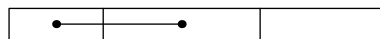


- What is $4^0 - 3^1 - 2^2 - 1^3$?
(A) -8 (B) -7 (C) -5 (D) 4 (E) 5
- A machine takes 6 seconds to make 4 coins. How long does it take for the machine to make 22 coins? The machine makes coins at the same constant rate.
(A) 30 (B) 33 (C) 36 (D) 39 (E) 42
- Jar A and Jar B each contain 10 beans. The number of beans in jar A is doubled, and the number of beans in jar B is halved. How many beans are now in jars A and B ?
(A) 15 (B) 20 (C) 25 (D) 30 (E) 40
- Which of the following answer choices is equivalent to $\sqrt{a^3b^2c}$?
(A) $ab\sqrt{ac}$ (B) $bc\sqrt{ac}$ (C) $b\sqrt{ac}$ (D) $abc\sqrt{ab}$ (E) $a\sqrt{bc}$
- Jamie accidentally misinterprets the rules of the order of operations, and adds or subtracts before multiplying or dividing. What would be her result for the equation $4 + 3 \times 1 - 2$?
(A) -7 (B) -5 (C) 5 (D) 7 (E) 9
- Two different 3×3 grids are chosen within a 5×5 grid. What is the least number of unit grids contained in the overlap of the two 3×3 grids?
(A) 0 (B) 1 (C) 3 (D) 4 (E) 6
- Consider the rectangular strip of length 12 below, divided into three rectangles. The distance between the centers of two of the rectangles is 4. What is the length of the other rectangle?

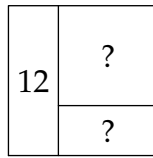


- (A) 2.5 (B) 3 (C) 3.5 (D) 4 (E) 4.5
- Write a list of the first 10 positive integers in increasing order. Erase any number adjacent to a prime; if two primes are adjacent, do not erase either prime. Apply this process twice. How many positive integers remain in the list?
(A) 2 (B) 3 (C) 4 (D) 5 (E) 6
 - How many integer values of x satisfy

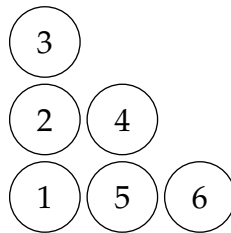
$$\frac{3}{2} < \frac{9}{x} < \frac{7}{3}?$$

- (A) 1 (B) 2 (C) 3 (D) 4 (E) 5

10. The diagram below shows a square of area 36 separated into two rectangles and a smaller square. One of the rectangles has an area of 12. What is the smallest rectangle's area?

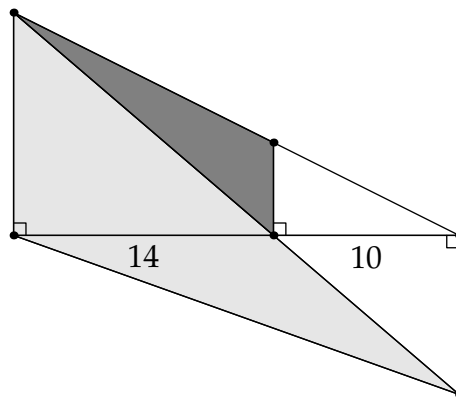


- (A) 8 (B) 9 (C) 12 (D) 16 (E) Not Enough Information
11. The sum of n consecutive numbers is divisible by n for some $n > 1$. For which n is this always true?
- (A) even n (B) odd n divisible by 3 (C) odd n (D) prime n (E) no such n exists
12. For a certain value of x , the sum of the digits of $10^x - 100$ is equal to 45. What is x ?
- (A) 4 (B) 5 (C) 6 (D) 7 (E) 8
13. Consider the numbers 1 through 6 numbered on the coins below. Ella takes a coin from each of the three columns. Bella takes a coin from each of the remaining two columns. Cassandra takes the remaining coin. In how many ways could they have taken out the six coins?



