Stockton University
Mathematical Mayhem 2015
Individual Round

March 21, 2015

Name: _____

High School:_____

Instructions:

- This round consists of **18** problems worth a total of **80** points, made up of 8 Appetizers worth 3 points each, 7 Entrées worth 5 points each, and 3 Desserts worth 7 points each.
- Each of the 18 problems is multiple choice, and each problem comes with **5** possible answers.
- For each problem, **circle the best answer**.
- You are not required to show any work this round.
- No calculators are permitted.
- This round is **75 minutes** long. **Good Luck!**

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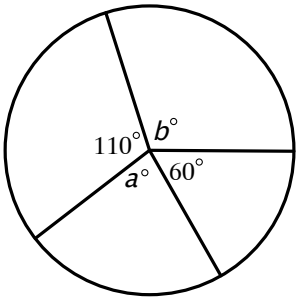
Problem #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Total
Points Earned																			

♣ Appetizers ♣

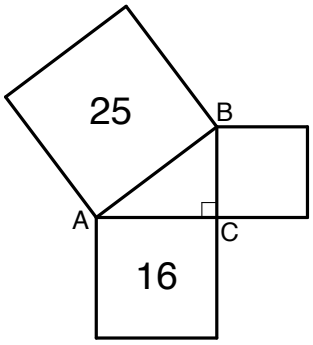
Problem 1. In the diagram, what does $a + b$ equal?
(A.) 10 (B.) 85 (C.) 110 (D.) 170 (E.) 190



Problem 2. What number goes in the box so that $\frac{2}{3} + \frac{3}{\square} = 1$?
(A.) 1 (B.) 2 (C.) 3 (D.) 6 (E.) 9

Problem 3. A square with side length 1 sits inside of a rectangle that is 1×2 and divides the rectangle into three parts. If the area of the rectangle above the square is twice as big as the area of the rectangle below the square, what is the area of rectangle below the square?
(A.)$1/2$ (B.) $1/3$ (C.) $1/4$ (D.) $1/5$ (E.) $1/6$

Problem 4. In the diagram, $\triangle ABC$ has a right angle at C. A square is drawn on each side of the triangle. The area of the square on side AB is 25. The area of the square on side AC is 16. What is the area of the square on side BC?
(A.) 8 (B.) 9 (C.) 10 (D.) 12 (E.) 13



Problem 5. Two high school classes took the same test. The average of the class of 20 students is 80 percent, and the average of the other class of 30 students is 70 percent. What is the average for all students in the two classes combined?
(A.) 75% (B.) 74% (C.) 72% (D.) 77% (E.) none of these

Problem 6. What is the difference between the two roots of $x^2 - 7x - 9 = 0$?
(A.) 7 (B.) 7.5 (C.) 9 (D.) $2\sqrt{85}$ (E.) $\sqrt{85}$

Problem 7. If $x^2yz^3 = 192$ and $xy^2 = 9$, then xyz is equal to which of the following?
(A.) 10 (B.) 11 (C.) 12 (D.)13 (E.) 15

Problem 8. Let $f(x)$ be the sum of the digits of x. Then $f(f(f(f(2015^2))))$ is equal to which of the following?
(A.) 1 (B.) 3 (C.) 5 (D.) 7 (E.) 9

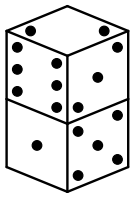
♢ Entrées ♢

Problem 9. A house and store were sold for $\$12,000$ each. The house was sold at a loss of 20% of the cost of the house, and the store at a gain of 20% of the cost of the store. How much total money was gained or lost in the transaction?

(A.) no loss or gain (B.) loss of \$1000 (C.) gain of \$1000 (D.) gain of \$2000 (E.) none of these

Problem 10. A traditional six-sided die is a cube on which each side has dots representing a number 1 through 6. The sum of the numbers shown on each pair of opposite sides of a die is 7. The figure below shows two dice stacked one on top of the other with two sides touching, one from each die. What is the maximum possible sum of the numbers on the sides that are touching?

(A.) 7 (B.) 8 (C.) 9 (D.) 11 (E.) 12



Problem 11. Which of the following is $\sqrt{\frac{1}{4^2}+\frac{1}{5^2}+\frac{2}{5\cdot 4}}$ equal to?

(A.) $\frac{9}{20}$ (B.) $\frac{9}{20}+\frac{\sqrt{10}}{10}$ (C.) $\frac{1}{20}$ (D.) $\frac{81}{400}$ (E.) 1

Problem 12. Some pigs have 2-looped tails and other pigs have 3-looped tails. While walking through a pig sty one day, you count exactly 100 loops. Based on this information, which of the following conclusions must be true?

(A.) The total number of pigs with 3-looped tails is odd.
(B.) The total number of pigs is even.
(C.) The total number of pigs with 2-looped tails cannot be prime.
(D.) The total number of pigs is odd.
(E.) The total number of pigs with 3-looped tails is even.

Problem 13. Suppose the base of a rectangle is increased by 10% and the area is unchanged. By what percentage did the altitude decrease?
(A.) 9% (B.) 10% (C.) 11% (D.) $9\frac{1}{11}\%$ (E.) $11\frac{1}{9}\%$

Problem 14. Alice and Bob each add up sets of three-digit positive integers. Each of them adds three different three-digit integers whose nine digits are all different. Alice creates the largest possible sum. Bob creates the smallest possible sum. What is the difference between Alice's sum and Bob's sum?
(A.) 594 (B.) 1782 (C.) 1845 (D.) 1521 (E.) 2592

Problem 15. For how many integers n is $(7n+15)/(n-3)$ an integer?
(A.) 5 (B.) 6 (C.)10 (D.)15 (E.) 18

♡ Desserts ♡

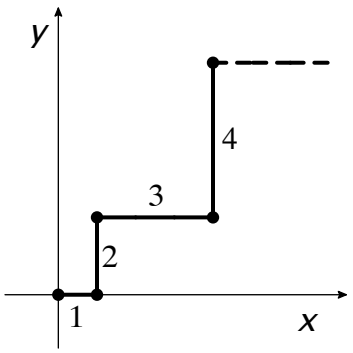
Problem 16. Two parallel chords of equal length are drawn 8 inches apart in a circle of radius 8 inches. What is the area of the part of the circle that lies between the two chords?

(A.) $21\frac{1}{3}\pi - 32\sqrt{3}$ (B.) $21\frac{1}{3}\pi + 32\sqrt{3}$ (C.) $42\frac{2}{3}\pi + 32\sqrt{3}$ (D.) $42\frac{2}{3}\pi + 16\sqrt{3}$ (E.) $42\sqrt{3}$

Problem 17. If you divide $2^0 + 2^1 + ... + 2^{1000}$ by 7, what is the remainder?

(A.) 0 (B.) 1 (C.)2 (D.) 3 (E.) 4

Problem 18. On a coordinate grid, your tedium loving brother draws a line segment of length 1 from the origin to the right, stopping at $(1, 0)$. He then draws a line segment of length 2 up from $(1, 0)$ to $(1, 2)$. He continues drawing line segments to the right and up, alternating the direction and increasing the length of the segment he draws by 1 each time. One of these line segments stops at the point $(529, 506)$. What is the endpoint of the next line segment that he draws?



(A.) $(529, 552)$ (B.) $(576, 506)$ (C.) $(575, 506)$ (D.) $(529, 576)$ (E.) $(576, 552)$