Manhattan Mathematical Olympiad 2016

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– Grades 5-6

– **p1.** Three excavators can dig 3 holes in 2 hours. How many holes can six excavators dig in 5 hours?

p2. There are 5 apples, 8 pears, and 11 oranges in a basket. Every day Alice eats two different fruits. Can it happen that some day there are the same number of apples, pears and oranges remaining in the basket?

p3. (a) Cover (without overlaps) the 8×8 chessboard by the triminos 3×1 such that there is one square left uncovered.
(b) Which square can it possibly be?

p4. A family: Father, Mother, Grandfather and Daughter want to cross the Dark bridge. They have only 2 flashlights, so at most two people can cross at the same time. • The father can cross in 1 minute. • The mother can cross in 2 minutes. • The daughter can cross in 5 minutes. • The grandfather can cross in 10 minutes.
If two people are crossing, they go with the speed of the slowest of the two. Can the entire family cross in
(a) 19 minutes?
(b) 17 minutes?

PS. You should use hide for answers.

– Grades 7-8

– **p1.** Two trains run on parallel tracks in opposite directions. The first train's speed is 50 ft/sec, the second train's speed is 75 ft/sec. A passenger in the first train observed that it took the second train 6 seconds to pass him. What is the length of the second train?

p2. In the month of May of a certain year there are 4 Fridays and 4 Mondays. What day of the week is May 1st of that year? Explain your answer.

p3. Cut a quadrilateral into 3 trapezoids.
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p4. Several gangsters stand on a flat field so that all pairwise distances between them are different. When the clock strikes twelve, every gangster shoots at the gangster that is closest to him. Is it possible that all gangsters are shot if there are
(a) 6 gangsters?
(b) 7 gangsters?

PS. You should use hide for answers.

– Grades 9-12

– **p1.** 40 children stand in a circle. 22 of them have a boy neighbor, and 30 have a girl neighbor (everyone has two neighbors). How many girls are there?

p2. In a chess tournament 7 players play each other exactly once. A game's winner gets 1 point, the looser gets 0. In case of a draw, both players get 0.5 points. Tom lost only one game, but finished last (he scored less points than any other player). Monica won the tournament (she scored more points than any other player).
(a) How many points did Tom have?
(b) How many points did Monica have?

p3. On the picture below 4ABC is an equilateral triangle, $AD = DE = EB$, and $BF = FG = GC$. Let $\alpha = \angle AGD$ and $\beta = \angle AFD$. Find the sum of the angles $\alpha + \beta$.
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p4. The sum of three positive real numbers equals their product. Prove that at least two of the numbers are greater than 1.

PS. You should use hide for answers.