- (A) 9 (B) 12 (C) 15 (D) 18 (E) 20
14. Four coins are placed in a line. A passerby walks by and flips each coin, and stops if she ever obtains two adjacent heads. If the passerby manages to flip all four coins, how many possible head-tail combinations exist for her four flips?
- (A) 4 (B) 6 (C) 8 (D) 10 (E) 12
15. A function $f(a\frac{b}{c})$ for a simplified mixed fraction $a\frac{b}{c}$ returns $\frac{a+b}{c}$. For instance, $f(2\frac{5}{7}) = 1$ and $f(\frac{4}{5}) = \frac{4}{5}$. What is the sum of the three smallest positive rational x where $f(x) = \frac{2}{9}$?
- (A) $\frac{5}{2}$ (B) $\frac{68}{27}$ (C) $\frac{23}{9}$ (D) $\frac{74}{27}$ (E) $\frac{13}{4}$

16. Let P be a point on side \overline{AB} of equilateral triangle ABC . If $BP = 6$ and $CP = 9$, what is the length of AB ?
- (A) $2\sqrt{5}$ (B) $3 + \sqrt{6}$ (C) $3\sqrt{5}$ (D) $3\sqrt{6} + 3$ (E) $6\sqrt{2}$
17. Jane and Jena sit at non-adjacent chairs of a four-chair circular table. In a turn, one person can move to an adjacent chair without a person. Jane moves in the first turn, and alternates with Jena afterwards. In how many ways can Jena be adjacent to Jane after nine moves?
- (A) 16 (B) 18 (C) 32 (D) 162 (E) 512
18. If the six-digit number $\underline{2021}a\underline{b}$ is divisible by 9, what is the greatest possible value of $a \cdot b$?
- (A) 18 (B) 20 (C) 36 (D) 40 (E) 42
19. A three-digit number N is equal to 36 times the sum of its digits. Find the sum of all possible values of N .
- (A) 576 (B) 648 (C) 972 (D) 1152 (E) 1620
20. The area of the dark gray triangle depicted below is 35, and a segment is divided into lengths 14 and 10 as shown below. What is the area of the light gray triangle?



- (A) 84 (B) 120 (C) 132 (D) 144 (E) 168
21. Let $T(p)$ denote the number of right triangles with integer side lengths and one of its side lengths being p . Which of the following values of p produces the greatest possible value of $T(p)$ among all five answer choices?
- (A) 24 (B) 27 (C) 28 (D) 36 (E) 54

22. Jerry and Aaron both pick two integers from 1 to 6, inclusive, and independently and secretly tell their numbers to Dennis.

Dennis then announces, "Aaron's number is at least three times Jerry's number."

Aaron says, "I still don't know Jerry's number."

Jerry then replies, "Oh, now I know Aaron's number."

What is the sum of their numbers?

- (A) 4 (B) 5 (C) 6 (D) 7 (E) 8
23. Elax creates a partially filled 4×4 grid, and is trying to write in positive integers such that any four cells that share no rows or columns always sum to a number S . Given that the sum of the numbers in the top row is also S , what is the missing cell number?

?	8		
10		7	
11			9
			4

- (A) 4 (B) 6 (C) 9 (D) 10 (E) 12
24. Cows Alpha and Beta are tied by eight-meter ropes, on the midpoints of adjacent sides of a rectangular fence. Both cows are outside the fence; Alpha can wander in a region with an area of 34π square meters and Beta can wander in a region with an area of 40π square meters. What is the area enclosed by the rectangular fence?

- (A) 45 (B) 48 (C) 96 (D) 120 (E) 144
25. For all positive integers $a > 1$, there are divisors of $2021a$ that are not divisors of 2021. If there are twelve unshared divisors, including $2021a$, which of the following answer choices could be a possible value of a ?

- (A) 9 (B) 10 (C) 16 (D) 18 (E) 19