

The 1st Annual West Windsor-Plainsboro Mathematics Expo

Saturday, October 26th, 2019

Grade 5 Problem Set

Directions:

Solve the following problems to the best of your ability. If you do not understand a problem or cannot solve it, skip it or ask for a hint. If you cannot solve a problem even after receiving all the hints for that problem, wait until the 30 minute mark and ask a proctor for further help or the solution. Some problems may not have hints.

Calculators are not allowed for these problems. You may, however, discuss with the people around you after 30 minutes have passed. That being said, do not ruin a problem for somebody by giving them a solution before they have a chance to attempt the problem themselves.

For this test, there will be 20 questions, and you will have a time limit of 60 minutes in total, which will be split into 30 minutes of individual work and 30 minutes of collaborative work. This test is very long and you are not expected to be able to do all of the problems. We recommend picking a range of 10-15 problems to work on.

Please note that this is not a competition, and your goal is to enjoy the problems and gain experience.

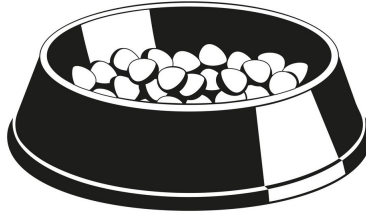
HAVE FUN!

By the way, if you finish this exceptionally early, you are most likely an exceptional student. Thus, here is a slightly harder problem that you may wish to solve:

CHALLENGE:

You are given an 8x8 chessboard, 21 3x1 dominoes, and one 1x1 domino. Is it possible to tile the board with the dominoes? Note that dominoes cannot overlap.

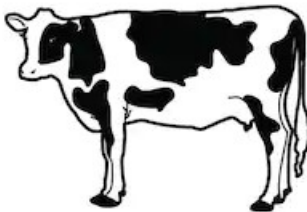
1. What are the next two numbers in the pattern? 1, 4, 16, 64, \dots
2. What is 90% of 110% of 100?
3. 100 students filled out a survey. 60 said they own a dog, 50 said they own a cat, and 10 said they owned neither. How many owned both a cat and a dog?
4. If 2 dogs eat 5 cans of dog food, how many cans of dog food do 7 dogs eat?



5. Jack is going to make an order at a restaurant. He has 3 options for his meal, 2 options for his drink, and 2 options for his appetizer. If an order consists of exactly one meal, one drink, and one appetizer, how many orders can Jack choose from?



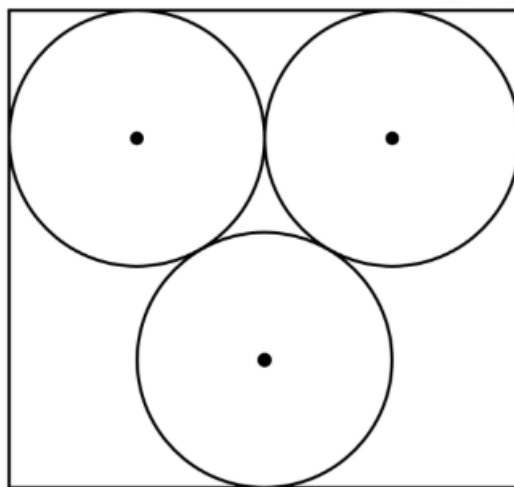
6. What is the area of the triangle defined by the coordinates (0,0), (6,4), and (4,6)?
7. What is the area of a triangle with side lengths 333, 444, and 555?
8. What is $\frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \dots$
9. Farmer John's cows have been oddly quiet. To solve this, he is giving his 4 cows some bells. In how many ways can he distribute 3 identical bells to the 4 (not identical) cows?



10. Quadrilateral ABCD is a square with side length 4. Points M and N are the midpoints of AB and CD respectively. Point P is the intersection of AN and MD and point Q is the intersection of MC and BN. What is the area of quadrilateral MPNQ?
11. For what values of x is $x^3 - x = 0$?
12. Before plums are dried to become prunes, they are 82% water. After they dried, they are only 10% water. If only water is lost in the drying process, how many pounds of prunes can be made from 100 pounds of plums?



13. Jim is making a model of a building that is shaped like a rectangular prism. He decides on a ratio of 1 foot to 1 inch for his model. If his model is 2 inches x 3 inches x 4 inches, how many times larger is the volume of the building than the model? (Note: there are 12 inches in a foot)
14. How many ways are there to get from (0,0) to (4,4) if you can only move 1 unit upward or to the right at a time?
15. A circle is inscribed in an equilateral triangle, which is in turn inscribed in another circle. What is the ratio between the areas of the two circles?
16. What is $\frac{1}{1 \cdot 2} + \frac{1}{2 \cdot 3} + \frac{1}{3 \cdot 4} + \dots + \frac{1}{99 \cdot 100}$
17. Find the area of a regular octagon with side length 1.
18. Given three tangent circles of radius 1, what is the area of the region between them?



19. Let X be a positive integer less than 300. When X is divided by 2, the remainder is 1. When X is divided by 3, the remainder is 2. When X is divided by 5, the remainder is 4. When X is divided by 7, the remainder is 6. Find X .
20. What is $\frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \frac{1}{5} + \dots$