

18.02 Recitation
Problems
19 September 2011

1. A particle starts at $\langle 1, 2 \rangle$ and moves in the direction $\langle 2, -2 \rangle$ with speed 2. What is its position at time t ?
2. What is the equation for a plane normal to $\langle 1, 2, 3 \rangle$ and passing through $(0, 0, 0)$? Through $\langle 2, -1, 2 \rangle$?
3. ($\approx 1G - 1$) Consider the three planes defined by the equations

$$\begin{aligned}3x + y - z &= 8 \\ -x + 2y &= 3 \\ -x - y - z &= 0\end{aligned}$$

Determine the unique point of intersection of the three planes. Hint:

$$\begin{pmatrix} 3 & 1 & -1 \\ -1 & 2 & 0 \\ -1 & -1 & -1 \end{pmatrix}^{-1} = \frac{1}{10} \begin{pmatrix} 2 & -2 & -2 \\ 1 & 4 & -1 \\ -3 & -2 & -7 \end{pmatrix}$$

4. The first two planes above intersect in a line. Give a parametric equation for the line. Check your answer to the previous question by finding the intersection of your parametrized line with the plane.
5. Consider the two lines given by the parametric equations $\vec{a}(s) = \langle 1, 0, 0 \rangle + \langle 1, 1, 1 \rangle s$ and $\vec{b}(t) = \langle 0, 0, 0 \rangle + \langle 0, 0, 1 \rangle t$. Do they intersect? What is the shortest distance between the two?
6. (1I-4) A roll of plastic tape of outer radius a is held in a fixed position while the tape is being unwound counterclockwise. The end P of the unwound tape is always held so the unwound portion is perpendicular to the roll. Taking the center of the roll to be the origin O , and the end P to be initially at $(a, 0)$, write parametric equations for the motion of P .
7. Find the equation of the plane passing through $(1, 0, 0)$, $(2, 3, -2)$, and $(1, 1, 1)$.
8. How would you find the equation of a plane containing a given line and passing through a given point? Contain two given points and orthogonal to a given plane?