

A Summary of topics for discussion.

Note that some of these may not be covered on the indicated days. So, this is more of a target.

## 1 August 2014

### 1.1 Aug. 27

- Coordinate systems in Euclidean spaces: Plane, Three space,  $n$ -space etc.
- Distinction between a point and a vector. The vector  $\overrightarrow{PQ} = Q - P$ .
- Interpreting vectors as displacements in space.
- Vector operations.
- Distance formula in  $n$ -space.

$$d(P, Q) = |PQ| = \sqrt{(b_1 - a_1)^2 + (b_2 - a_2)^2 + \cdots + (b_n - a_n)^2}.$$

- Understanding planes  $ax + by + cz = d$  and half spaces  $ax + by + cz > d$ .
- Sketching and how to avoid it.
- Sphere, its inside and outside.

### 1.2 Aug. 29

- Dot product  $v \cdot w$  and a new distance formula  $|v| = \sqrt{v \cdot v}$ .
- Unit vectors.  $\frac{1}{|v|} v$ .
- Cauchy-Schwartz Inequality

$$|v \cdot w| \leq |v||w| \text{ where equality holds only when } v, w \text{ are dependent.}$$

- Angle between (non zero)  $v, w$  given by  $\arccos\left(\frac{v \cdot w}{|v||w|}\right)$ .
- Test for parallel vectors  $|v \cdot w| = |v||w|$  and perpendicular vectors  $v \cdot w = 0$ .
- Projection of a vector  $v$  along a vector  $w$ .  $\frac{v \cdot w}{w \cdot w} w$ .
- Standard basis  $\mathbf{i}, \mathbf{j}, \mathbf{k}$  and components of a vector.
- Redoing trigonometry and plane geometry using vectors!

To be continued ...