Stockton University
Mathematical Mayhem 2016
Individual Round

April 9, 2016

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, **mark your answer on the answer sheet**.

- You are not required to show any work this round.

- No calculators are permitted.

- This round is **75 minutes** long. **Good Luck!**

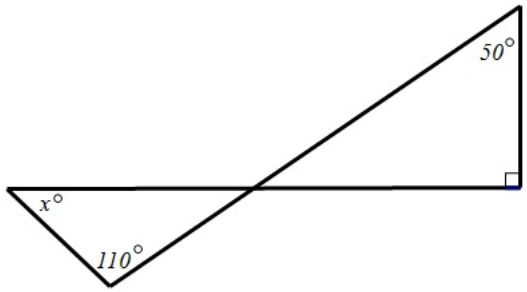
♣ Appetizers ♣

Problem 1. $\sqrt{16 \cdot \sqrt{16}} = ?$

(A.) 2^1 (B.) 2^2 (C.) 2^3 (D.) 2^4 (E.) 2^5

Problem 2. What is the value of x in the diagram below?

(A.) 30 (B.) 20 (C.) 40 (D.) 50 (E.) 35



Problem 3. Charles has $5q + 1$ quarters and Richard has $q + 5$ quarters. What is the difference between Charles' money and Richard's money in dimes?

(A.) $10(q - 1)$ (B.) $\frac{2}{5}(4q - 4)$ (C.) $\frac{2}{5}(q - 1)$ (D.) $\frac{5}{2}(q - 1)$ (E.) none of these

Problem 4. During his lunch break from 12:00 to 1:00, Bill eats, then checks his messages, then goes to the restroom, then talks to a friend. Each activity after the first takes half as much time as the preceding activity. If there is no time between activities and, after talking to a friend, Bill has used his entire lunch break, at what time did Bill finish checking his messages?

(A.) 12:22 (B.) 12:26 (C.) 12:30 (D.) 12:36 (E.) 12:48

Problem 5. A clown rides a unicylce around a circular park. The park has radius 25 ft. The wheel has diameter 1 ft. How many revolutions will the wheel make for one full trip around the park?
(A.) 20 (B.) 5π (C.) 25 (D.) 50 (E.) $\frac{25}{2}\pi$

Problem 6. If x and y are positive integers with $3^x 5^y = 225$, then $x + y =$?
(A.) 7 (B.) 4 (C.) 5 (D.) 3 (E.) 8

Problem 7. A boy buys oranges at 3 for 10 cents. He will sell them at 5 for 20 cents. In order to make a profit of $1.00, how many oranges must he sell?
(A.) 67 oranges (B.) 150 oranges (C.) 200 oranges
(D.) an infinite number of oranges (E.) none of these

Problem 8. A duck and a donkey take a walk about across a field that is 2 miles wide. The duck walks at a constant rate of 1 mph. The donkey walks at a constant rate of 2 mph. After 15 minutes the duck stops walking, waits for the donkey to come back then rides on the donkey's back for the rest of the walk. How long does it take the pair to walk across the field?
(A.) 1 hour (B.) 1 hour 12 min (C.) 1 hour 15 min (D.) 1 hour 20 min (E.) 1 hour 22 min

♢ Entrées ♢

Problem 9. John goes for a jog every 3 days. He went for a jog on Monday, January 5. He went for his next jog on January 8. What was the date of the next Monday on which he went for a jog?

(A.) January 12 (B.) January 19 (C.) January 26 (D.) February 2 (E.) February 9

Problem 10. A circular piece of metal of maximum size is cut out of a larger square piece. Then a square piece of maximum size is cut out of that circular piece. How much metal is wasted in total?

(A.) $\frac{1}{4}$ the area of the original square (B.) $\frac{1}{2}$ the area of the original square

(C.) $\frac{1}{2}$ the area of the circular piece (D.) $\frac{1}{4}$ the area of the circular piece (E.) none of these

Problem 11. Two students attempted to solve a quadratic equation $x^2 + bx + c = 0$. Although both students did the work correctly, one miscopied the middle term and obtained the solution set $\{2, 3\}$, while the other miscopied the constant term and obtained the solution set $\{2, 5\}$. What is the correct solution set?

