

Georgia Institute of Technology
High School Mathematics Competition 2007

Junior Varsity Proof-Based Test
Problem #1

ID#:

Show that at a gathering of any six people, some three of them are either mutual acquaintances or are complete strangers to each other.

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Problem #2

ID#:

A regular tetrahedron and a regular octahedron have equal edges. Find the ratio of their volumes.

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Problem #3

ID#:

Find the number of paths (that is, moving only vertically or horizontally)
in the following array which spell out the word *GEORGIA*.

G
GEG
GEOEG
GEOROEG
GEORGROEG
GEORGIGROEG
GEORGIAIGROEG

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Problem #4

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Solve

$$\begin{cases} a^3 - b^3 - c^3 = 3abc \\ a^2 = 2(b + c) \end{cases}$$

simultaneously in the positive integers.

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Problem #5

ID#:

Prove that if a, b, c are real numbers such that $a + b + c = 0$, then

$$3abc = a^3 + b^3 + c^3.$$