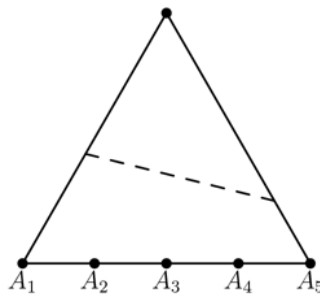


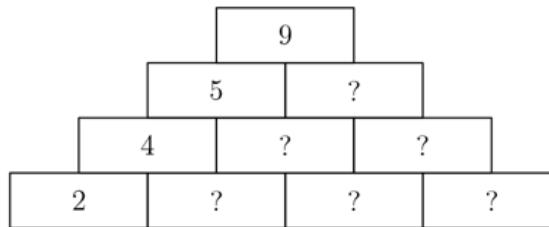
Individual Round

1. Calculate the numerical value of $1 \times 1 + 2 \times 2 - 2$.
(A) 2 (B) 3 (C) 4 (D) 5 (E) 6
2. A certain value of x satisfies $1 + x + 5 - 1 = 7$. What is this value of x ?
(A) 0 (B) 1 (C) 2 (D) 3 (E) impossible to determine
3. What is the positive difference between the largest possible two-digit integer and the smallest possible three-digit integer?
(A) 1 (B) 2 (C) 3 (D) 5 (E) 9
4. If you were to randomly select an answer to this question, what is the probability it would be correct?
(A) 0% (B) 20% (C) 40% (D) 80% (E) 100%
5. What is the side length, in meters, of a square with area 49 m^2 ?
(A) 3 (B) 4 (C) 5 (D) 6 (E) 7
6. The top vertex of this equilateral triangle is folded over the shown dashed line. Which of the 5 points will the vertex lie closest to after this fold?



- (A) A_1 (B) A_2 (C) A_3 (D) A_4 (E) A_5
7. John's digital clock is broken. It scrambles the digits of the time and displays them in a random order. For example, if the current time is $4 : 21$, it could display $4 : 12$, $2 : 14$, or any other reordering of 4, 1, and 2. If his clock reads $6 : 71$ one morning, how many possibilities are there for the correct time?
(A) 0 (B) 1 (C) 2 (D) 4 (E) 6
 8. $(1 + \sqrt{3})^2$ may be written as $a + b\sqrt{3}$ for certain integers a and b . What is $a + b$?
(A) 1 (B) 2 (C) 4 (D) 6 (E) 7
 9. Lily has an unfair coin that has $\frac{2}{3}$ probability of showing heads and $\frac{1}{3}$ probability of showing tails. She flips the coin twice. What is the probability that the first flip is heads while the second is tails?
(A) 0 (B) $\frac{1}{9}$ (C) $\frac{2}{9}$ (D) $\frac{4}{9}$ (E) 1

10. In the diagram below, for each row except the bottom row, the number in each cell is determined by the sum of the two numbers beneath it. Find the sum of all cells denoted with a question mark.

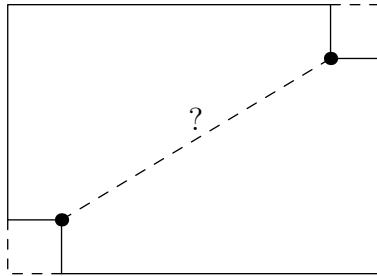


- (A) 6 (B) 8 (C) 12 (D) 13 (E) 14
11. The numbers 1, 2, 3, 4, 5, 6 are placed onto the following six spots such that the average of the leftmost two spots, middle two spots, and rightmost two spots are all equal. What is the difference between the largest and smallest possibilities of the number on the shaded spot shown below?

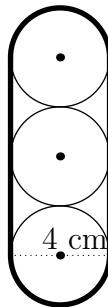


- (A) 1 (B) 2 (C) 3 (D) 4 (E) 5
12. Jane's mother bakes cookies for Jane to share with her 6 friends. When the cookies are evenly divided among the 7 children (Jane and her 6 friends), there is one cookie left over. Given that each child receives at least 1 cookie, and Jane's mother baked less than 100 cookies, how many different numbers of cookies could Jane's mother have baked? For example, she could have baked 15 cookies, because each child receives 2 cookies, with 1 left over.
- (A) 9 (B) 11 (C) 14 (D) 15 (E) 17
13. For how many real values of x is the equation $(x^2 - 7)^3 = 0$ true?
- (A) 0 (B) 1 (C) 2 (D) 3 (E) 4
14. Given that x satisfies $2^{4x} \cdot 4^{2x} \cdot 8^{4x} = 16^5$, find the value of x .
- (A) 1 (B) 2 (C) 4 (D) 5 (E) 10
15. In the city of Urbextorto, the sales tax is 25%. A certain clothing store in the city is currently giving an $n\%$ discount on all its items, and n is special in that, after both the sales tax and discount are applied, a \$20 shirt ends up costing \$20. Find the value of n .
- (A) 5 (B) 10 (C) 20 (D) 25 (E) 50

16. Two 1 inch by 1 inch squares are cut out from opposite corners of a 7 inch by 5 inch piece of paper to form an octagon. What is the distance, in inches, between the two dotted points, both of which lie on corners of the octagon?

