41. A palindrome between 1000 and $10,000$ is chosen at random. What is the probability that it is divisible by 7 ?

**(A)** $\frac{1}{10}$ **(B)** $\frac{1}{9}$ **(C)** $\frac{1}{7}$ **(D)** $\frac{1}{6}$ **(E)** $\frac{1}{5}$

42. For what value of $x$ does

$$\log_{\sqrt{2}} \sqrt{x} + \log_2 x + \log_4(x^2) + \log_8(x^3) + \log_8(x^3) + \log_{16}(x^4) = 40\,?$$

43. In $\triangle ABC$, $\cos(2A - B) + \sin(A + B) = 2$ and $AB = 4$. What is $BC$ ?

**(A)** $\sqrt{2}$ **(B)** $\sqrt{3}$ **(C)** 2 **(D)** $2\sqrt{2}$ **(E)** $2\sqrt{3}$

44. Let $a, b, c, d$, and $e$ be positive integers with $a + b + c + d + e = 2010$, and let $M$ be the largest of the sums $a + b, b + c, c + d$, and $d + e$. What is the smallest possible value of $M$ ?

45. For how many ordered triples $(x, y, z)$ of nonnegative integers less than 20 are there exactly two distinct elements in the set $\{i^x, (1 + i)^y, z\}$, where $i = \sqrt{-1}$ ?

46. Positive integers $a, b$, and $c$ are randomly and independently selected with replacement from the set $\{1, 2, 3, \ldots, 2010\}$. What is the probability that $abc + ab + a$ is divisible by 3 ?

**(A)** $\frac{1}{3}$ **(B)** $\frac{29}{81}$ **(C)** $\frac{31}{81}$ **(D)** $\frac{11}{27}$ **(E)** $\frac{13}{27}$

47. The entries in a $3 \times 3$ array include all the digits from 1 through 9, arranged so that the entries in every row and column are in increasing order. How many such arrays are there?

48. A frog makes 3 jumps, each exactly 1 meter long. The directions of the jumps are chosen independently and at random. What is the probability that the frog's final position is no more than 1 meter from its starting position?

**(A)** $\frac{1}{6}$ **(B)** $\frac{1}{5}$ **(C)** $\frac{1}{4}$ **(D)** $\frac{1}{3}$ **(E)** $\frac{1}{2}$

49. A high school basketball game between the Raiders and the Wildcats was tied at the end of the first quarter. The number of points scored by the Raiders in each of the four quarters formed an increasing geometric sequence, and the number of points scored by the Wildcats in each of the four quarters formed an increasing arithmetic sequence. At the end of the fourth quarter, the Raiders had won by one point. Neither team scored more than 100 points. What was the total number of points scored by the two teams in the first half?

50. A geometric sequence $(a_n)$ has $a_1 = \sin x, a_2 = \cos x$, and $a_3 = \tan x$ for some real number $x$. For what value of $n$ does $a_n = 1 + \cos x$ ?