WISCONSIN MIDDLE SCHOOL STATE MATHEMATICS MEET

WISCONSIN MATHEMATICS COUNCIL

March 7 – 11, 2016

Problem Set #1 Score: (For Scorer's Use Only)

Name: _____ Team: _____

[Reduce all common fractions. Decimal approximations are **not** accepted unless specifically asked for. When allowed, round decimal approximations to **3** decimal places. **No rounding should be done except on the final answer.**]

For this first problem set, calculators are <u>not</u> allowed. They may be used for the remainder of the meet only, starting with Problem Set #2.

Answers

1. (1 point)

   What is the next number in this sequence: _____

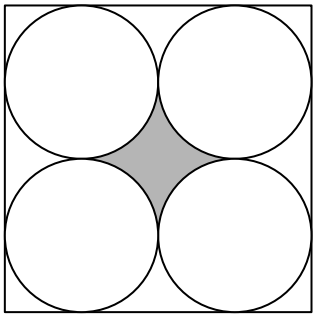
   1 2 6 15 31 56 ?

2. (3 points)

   How many digits are in the number $N = 2^{20} \times 5^{16}$? _____

3. (5 points)

   Determine the area of the shaded region in the picture below. The large square has a side length of 20. **Leave your answer as an exact answer in terms of π, with no decimal approximations.** _____



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Problem Set #2 Score: (For Scorer's Use Only)

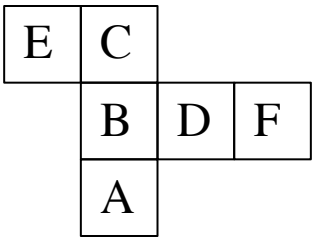
Name: _____ Team: _____

[Reduce all common fractions. Decimal approximations are **not** accepted unless specifically asked for. When allowed, round decimal approximations to **3** decimal places. **No rounding should be done except on the final answer.**]

Answers

1. (1 point)

   A piece of paper containing six joined squares labeled as shown is folded along the edges of the squares to form a cube. What is the label of the face opposite the face labeled D?



   _____

2. (3 points)

   The post office gives you four 3¢ stamps and three 5¢ stamps. Using one or more of these stamps, how many different amounts of postage can you make?

   _____

3. (5 points)

   A mother left all her money to her three daughters. Anne received $\frac{1}{6}$ of her mother's money, while Bella received $\frac{1}{7}$ of her mother's money. Cara received the remainder of the money, a total of $23,490. How much money did Anne receive?

   _____

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Problem Set #3 Score: (For Scorer's Use Only)

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[Reduce all common fractions. Decimal approximations are **not** accepted unless specifically asked for. When allowed, round decimal approximations to **3** decimal places. **No rounding should be done except on the final answer.**]

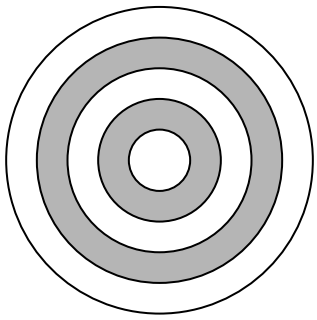
Answers

1. (1 point)

   In bowling games, Susi scored 175, 180, and 191. What score will Susi need in a fourth game in order to have an average score of 192 for all four games? _____

2. (3 points)

   The circles in the archery target shown below have radii of 1, 2, 3, 4, and 5. What <u>percent</u> of the entire region is shaded? _____



3. (5 points)

   Sheldon tortoise was born (hatched?) at the Minneapolis Zoo in the year x^2. He died on his 89^{th} birthday in the year $(x + 1)^2$. In what year was Sheldon born? _____

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Problem Set #4 Score: (For Scorer's Use Only)

Name: _____ Team: _____

[Reduce all common fractions. Decimal approximations are **not** accepted unless specifically asked for. When allowed, round decimal approximations to **3** decimal places. **No rounding should be done except on the final answer.**]

Answers

1. (1 point)

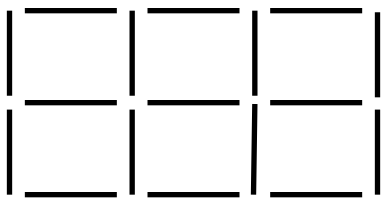
   A 10-foot ladder is leaning against a wall. The distance from the base (bottom) of the ladder to the wall is 6 feet. How high up the wall does the ladder reach? _____

2. (3 points)

   Josh's family bought 4 pounds of ice cream (64 ounces). Josh suggested that the fair way to split it was to give their share based on their weights. If Josh weighs 80 pounds, and there are three other people in his family who weigh 120, 150, and 162 pounds, how many ounces of ice cream should Josh get? _____

3. (5 points)

   In the diagram below, 17 toothpicks are used to form a 2-square by 3-square rectangle. How many toothpicks would be needed to form an 8-square by 9-square rectangle? _____



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March 7 – 11, 2016

Team Problem Set (Page 1) Score: (For Scorer's Use Only)

Name: _____ Captain: _____

[Reduce all common fractions. Decimal approximations are **not** accepted unless specifically asked for. When allowed, round decimal approximations to **3** decimal places. **No rounding should be done except on the final answer.**]

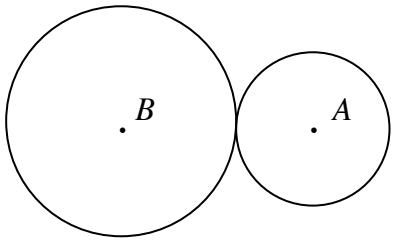
Answers

1. (10 points)

   A palindrome is a positive integer that does not change when its digits are reversed, such as 101 or 4554. What is the smallest integer greater than 9 that is a palindrome when written in both base 5 and base 10? For example, $46 = \mathbf{1}(5^2) + \mathbf{4}(5^1) + \mathbf{1}(5^0)$, so 46 is written as 141 in base 5. Thus, 46 is a palindrome in base 5, but not in base 10. Write the answer as its base 10 value. _____

2. (10 points)

   A pirate sails in a circular route around point *A* with a circumference of 32 km, and a merchant ship sails in a circular route around point *B* with a circumference of 48 km.



   If they both start where the routes meet, and the pirate sails 12 km per day and the merchant sails at 8 km per day, how many days later will they meet next? _____

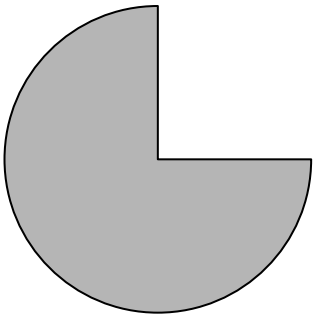
3. (10 points)

   There are numbers that divide 154 with a remainder of 4. List all two-digit numbers that have this property. _____

Team Problem Set (Page 2)

4. (10 points)

   If you cut out the sector shown below and bend it to form a cone with a circular base, what is the height of the cone? The radius of the sector is 1 cm. **Give an exact answer for this, not a decimal approximation.**



5. (10 points)

   Find the smallest positive integer b for which the expression $x^2 + bx + 2016$ factors into a product of two terms, each having integer coefficients.

6. (10 points)

   Place the digits from 1 to 9 into the boxes so that each digit is used exactly once, and all four three-digit numbers (indicated by arrows) are perfect squares.