



New Zealand Mathematical Olympiad Committee

Maths Workshop (Auckland Central)

Tuesday June 4th, 6:15pm to 8:15pm

University of Auckland, rooms 303-G13 and 303-G15

Problems

1. What is the minimal number of *saps* required to break a 6×4 block of chocolate into 24 units of chocolate?

(available online: <http://www.gustygames.co.nz/challenges/Chocolate.html>)

2. Find all integers n such that $n!$ is not a multiple of n^2 .

3. what is the value of

$$\frac{1}{2} - \frac{2}{4} + \frac{3}{8} - \frac{4}{16} + \frac{5}{32} - \frac{6}{64} + \dots$$

4. Let $ABCD$ be a convex quadrilateral such that the length of the segment connecting midpoints of the two opposite sides AB and CD equals $\frac{AD+BC}{2}$. Prove that AD is parallel to BC .
5. An ant, located in a square field, is 1 meter from one of the corner posts of the field, 7 meters from the corner post diagonally opposite that one, and 5 meters from a third corner post. Find the area of the field.
6. My shop sells apples, bananas, carrots and donuts. In how many ways can you purchase 10 items from my shop?
7. Suppose $f : \mathbb{N} \rightarrow \mathbb{N}$ is an increasing function such that

$$f(f(n)) = 3n$$

for all $n \in \mathbb{N}$. What is $f(100)$?

8. Let A , B and C be the angles of an acute triangle. Show that: $\sin A + \sin B + \sin C > 2$.