

Cubey the Penguin Mock AMC 8

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RULES

This is a 40-minute, 25-question test. Be sure to set a timer for 40 minutes before taking this test. Note that this test will be easier than most AMC 8s.

You may not use any aids other than a pencil and scratch paper. Calculators are absolutely not allowed.

To submit your answers, PM coolmath34 under the title "Cubey the Penguin Mock AMC 8 Submission" or anything else that lets me know that you are submitting answers to this contest.

I will be making a leaderboard. If you do not wish to have your score public, I can list you as "Anonymous."

TEST

1. Cubey's teacher wants to keep the class busy. He tells them to simplify this expression:

$$5(5^4 - 5^3 - 5^2 - 5^1)$$

What is the value of this expression?

- A) 5 B) 625 C) 470 D) 2350 E) 125

2. Let an operation $x@y$ denote $x^2 + 2xy + y^2$. What is the value of $3@(2@2)$?

- A) 123 B) 16 C) 25 D) 361 E) 278

3. Cubey has four types of fish: trout, salmon, cod, and a goldfish. How many ways can he arrange them in a row?

- A) 4 B) 24 C) 36 D) 256 E) 6

4. Cubey is running to the store. His average running speed is one mile per hour. If the distance from Cubey's house to the store is 440 yards, how much time, in minutes, would it take Cubey to get to the store? (One mile is equal to 1760 yards.)

- A) 0.25 B) 15 C) 440 D) 1 E) 1760

5. When sitting around in the house, Cubey finds a tennis ball container. It is a cylinder with a radius of 1 inch and a height of 8 inches. What is the volume of this container, in inches? Express your answer in terms of π .

- A) 64π B) 16π C) π D) 128π E) 8π

6. Cubey is running through a cornfield. The cornfield is a rectangle with sides 5 and 10. If Cubey runs along the diagonal, what is the distance that Cubey runs?

- A) $\sqrt{5}$ B) $5\sqrt{5}$ C) 15 D) $\sqrt{10}$ E) $10\sqrt{5}$

7. Penguins' birth survival rates are 40%. If two penguin babies are born, what is the probability that at least one survives? Express your answer as a common fraction.

- A) $\frac{3}{5}$ B) $\frac{2}{5}$ C) $\frac{16}{25}$ D) $\frac{9}{25}$ E) $\frac{1}{5}$

8. Cubey doesn't like to carry heavy backpacks. For every pound of weight he adds to his backpack, he moves half a meter per second slower. If he can move at six meters per second with an empty backpack, what is the number of pounds he can hold before he can't move at all?

- A) 1 B) 6 C) 12 D) 11 E) 8

9. The flag that Cubey is using for his ship is a right triangle with legs 7 and 24. His friend also makes a flag with legs 12 and 9. What is the positive difference in length of the hypotenuse of the flags?

- A) 25 B) 15 C) 19 D) 12 E) 10

10. Cubey is sculpting in art class. If Cubey is a cube with 6 inches for each side and makes a sculpture with 216 times his volume, what is the length of one edge of his sculpture? Assume the sculpture is a cube.

- A) 216 B) 36 C) 12 D) 1296 E) 360

11. Cubey has a bag of candied fish. He gives half to his brother. Then, out of the other half, he takes the half of that and gives it to his sister. This process is repeated with his mom and with his dad. After he gives the fish to his dad, Cubey has 6 candied fish left. How much candied fish did Cubey start out with?

- A) 12 B) 24 C) 72 D) 48 E) 96

12. Let a function be defined as follows.

(I) $f(0)=1$

(II) $f(1)=2$

(III) $f(n)=3(f(n-1)+f(n-2))$

What is the value of $f(6)$?

- A) 477 B) 36 C) 33 D) 1809 E) 981

13. A painting of a penguin with dimensions 10 inches by 14 inches is placed in a picture frame, increasing its area to 221 square inches. How many inches is the thickness of the picture frame if the frame is with uniform width?

- A) 2 B) 3 C) $\frac{3}{2}$ D) $\frac{7}{2}$ E) 4

14. Twenty penguins and fifteen walruses are at the Annual Arctic Animals Convention. The walruses have had a lot of in-fighting lately and refuse to shake flippers with each other. Meanwhile, all the penguins are quite friendly and shake flippers with all of the other penguins as well as walruses. Each pair of creatures shakes hands at most once. How many flipper shakes were at the convention?

- A) 190 B) 250 C) 300 D) 490 E) 270

15. Cubey has a Nike shoebox. The shoebox is 7 inches wide, 16 inches long, and 5 inches tall. His brother then puts another smaller box inside that is 2 inches wide, 4 inches long, and 3 inches tall. What is the volume of the space in the Nike shoebox that is not occupied by the smaller box?

