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ARITHMETIC

- 2006B 11. What is the tens digit in the sum $7! + 8! + 9! + \cdots + 2006!$?
- (A) 1 (B) 3 (C) 4 (D) 6 (E) 9

- 2003B 13. Let $\clubsuit(x)$ denote the sum of the digits of the positive integer x . For example, $\clubsuit(8) = 8$ and $\clubsuit(123) = 1 + 2 + 3 = 6$. For how many two-digit values of x is $\clubsuit(\clubsuit(x)) = 3$?
- (A) 3 (B) 4 (C) 6 (D) 9 (E) 10
- 2002B 14. The number $25^{64} \cdot 64^{25}$ is the square of a positive integer N . In decimal representation, the sum of the digits of N is
- (A) 7 (B) 14 (C) 21 (D) 28 (E) 35
- 2013B 14. Define $a\clubsuit b = a^2b - ab^2$. Which of the following describes the set of points (x, y) for which $x\clubsuit y = y\clubsuit x$?
- (A) a finite set of points
(B) one line
(C) two parallel lines
(D) two intersecting lines
(E) three lines

2018A

14. What is the greatest integer less than or equal to

$$\frac{3^{100} + 2^{100}}{3^{96} + 2^{96}} ?$$

- (A) 80 (B) 81 (C) 96 (D) 97 (E) 625

2005A

15. How many positive cubes divide $3! \cdot 5! \cdot 7!$?

- (A) 2 (B) 3 (C) 4 (D) 5 (E) 6

2011B

15. Let @ denote the “averaged with” operation: $a @ b = \frac{a+b}{2}$. Which of the following distributive laws hold for all numbers x , y , and z ?

- I. $x @ (y + z) = (x @ y) + (x @ z)$
II. $x + (y @ z) = (x + y) @ (x + z)$
III. $x @ (y @ z) = (x @ y) @ (x @ z)$

- (A) I only (B) II only (C) III only (D) I and III only
(E) II and III only