Mathworks Math Contest
For Middle School Students
October 14, 2014

PROCTORING TEACHER COVER SHEET

- Please complete the following fields and return this cover sheet with all student exams
- Only **one** Proctoring Teacher Cover Sheet is required
- Each student must fill out the Student Cover Sheet on page 2.

PROCTORING TEACHER

First Name:_____ **Last Name:**_____

E-mail Address:_____

Name of School:_____

Student scores will be sent to the e-mail address you provide above.

Return all student tests with this Proctoring Teacher cover sheet by October 21st to:

Mathworks
601 University Dr., ASBS #110
Texas State University
San Marcos, TX 78666

Mathworks Math Contest (MMC)
For Middle School Students
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SCORE
(for Mathworks use)

STUDENT COVER SHEET

Please write in all information neatly and clearly to ensure proper scoring. Thank you!

Student **First** Name:_____**Last** Name:_____Current Grade in School: _____

Home Address:_____

City:_____ State: _____ Zip: _____

Home Phone: (_____) _____E-mail Address: _____

School Name: _____

Check all math courses taken or currently taking:

☐Pre-Algebra ☐Algebra 1 ☐Algebra 2 ☐Geometry

Student Birth Date (MM/DD/YYYY): _____ / _____/ _____

Gender: ☐Male ☐Female

Are you a U.S. Citizen or Permanent Resident? ☐Yes ☐No

Return Completed Test by October 21st, 2014 to:
Mathworks
601 University Dr., ASBS #110
Texas State University
San Marcos, TX 78666

Test Directions

- ***Please write as neatly as possible***.
  - We award points only if we can read your work!
- 15 problems in 120 minutes (2 hours)
- NO calculators allowed. Use additional paper as needed
- Show all your work and how you obtained each answer
- **Please BOX your final answers**

2014 Mathworks Math Contest (MMC)

1. At Roosevelt Middle School, there are 12 different student clubs. Each club has exactly 50 members. Each student in the school is in exactly 3 clubs. How many students total are there at Roosevelt Middle School?

2. At Washington Middle School, there are 300 students total who play soccer, basketball, or both sports. $\frac{1}{4}$ of the soccer players also play basketball. $\frac{1}{9}$ of the basketball players also play soccer. How many of the students play only soccer?

3. The integers a, b, c, d are all positive, not necessarily distinct. We know that:
   $a+b+c+d=10$ and
   $343a+49b+7c+d=988$.
   Find $1000a+100b+10c+d$

4. Albert and Becky pick their favorite positive integers a and b, and write down the following sequence of 20 integers: $a, a+b, a+2b, a+3b, \ldots a+19b$. Albert adds up the first 10 integers in the sequence, and obtains a total of 500. Becky adds up the last 10 integers of the sequence. What is the smallest possible total that Becky will obtain?

5. Larry bought some raffle tickets at the county fair. Each ticket has a different number between 1 and 100. None of his ticket numbers are divisible by 13, and no two of his numbers add up to a multiple of 13. What is the largest possible number of tickets that Larry bought?

6. Cathleen and Doug play a game where each person takes turns tossing two coins at once. The winner is the first to toss heads for both coins on the same turn. For example, if Cathleen tosses both heads, she wins. However, if she tosses one head and one tail, or both tails, then she gives the two coins to Doug, and he gets to toss. Cathleen starts the game. What is the probability that Cathleen wins the game?

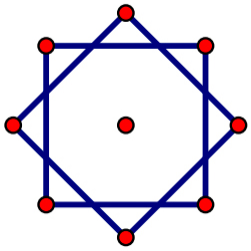
7. What is the remainder when 11^{2014} is divided by 1000?

8. Let x, y be two positive integers. Suppose $x^2 = 40 + y^2$.
   Find the largest possible value of $(x - y)$.

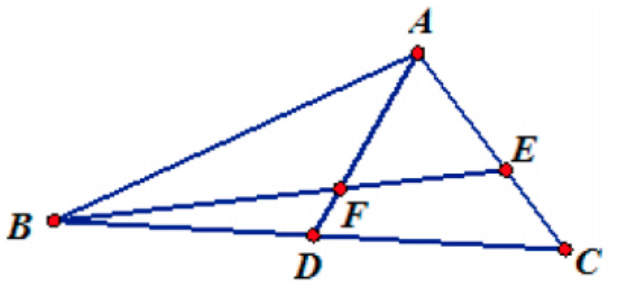
9. It takes a boat 8 hours to go from Acorn City to Bay Town, going with the current. That same trip takes 24 hours, going against the current. Assume that the current adds to, or subracts from, the boat's speed. How long would the boat trip take with no current (totally calm waters)?

10. Boat A leaves from the south bank of a river and sails directly towards the north bank. Five minutes later, boat B leaves the north bank of the river and sails directly towards the south bank. They pass each other in the middle of the river. Upon reaching the opposite bank, each boat turns around immediately and sails back to its starting point. When the two boats pass each for a second time, boat A has completed $\frac{1}{3}$ of the return trip. Given all this information: how many minutes does it take for boat B to cross the river (going from one bank to another)?

11. Two congruent squares are drawn, as shown below. One is obtained from the other by rotating 45° about their common center. Let A be the eight-pointed star shape. Let B be the octagonal region consisting of only points inside both squares. Find the ratio of area A to area B.

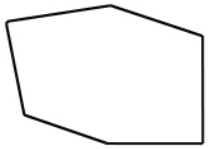


12. In the diagram below, the area of triangle ABC is 40 square units, the area of triangle AFE is 10 square units, and the area of triangle ABF is 15 square units. Find the area of triangle BDF.



13. Let $ABCD$ be a rectangle. E and F lie on AB.
$AB = 7$, $AE = 2$, $EF = 3$, $FB = 2$, and $AD = 4$. DF and CE intersect at G.
Find the area of the quadrilateral $ADGE$.

14. A hexagon has consecutive angle measures of 90°, 120°, 150°, 90°, 120°, and 150°. If all of its sides are 4 units in length, what is the area of the hexagon?



15. The Union Pacific train is traveling from point A to point B in the railroad diagram below. The train's path must satisfy the following conditions:

    - The path must be on the horizontal or vertical segments
    - The horizontal segments may only be traveled in the left-to-right direction
    - Along the same path, no segment may be travelled on twice.
    - All upward moves must happen before all downward moves

    How many different ways are there for the train to travel from point A to point B?