- A) 560 B) 536 C) 12 D) 24 E) 49

16. Cubey's parents own a shop. In one corner is a dusty box containing coins of value 13 and 15 flargs. What is the largest number of flargs than cannot be made by using a combination of these coins?

- A) 68 B) 81 C) 97 D) 52 E) 167

17. Cubey and his sister are building snow pyramids. Cubey builds a tetrahedral three-dimensional structure of snowballs 16 layers high. Cubey's sister builds a two-dimensional triangular structure of snowballs 50 layers high. What is the positive difference between the number of snowballs Cubey and his sister used in building the snow pyramids?

- A) 459 B) 1276 C) 816 D) 764 E) 581

18. Cubey is in a room shaped with an equilateral triangle with length 8. He fires a laser from one of the vertices.

Coincidentally, the path of the laser is the median and the altitude of one of the sides of the triangle. What is the length of the laser that Cubey fired? Only count the distance made from the vertex and the opposite side of the triangle.

- A) $\frac{8\sqrt{3}}{3}$ B) 8 C) $8\sqrt{3}$ D) $\frac{4\sqrt{3}}{3}$ E) $4\sqrt{3}$

19. Cubey is waddling around a number line with boundaries at 2 and -2. Every time he moves, he moves left with $\frac{1}{4}$ probability, moves right with $\frac{1}{4}$ probability, and stays put with $\frac{1}{2}$ probability. Suppose Cubey starts at 0. What is the probability that after 2 moves, he ends up at 0?

- A) $\frac{1}{2}$ B) $\frac{1}{4}$ C) $\frac{3}{8}$ D) $\frac{1}{3}$ E) $\frac{5}{8}$

20. Cubey draws a circle. At random, he draws a point inside the circle. What is the probability that the point Cubey chose is closer to the center of the circle than to the outside of the circle?

- A) $\frac{1}{2}$ B) $\frac{3}{4}$ C) $\frac{1}{4}$ D) $\frac{3}{8}$ E) $\frac{1}{8}$

21. In math class, Cubey is bored and decides to doodle. He draws a square with side length 2, and inscribes a circle in it. Then, he creates another square with a side length being the diagonal of the smaller square, then inscribes a circle in the bigger square. What is the positive difference of the areas of the two circles?

- A) $2\sqrt{2}\pi$ B) $\sqrt{2} - \pi$ C) π D) 1 E) $\frac{\sqrt{2}}{2}\pi$

22. What is the constant term of $(2x + 6)^5$?

- A) 32 B) 480 C) 12960 D) 7776 E) 960

23. Cubey, not satisfied with his first drawing, tries to draw something else. He starts with an equilateral triangle with side length 4. He then draws a circle inside of it, then shades the area not occupying the circle. What is that area?

- A) $4\sqrt{3} - \frac{4}{3}\pi$ B) 4π C) $2\sqrt{3}$ D) $4\sqrt{3} - 2\pi$ E) 2π

24. Let O be the center of a triangle. Line \overline{AB} is a chord of circle O with length 8. The distance from \overline{AB} to O is 1. What is the length of AO ?

- A) $\sqrt{17}$ B) $\sqrt{15}$ C) 4 D) $\sqrt{14}$ E) $2\sqrt{5}$

25. The positive five-digit integers that use each of the digits 1, 2, 3, 4 and 5 exactly once are ordered from least to greatest. What is the 50th integer in the list?

- A) 24351 B) 31254 C) 32451 D) 45123 E) 34512

TIEBREAKER QUESTIONS

If you have the same score as someone else, you will attempt the tiebreaker questions. Whoever gets the most correct out of these tiebreaker questions will be ranked higher.

1. The value b^n has both b and n as positive integers less than or equal to 15. What is the greatest number of positive factors b^n can have?

2. There is an assortment of candy at the convenience store. There are three lollipops, five Airheads, and eight chocolate bars. How many different ways are there to arrange the candies of the respective candies are indistinguishable to each other?

3. What is the length of the segment of the number line consisting of the points that satisfy $(x - 4)^2 \leq 9$?

ADJUDICATING TIEBREAKERS

If two people get the same score on the tiebreakers, I will use (almost) the same method that reün used on his Thanksgiving Mock AMC 10. Your tiebreaker score will be determined as follows: $((\text{number of problems correct} \times 2) - (\text{total number value of problems missed})) / 25$. (Sorry, LaTeX isn't very agreeable today.) This is my first time writing a mock contest; I hope you enjoy!