

**Assignment 3** - Due Thursday 9/28/2017

**Read:** Hubbard and Hubbard Section 1.5, probably only to page 92.

**Exercises:**

Hand in only the exercises which have stars by them.

Further questions on Section 1.4: 11, 16\*, 17

Let P1 be the plane  $x + 2y + 3z = 4$  and let P2 be the plane  $x - y + z = 6$ .

1. Find the angle between P1 and P2.
- 2\*. Find a vector which has the same direction as the line of intersection of P1 and P2.
- 3\*. Find the equations of the line of intersection of P1 and P2 in the form  $(x-a)/u = (y-b)/v = (z-c)/w$
- 4\*. Find the shortest distance from the point (1,1,1) to the plane P1.
- 5\*. Find the equation for the plane which passes through the point (2,3,5) and is perpendicular to the vector (-1,4,1).
6. Find the shortest distance between the line  $x-1 = 2y-4 = z+1$  and the line  $3x+1 = y-1 = 2z-1$ .

Section 1.5: 1, 2, 3, 4\*, 5, 6\*.

**Comments:**

The extra questions numbered 1 - 6 above are of a kind which is not covered in the text book, but this type of material does appear in other calculus texts; for example there is quite an old book by Simmons which does this material and also the book on Multivariable Calculus by Trotter and Williamson does it. They can all be done with dot and cross products and without minimization techniques. It is also possible to do questions like 'Find the shortest distance ...' by setting up a distance function and minimizing it by setting the derivative equal to zero. My intention is that you should not do these problems this way here. I want you instead to get practice in how the dot and cross products may be used. These methods work amazingly well, and are actually useful in problems that come up in life. The questions also give you practice in recognizing the various forms that equations of lines and planes can take.