**2015 Mathworks Math Contest**


Mathworks Math Contest
For Middle School Students
November 10, 2015


**PROCTORING TEACHER COVER SHEET**
- Please complete the following fields and return this cover sheet with ALL student exams
- Only one Teacher Cover Sheet is required
- Each student must fill out the student cover sheet

Proctoring Teacher
First Name: _____

Last Name:_____

E-mail Address: _____

Name of School:_____

Your students' scores will be sent to the e-mail address you provide above.

Please return all student exams so that we receive it by November 17th. Please mail to:
Mathworks - MMC
601 University Dr., ASBS #110
Texas State University
San Marcos, TX 78666

Mathworks Math Contest (MMC)
For Middle School Students
November 10th, 2015

**STUDENT COVER SHEET**

SCORE

(for Mathworks use)

Please write in all information <u>neatly and clearly</u> to ensure proper grading.  Thank you!

Student First Name:_____ Last Name:_____

Current Grade in School: _____

Home Address:_____

City:_____ State: _____ Zip: _____

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

School Name: _____

Check 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 <u>by November 17th</u> to:
Mathworks - MMC
601 University Dr., ASBS #110
Texas State University
San Marcos, TX 78666

**Contest 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

1. Catherine and Doris enter the first floor of the skyscraper, Taipei 101, and have to get to a meeting on a certain floor. The elevator is at the very top floor. It takes the elevator 1 minute to reach the first floor from the top floor, and 1 second to move up each floor. Alternatively, if you decide to walk up the stairs, it will take you 16 seconds to walk up each flight (each floor) of stairs. Doris walks up the stairs, while Catherine waits for the elevator and then takes the elevator up. They both arrive at the meeting at the same time. On which floor was the meeting held?

2. Let $x$ be a two-digit positive integer. Let $y$ be the two-digit integer that results from switching the order of the digits of $x$. Let $z = x + y$. How many possibilities are there for $x$ such that $z$ is a perfect square?

3. A right triangle has legs of length 7 and 24 units. An altitude is drawn to its hypotenuse. What is the length of the shorter segment of the hypotenuse?

4. In the diagram below, EB=2, DC=3, BC=10, and the angles EBC and BCD are right angles. Find the area of the shaded triangle ABC.
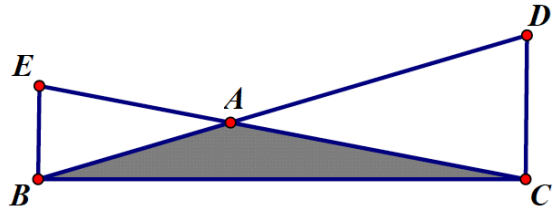


5. The missing number in each of the unmarked squares is the sum of the two numbers in the squares below. a, b, and c are positive integers where a < b < c, and b is the average of a and c. What is the sum of the five numbers in the bottom row if the number in the top square is 100?
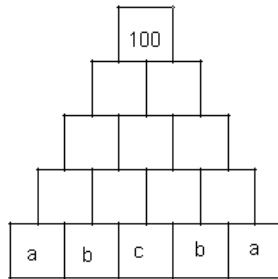


6. Solve the equation for x where $| x+1 | + \frac{1}{2} |2x\text{-}3| = 5x +2$

7. How many routes are there from A to B along the grid in the following diagram? At all times, you must move upwards or to the right along segments of the grid until you reach B.

*B*

*A*
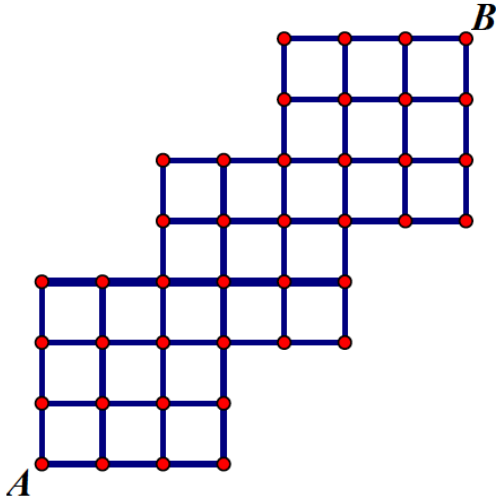
8. In a quadrilateral ABCD, the diagonals AC and BD intersect at point O. Suppose that triangles ABO, BCO, CDO have areas of 30, 40, 20 square units, respectively. Find the area of the triangle DAO.

9. In the following table you are to replace all the blank squares with positive integers so that if you add the four numbers on any line (horizontal row, vertical column, or diagonal), you get the same total regardless of which line you choose. What integer must be in the top right blank corner?

| 26 | 17 | 8 | |
|----|----|----|----|
| 11 | | 29 | 14 |
| 41 | | | 32 |
| | 35 | 38 | |

10. The natural numbers 1, 2, 3…998, 999 are written down in one long string.
The string looks like this: 12345678910111213…998999.
How many 1s appear in this string?

11. An isosceles triangle has base angles of 75 degrees and legs of 12 units. What is the area of the triangle?

12. Consider the quadratic equation, $x^2 + bx + c = 0$, where $b + c = 298$.
Let $(x - v)(x - u) = x^2 + bx + c$, where u and v are integer solutions to the quadratic equation above and $u < v$. Find the smallest possible value of $v - u$.

13. In the diagram below, C is the midpoint of AB. AC=CD=6. Angle ACE is a right angle. EC=4. Find the area of the quadrilateral ACED
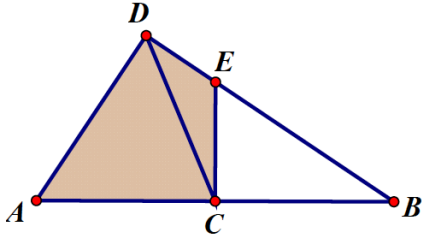


14. Jake's Junk Store has three items on sale that Jessica wants to buy. Their unit prices are $0.50, $3.00, and $7.00.  Jessica finds that she can buy some of each and purchase 100 items for $100.00. How many of the cheapest item can she buy?

15. A bakery sells cookies in packages of 8, 12, or 15. What is the largest number of cookies that you *cannot* purchase?