

Coffee Hour Problems

Edited by Matthew McMullen

Fall 2016

Week 1. *Proposed by Matthew McMullen.*

An interesting fact about a 5-12-13 right triangle is that its area and perimeter are numerically equal. Find a triangle (not necessarily right) with integer side-lengths whose area and perimeter are both numerically equal to 42.

Week 2. *Proposed by Matthew McMullen.*

Show that

$$\sqrt{1 + \sin x} - \sqrt{1 - \sin x} = 2 \sin(x/2)$$

for all x with $0 \leq x \leq \pi/2$, but not for any x with $\pi/2 < x < 2\pi$.

Week 3. *Proposed by Matthew McMullen.*

Find

$$\int_1^{\infty} \frac{\ln(x-1)}{x^{3/2}} dx.$$

Week 4. *Proposed by Matthew McMullen.*

You roll three fair dice. What is the probability that some subset of the numbers rolled sums to 4? (This includes rolls such as 1,2,1 and 4,5,6.)

Week 5+. *Proposed by Matthew McMullen.*

You roll n fair dice. What is the probability that some subset of the numbers rolled sums to k , where $1 \leq k \leq 6n$?