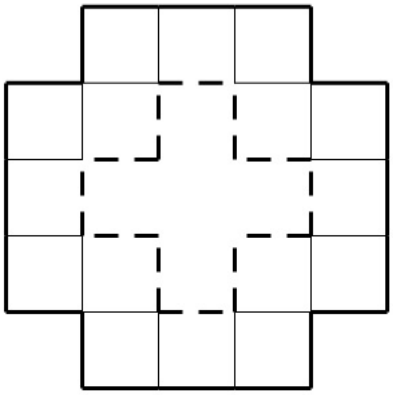
(A.) $\{1, 6\}$ (B.) $\{3, 3\}$ (C.) $\{1, 3\}$ (D.) $\{2, 6\}$ (E.) $\{1, 5\}$

Problem 12. A woman has part of \$4500 invested at 4% and the rest at 6% both yearly. If her annual return on each investment is the same, what is the yearly rate of interest which she realizes on the whole \$4500?

(A.) 5% (B.) 4.8% (C.) 5.2% (D.) 4.6% (E.) none of these

Problem 13. Sixteen squares are arranged as shown in the diagram. Alice walks around the outer edges of the region shown in bold solid lines, while Bob walks around the inner edges of the region shown in bold dashed lines. Alice and Bob walk at the same rate and Alice walks around the outside of the region 15 times. How many times does Bob walk around the inside of the region?

(A.) 9 (B.) 12 (C.) 15 (D.) 20 (E.) 25



Problem 14. Let x_1 and x_2 be the roots of $x^2 - x - 2016$ and let x_3 and x_4 be the roots of $x^2 - 2x - 2016$. What does $(x_4 - x_2) + (x_3 - x_1)$ =?

(A.) 0 (B.) 1 (C.) $\sqrt{2}$ (D.) 2 (E.) 4

Problem 15. Which of the following numbers is largest?

(A.) 1^1 (B.) $2^{1/2}$ (C.) $3^{1/3}$ (D.) $4^{1/4}$ (E.) $5^{1/5}$

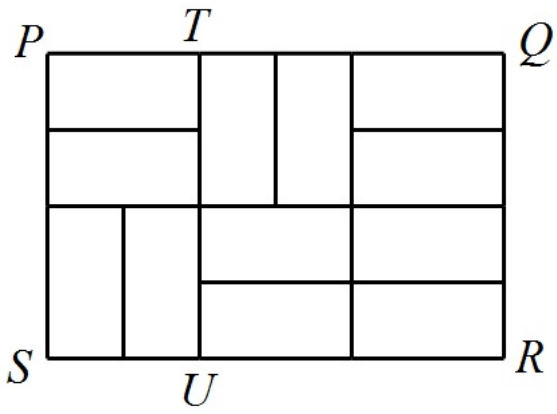
♡ Desserts ♡

Problem 16. If the odd numbers are grouped in the following way:
$\{1\}; \{3, 5\}; \{7, 9, 11\}; \{13, 15, 17, 19\}; ...$
What is the sum of the numbers in the tenth group?

(A.) 510 (B.) 800 (C.) 950 (D.)1000 (E.) 2032

Problem 17. In the diagram, a rectangular ceiling $PQRS$ measures 6 m by 4 m and is to be completely covered using 12 rectangular tiles, each measuring 1 m by 2 m. There is a beam, TU, that is positioned so that $PT = SU = 2$ m. The beam cannot be crossed by any tile. How many different tile arrangements are possible?

(A.) 180 (B.) 190 (C.) 185 (D.) 170 (E.) 175



Problem 18. The base of a triangle is 15 inches. Two line segments are drawn parallel to the base. These segments connect the other two sides of the triangle and divide the triangle into three equal areas. What is the length of the parallel closer to the base of the triangle?

(A.) $5\sqrt{6}$ inches (B.) 10 inches (C.) $4\sqrt{3}$ inches (D.) 7.5 inches (E.) none of these