

COLLEGE of
CHARLESTON
Math Meet

2012

All-Day Sprint

Each team gets many copies of this sprint printed on white paper, but only one on yellow paper. Solve the puzzle and submit the yellow copy into the box in front of Maybank Hall by 2:00 PM.

When we last left our hero —

"Oh no," said Jamie, "Rex Ruthless has kidnapped Lucy Street and imprisoned her in a cell made of kryptographite! How will you ever break her out?"

"Kryptographite is unbreakable even with my super strength," said Math Meet Man. "I'll have to pick the lock!"

"Hurry! She's running out of air!"

"Egads! It's an algebraic lock with geometric substructure!

I'll have to reduce all these

formulas down to integers. Here's

how the mechanism works: "

Jamie wrote down the rules as

Math Meet Man used his CAT scan

vision to see how the lock works...

The
gears with triple
dials exhibit pure
antisymmetry!



Rules

① $[k_1, k_2, \dots, k_n]$ is an operation on integers

② $[mk_1, mk_2, \dots, mk_n] = [k_1, k_2, \dots, k_n]$

"It's resistant to common divisors!"

③ $[k_1, k_2, \dots, k_n] = - \left([k_1, m, k_2] + [k_2, m, k_3] + \dots \right. \\ \left. \dots + [k_{n-1}, m, k_n] + [k_n, m, k_1] \right)$

④ $[a, b, c] = -[b, a, c]$

$[a, b, c] = -[a, c, b]$

$[a, b, c] = -[c, b, a]$

"The gears with triple dials exhibit pure antisymmetry!"

⑤ $[a, b, bc^n] = [a, b, bc] + [a, b, bc^{n-1}]$ if $n \geq 1$

⑥ $[a, b, c] = [a^2, ab, bc]$

"Use Pick's Theorem!"
cried Lucy from inside the cell "Don't you see how it works?"

⑦ $[1, 2, 3] = 1$

Help Math Meet Man — Resolve these before time runs out!

A $[27, 3, 48] = \boxed{}$

E $[108, 16, 12, 216] = \boxed{}$

B $[2, 24, 9] = \boxed{}$

F $[27, 4, 24, 96] = \boxed{}$

C $[1, 2, 6, 9] = \boxed{}$

G $[6, 4, 48, 864, 216] = \boxed{}$

D $[54, 8, 48, 108] = \boxed{}$

H $[1, 24, 4, 72, 9, 54] = \boxed{}$