Math 53 Homework 2

Due Wednesday 9/6/17 in section

(The problems in parentheses are for extra practice and optional. Only turn in the underlined problems.)

Monday 8/28 – Cross product

- **Read:** section 12.4.

- **Work:** 12.4: (3), (9), (13), <u>16</u>, (19), (27), <u>31</u>, <u>36</u>, (37), (45), <u>46</u>, <u>53</u>.

  p. 823 "The geometry of a tetrahedron", <u>parts 1[†] and 3</u>.[1]

† Hint: for part 1, don't introduce coordinates; instead, express everything in terms of the vectors $\vec{a} = \overrightarrow{SP}$, $\vec{b} = \overrightarrow{SQ}$, and $\vec{c} = \overrightarrow{SR}$ and use the properties of cross-product.

Wednesday 8/30 – Equations of lines and planes

- **Read:** section 12.5.

- **Work:** 12.5: (1), <u>5</u>, (9), (19), (25), <u>33</u>[2], (37).

  12.5: (45), <u>48</u>[3], (51), <u>58</u>, <u>63</u>, (65), (71), <u>77</u>.

  <u>Problem 1</u> (next page).

(Hint for 12.5 #77: even though we are given symmetric equations rather than parametric ones, this is similar to examples 3 and 10 in the book.)

Friday 9/1 – Parametric equations and vector functions

- **Read:** section 10.1; section 13.1 to middle of p. 851 [7th ed: p. 843].

- **Work:** 10.1: (9), (11), <u>13</u>, <u>19</u>[4], (21), (24), (31), <u>33</u>, (37), (41), <u>45</u>.

  13.1: (9), <u>14</u>, (21), (25), (27), (31), (49).[5]

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[1] **7th ed:** p. 816.
[2] **7th ed:** do the 8th ed problem: plane through points (2,1,2), (3,-8,6), and (-2,-3,1).
[3] **7th ed:** do the 8th ed problem: line through (-3,1,0) and (-1,5,6), plane $2x + y - z = -2$.
[4] **7th ed:** do the 8th ed problem: $x = 5 + 2\cos \pi t$, $y = 3 + 2\sin \pi t$, $1 \leq t \leq 2$.
[5] **7th ed:** 13.1: (9), <u>14</u>, (21), (25), (27), (29), (47).

Problem 1. In 3D computer graphics, one needs to represent 3-dimensional objects on a plane screen, by drawing a given point P at the place where the line from P to the eye meets the screen. Suppose that the screen is the yz-plane, and the eye is at $E : (2, 0, 0)$.

a) At what point $Q : (y, z)$ in the yz-plane should one represent the point $P : (x_0, y_0, z_0)$? (Express y and z in terms of the coordinates of P. Assume that $x_0 < 2$. Why is this assumption legitimate?)

b) What does the image on the screen of a line segment in space look like? (Justify your answer.)

c) A line segment connects $P_0 : (-1, -3, 1)$ to $P_1 : (-2, 4, 6)$. What is drawn on the screen?

d) A bird leaves from P_0 at time $t = 0$, and flies in a straight line at constant speed in such a way that it passes through P_1 at time $t = 1$.

What does the trajectory of the bird (for $t \geq 0$) look like on the screen? Show that, as t tends to infinity, the trajectory on the screen tends to a limit point (the "vanishing point"), and give its coordinates.