

# MATHELON

## Techxetra 2013

27th Oct

**Problem 1 :** One disk 20 inches in diameter and one 10 inches in diameter are cut from a disk of plywood 30 inches in diameter. What is the largest disk that can be cut from the remainder of the plywood?

**Problem 2 :** If  $a$ ,  $b$  and  $c$  are integers with no factor common to all three; and  $\frac{1}{a} + \frac{1}{b} = \frac{1}{c}$ , is  $(a-b)$  a perfect square?

**Problem 3:** Write the cubic equation in  $x$ , where  $x_1, x_2$  and  $x_3$  are roots of the equation such that  $\frac{1}{x_2x_3} + \frac{1}{x_1x_3} + \frac{1}{x_2x_1} = 1$  and  $\frac{1}{x_3} + \frac{1}{x_2} + \frac{1}{x_1} = \frac{11}{6}$ .

**Problem 4:** Partition 316 into two parts so that one part is divisible by 13 and other part by 11.

**Problem 5:** Saif Ali Khan gives both John and Akshay a start of 60 m in a 1500 m race. However, while John finishes with him, Akshay is 15 m behind them when Saif and John cross the finishing line. How much start can John give Akshay for the 1500 m race.

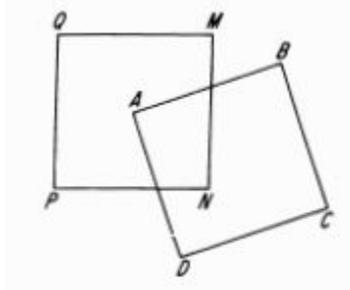
**Problem 6:** Two ferry boat ply back and fourth across a river with constant speeds, turning at the banks without loss of time. They leave opposite shores at the same instant, meet for the first time 700 feet from one shore, continue on their ways to the banks, return and meet for second time 400 feet from the opposite shore. Determine the width of the river?

**Problem 7:** Three truck-drivers went into a roadside cafe. One truck-driver purchased four sandwiches, a cup of coffee and ten doughnuts for Rs. 60.00. Another truck-driver purchased three sandwiches, a cup of coffee and seven doughnuts for Rs. 45.00. What did the third truck-driver pay for a sandwich, a cup of coffee and a doughnut?

**Problem 8:** A merchant had a forty-pound measuring weight that broke into four pieces as the result of a fall. When the pieces were subsequently weighed, it was found that the weight of each piece was a whole number of pounds and that the four pieces could be used to weigh every integral weight between 1 and 40 pounds. What were the weights of the pieces?

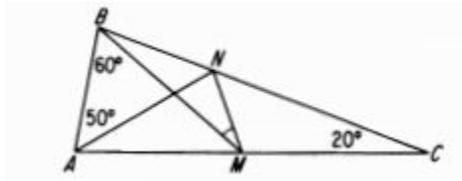
**Problem 9:** Find the sum of the series  $1(1!) + 2(2!) + 3(3!) + \dots + 2013(2013!)$ .

Problem 10:



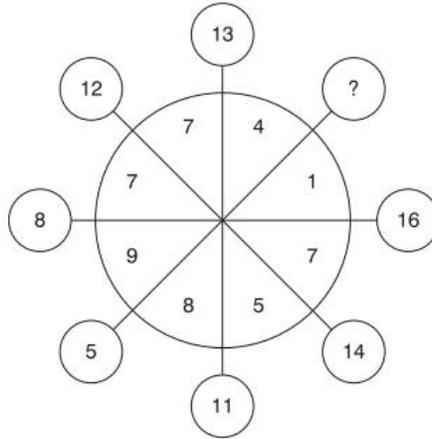
The vertex A of square ABCD is placed so that it coincides with the center of square MNPQ and so that AB trisects MN, If  $AB = MN = a$ , find the common area.

Problem 11:



An isosceles triangle ABC has a vertex angle  $C = 20$  degree. Points M and N are so taken on AC and BC that angle  $ABM = 60$  degree and angle  $BAN = 50$  degree. Find the angle BMN.

Problem 12:



What number should replaces the question mark?

Problem 13: Given that  $f(x) = x^4 + x^3 + x^2 + x^1 + x + 1$ , find the remainder when  $f(x^5)$  is divided by  $f(x)$ .

Problem 14: a cows graze b fields bare in c days, a' cows graze b' fields bare in c' days, a'' cows graze b'' fields bare in c'' days. What is the relation between the nine magnitudes a to c''.(hint: assume that all the fields provide the same amount of grass, that the daily growth of the fields remains constant, and that all the cows eat the same amount each day.)