# CARMEL VALLEY MIDDLE SCHOOL MOCK TEST

Credits to Jeffisepic, Oceanair, Budu, Designerd, Giacomorizzo, and Itised

Thanks to our testsolvers, Anno, Flyrain and Math1331Math!

## $\sum$ Rules

1. This is a 25 question short answer test. The test is around AMC 12 difficulty. We will not specify what form the answers should be in, but all answers should be completely simplified.

2. You will receive 6 points for each correct answer, 1.5 points for each blank answer, and 0 points for each incorrect answer.

3. No aids are permitted other than writing utensil, scratch paper. No calculators are allowed; no problems on the test require the use of a calculator.

4. You are given 90 minutes to complete the test.

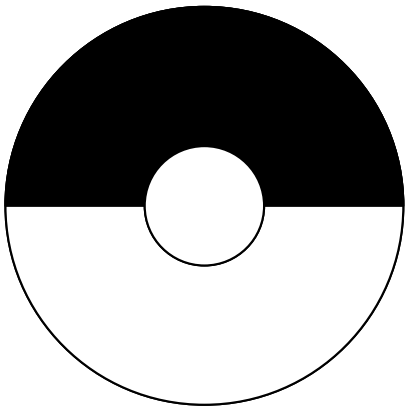
5. There will be a discussion forum after this. If you feel that any problem is too challenging, you may discuss it after the mock is over.

6. When you are finished with the test, please PM your answers to Jeffisepic and Oceanair.

7. Have fun!!!

1. Designerd doubles the amount of candies he eats each day. If on Day 1 he eats 1 candy, what is the total number of candies he will have eaten when Day 4 ends?

2. Jeffisepic's pokeball is shaped by a big circle with a radius of 3 and a smaller one with a diameter of 2. What is the area of the shaded area in Jeffisepic's pokeball? (the area of the lines is negligible)



3. Find the remainder when $2018 + 2019 + .... + 4033$ is divided by 2017.

4. Oceanair is at a 1 mile racetrack. Each lap he runs is 2 mph slower than the one previously run. If he runs 4 laps and runs his first lap at 10 mph, what is his average time in hours per lap?

5. If $(\sqrt{x} + \sqrt{y})^2 - (\sqrt{x} - \sqrt{y})^2 = 128$ find the sum of the possible positive integer values of $x$.

6. How many triangles can be formed from 3 vertices of a regular hexagon such that the area is less than a third of the area of the hexagon?

7. If a number has 8 odd factors and 24 factors, what is the least possible value of this number?

8. 4 sides of a hexagon are 20 and the other 2 are $10\sqrt{2}$. What is the area of this hexagon if 2 of the angles are right angles and the other angles are all congruent?

9. In rectangle $ABCD$, $AB = 4$ and $BC = 5$. A point E is placed on diagonal $AC$ such that $\frac{AE}{EC} = n$. $DE$ is then extended to meet side $BC$ at point $F$. What is the greatest possible $n$ such that FB is an integer and $E \neq C$?

10. There are 36 marbles in a bag. Each marble is either red or blue. If two of the marbles are removed (without replacement) from the bag, the ratio of the probability that two red marbles are removed to the probability that one red and one blue marble are removed is $\frac{1}{3}$. How many of the marbles are blue?

11. How many 9s are in the least possible number that is divisible by 91 and consists of only 9s?

12. Find the larger $x$ if $\log_2 x = \log_4 x \cdot \log_6 x$.

13 . A number is bad if it has exactly two or three composite factors that aren't itself. For example, 16 is bad because it has two composite factors other than itself, 4 and 8. How many bad numbers are less than 100?

14. Let $a^! = a^{a-1^{\cdots^1}}$. For example, $3^! = 3^{2^1} = 9$. How many $a$ less than 2017 are there such that $a^!$ has unit digit 1?

15. In triangle $ABC$, the altitude from $A$ to $BC$ is 7 and the altitude from $B$ to $AC$ is 10. What is the positive difference between the smallest possible integer altitude and the largest possible integer altitude from $C$ to $AB$?

16. Compute the number of possible values of $(A, B)$ where $A, B, C, D$ are nonzero digits and where $\frac{AB}{CD} = \frac{BA}{DC} \neq 1$

in base 8. $A \neq B, C \neq D$

17. Find the hundreds digit of $1 + \frac{1}{2} + \frac{1}{3} \cdots \frac{1}{2^{199}-1}$.

18. Itised has 12 sticks of lengths $1, 2, 3...12$. How many ways can he remove 4 sticks such that he can make a quadrilateral out of these 4 sticks?

19. The solutions to $2b^2 + 2a^2 - 2ab + a + 2b = 14$ can be represented as $(a, b)$. What is the sum of all possible values of $b$ if both $a$ and $b$ are integers?

20. 1092791 can be expressed as $a \cdot b$, where $a$ is a 3 digit positive integer and $b$ is a 4 digit positive integer. Compute $a + b$.

21. Budu is rolling a 4 sided die (with numbers 1,2,3,4). What is the expected number of times he will roll the die until (and including the final roll) the number he rolls is greater than the number he rolled before it?

22. If the solutions to

$$(2a + 1)(4a^2 + 1)(16a^4 + 1) = 3$$

are $a_1, a_2, \cdots a_7$, find $a_1^8 + a_2^8 \cdots a_7^8$.

23. In acute triangle $ABC$, let $M$ be the midpoint of $\overline{BC}$. The circle with diameter $\overline{BC}$ intersects $\overline{AB}$ and $\overline{AC}$ at $P \neq B$ and $Q \neq C$, respectively. Let the midpoint of $\overline{PQ}$ be $R$. Given that $\angle RMQ + \angle ACB = 90^\circ$ and $\sin(\angle ABC) = \frac{2}{5}$, compute $\frac{[BMP]}{[PMCQ]}$.

24. Find the largest possible value of $x$ if $x$ satisfies $\sqrt{5 - x} = 5 - x^2$.

25. What is the maximum possible area of a rectangle entirely within or on the boundary of the region bounded by the graphs of $y = x^2 - 4$ and $y = -x^2 - 4x + 4$?