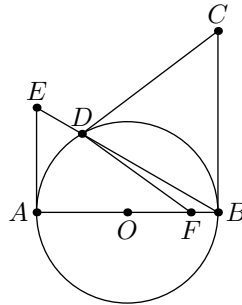


- (A) 5 (B) $\sqrt{34}$ (C) $5\sqrt{2}$ (D) 8 (E) $\sqrt{74}$
17. A rubber band of negligible thickness encloses three pegs that lie in a perfect line, as shown. Each peg has a diameter of 4 cm, as shown. What is the length of the rubber band used, in centimeters? All pegs shown are congruent circles.



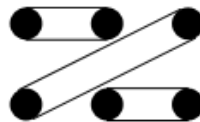
- (A) 8 (B) $8 + 4\pi$ (C) $16 + 4\pi$ (D) $16 + 8\pi$ (E) 16π
18. When 171 is written as the sum of 19 consecutive integers, the median of those numbers is M . When 171 is written as the sum of 18 consecutive integers, the median of those numbers is N . Find $|M - N|$.
- (A) -1 (B) -0.5 (C) 0 (D) 0.5 (E) 1

19. In the diagram below, AB is a diameter of circle O . Point C is drawn such that \overline{BC} is tangent to circle O , and $AB = BC$. A point F is selected on line AB and a point D is selected on circle O such that $\angle CDF = 90^\circ$. Line \overline{BD} is then extended to point E such that AE is tangent to circle O . Given that $AE = 5$, calculate the length of \overline{AF} . (Diagram not to scale)

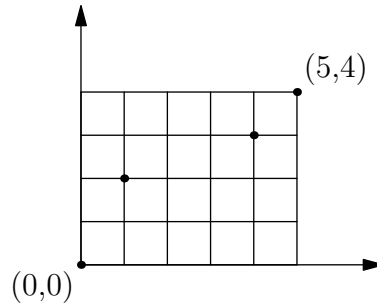


- (A) $\frac{9}{2}$ (B) 5 (C) $3\sqrt{3}$ (D) 7 (E) impossible to determine
20. John can purchase pieces of gum in packs of 4, 14, and 20 pieces. Given that he purchases at least one of each kind of pack, what is the positive difference between the greatest and least number of packs he can purchase to end up with exactly 86 pieces of gum?
- (A) 5 (B) 6 (C) 7 (D) 8 (E) 9
21. Consider the following 2×3 arrangement of pegs on a board. Jane places three rubber bands on the pegs on the board such that the following conditions are satisfied:
- (I) No two rubber bands cross each other.
 (II) Each peg has a rubber band wrapped around it

How many distinct arrangements could Jane create exist? One acceptable arrangement is shown below.



- (A) 2 (B) 3 (C) 5 (D) 6 (E) 8
22. Jane's uncle gives her a "4-balance." The 4-balance acts like a normal balance scale, but it compares four masses instead of two, tilting towards the weight that is heaviest (if all four are equal, it stays balanced). He then gives her 25 coins, one of which is a counterfeit heavier than the rest. What is the minimum number of uses of the 4-balance needed to ensure she identifies the counterfeit?
- (A) 1 (B) 2 (C) 3 (D) 4 (E) 5
23. There exists a positive integer b such that the base-10 fraction $\frac{59}{48}$ can be expressed as $1.\overline{14}_b$ (or $1.141414\dots_b$), a value in base b . Find b .
- (A) 5 (B) 6 (C) 7 (D) 8 (E) 9



24. A leprechaun wishes to travel from the origin to a pot of gold located at the coordinate point $(5,4)$. If she can only move upwards and rightwards along the unit grid, must pass a checkpoint at $(1,2)$, and must avoid an evil thief at $(4,3)$, how many distinct paths can she take?

(A) 7 (B) 15 (C) 21 (D) 45 (E) 126

25. A number N is defined as follows:

$$N = 2 + 22 + 202 + 2002 + 20002 + \cdots + 2 \overbrace{00 \dots 000}^{19 \text{ 0's}} 2$$

When the value of N is simplified, what is the sum of its digits?

(A) 42 (B) 44 (C) 46 (D) 50 (E) 52

Answer key

1. B
2. C
3. A
4. B
5. E
6. B
7. C
8. D
9. C
10. D
11. A
12. C
13. C
14. A
15. C
16. B
17. C
18. D
19. B
20. E
21. C
22. B
23. C
24. C
25. C