ be the position vectors for any two points on ℓ.

   (a) Show that the point with position vector $\vec{p} + \vec{q}$ also lies on the line ℓ.

   (b) Show that for any scalar c, the point with position vector $c\vec{p}$ also lies on the line ℓ.

   (c) Repeat parts (a) and (b) with ℓ replaced by a *plane* through the origin.