

# Puzzles/problems

<http://bit.ly/trig2013>

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In some of the classes, we did some puzzle/problem solving. Here is a list of them (without solutions):

- Every point in the plane is colored with one of the two colors in some random way. Prove that there are two points of same color separated by distance 1.
- Complete the sequence: 1,11,21,1211,.....
- Five points are randomly spread within (including the boundary) of a unit square. Prove that some two of them must be separated by not more than  $1/\sqrt{2}$ .
- Prove that  $x + \frac{1}{x} = 1$  has no real solution.
- Find the number of integer solutions of  $x + y = xy$ .
- Prove that  $2^n$  divides  $(n + 1)(n + 2) \dots 2n$  for all  $n \in \mathbb{N}$ .

- Find the sum

$$\frac{1}{1 \times 2} + \frac{1}{2 \times 3} + \frac{1}{3 \times 4} + \dots + \frac{1}{99 \times 100}$$

- Prove that the maximum number of regions formed on a a plane by intersection of  $n$  lines is  $\frac{n(n+1)}{2} + 1$ .

- Find the point inside a convex quadrilateral such that sum of distances from the point to all the vertices is minimum. Whats the answer when a quadrilateral is replaced by triangle?
- Let  $ABC$  be a triangle and  $P$  be an interior point of the triangle. Then, prove that  $BP + CP < BA + CA$
- Let a box of pencils have at least 3 pencils. Every pencil has a certain color and a certain length. We can always find two pencils that differ in color. We can always find two pencils that differ in length. Prove that we can find two pencils that differ in both color and length.