1. How many unique, four digit pin code numbers are there? Each digit in the pin code must be chosen from the range 0 – 9 (inclusive).
2. 36 B) 40 C) D) E) NOTA
3. Hilary is stacking eight books on a shelf. How many ways she arrange the books if three books are identical and the other five are distinct from all others?
4. 42 B) 120 C) 6720 D) 8! – 3! E) NOTA
5. Kevin is preparing for battle and can make one battle kit that contains exactly one suit of armor, one helmet, and two weapons. There are four distinct suits of armor, three distinct helmets, and five distinct weapons. Given his choices, how many distinguishable battle kits can Kevin make?
6. 16 B) 21 C) 60 D) 240 E) NOTA
7. Fifteen identical boxes are being sent to five distinct people. How many different ways can the boxes get distributed if it is possible for people to get no boxes (e.g. all the boxes get lost)?
8. B) C) D) E) NOTA
9. A committee consisting of two monks and three knights is being formed from a group of six monks and five knights; every monk or knight is a distinguishable person. How many distinct committees are possible if one monk and one knight refuse to serve together?
10. 120 B) 100 C) 90 D) 40 E) NOTA
11. A robot named Karel is trapped on a Cartesian grid. Karel travels in “steps” where each step either moves Karel to (x + 1, y) or (x, y + 1), where (x, y) is Karel’s location before making the step. If Karel is located at **(1, 1)**, how many distinct paths can Karel take to get to **(6, 8)**. Two paths are distinct if the sequences of coordinates that Karel travels to contain at least one different coordinate pair.
12. 35 B) C) D) E) NOTA
13. Three integers are picked randomly from the range 1 – 20, inclusive. What is the probability that the value of the second number lies exclusively in between the values of the first and third number?
14. 209/400 B) 57/200 C) 19/40 D) 1/3 E) NOTA
15. When the following binomial expression is fully expanded, what is the sum of the coefficients?
16. 96 B) 97 C) 625 D) 1296 E) NOTA
17. David is dealt a hand consisting of five cards from a Salty Card Deck. A Salty Card Deck has fifty-four cards: a numberless silver card, a numberless golden card, and a standard deck of fifty-two playing cards. What is the probability that David gets dealt two pairs?
18. B) C) D) E) NOTA
19. Michela rolls a fair, standard 6-sided dice four times. What is the probability that she rolls two different numbers, twice each?
20. B) C) D) E) NOTA
21. Chris rolls two fair, standard 6-sided dice. What is the probability that sum of the two numbers he rolls equals 7?
22. B) C) D) E) NOTA
23. The words “color” and “colour” are two spellings of the same word. Out of the world’s English speakers. 60% of them spell the word as “color.” Call such people “American.” 40% of the world’s English speakers spell the word as “colour.” Call such people “European.” A random English speaker is asked to write the word, and a letter is randomly chosen from his spelling. Given that a vowel is chosen, what is the probability that the speaker is American?
24. 1/2 B) 2/5 C) 3/7 D) 6/11 E) NOTA
25. Nick, Alex, and Duke are being put in a lunch line with seven additional students (everyone in line is distinguishable). If the order of the lunch line is chosen at random, what is the probability that the group of Nick, Alex, and Duke (in any order) is at the front of the line (i.e. the first three people in line must be some arrangement of Nick, Alex, and Duke)?
26. 1/120 B) 1/240 C) 1/720 D) E) NOTA
27. John is mailing letters to n friends, all of whom have different addresses. He has his n letters and n envelopes already addressed to his friends, but, in a fit of whimsy, John decides to randomly assign each letter to an envelope. Each envelope receives exactly one letter. Richard and Diane are two of John’s friends who are sent letters. What is the probability that Richard or Diane (but not both) receive the correct letter in the envelope addressed to him or her?
28. B) C) D) E) NOTA
29. A point is randomly chosen on a hundred foot pole and the pole is cut at that point into two pieces. What is the probability that the shorter piece is less than 1/3 the size of the longer piece?
30. 1/5 B) 1/4 C) 1/3 D) 1/2 E) NOTA
31. In Mirrielees, 30% of people speak German and 16% of people who speak German speak Chinese. Given that 20% of people in Mirrielees speak Chinese, what is the probability that a randomly selected person speaks German if he/she speaks Chinese?
32. 0.032 B) 0.048 C) 0.16 D) 0.24 E) NOTA
33. Sandy is throwing 88 darts at 9 different dartboards. Every dart she throws hits and sticks to one of the dartboards and each dart is colored exclusively red, yellow, or blue. After Sandy throws all the darts, combinatorics guarantees that one of the dartboards will have at least *n* darts of the same color. What is the maximum value of *n*?
34. 1 B) 4 C) 10 D) 88 E) NOTA
35. Lisa is tossing an unbreakable disc and hopes it lands in one of three buckets. The probability that she tosses the disc into the first bucket is 0.3, the probability that she tosses the disc into the second bucket is 0.5, and the probability that the disc she tosses lands in none of the buckets is 0.1. What is the probability that she tosses the disc into the third bucket?
36. 0.1 B) 0.3 C) 0.5 D) 0.9 E) NOTA
37. A chess bag contains eight identical white pawns and eight identical black pawns. Dieterich draws two pawns at random from the bag without replacement. If the two pawns are the same color, he wins $2.00, otherwise he loses $1.00. To the nearest cent, what is Dieterich’s expected winnings?
38. $0.33 B) $0.40 C) $0.50 D) $0.67 E) NOTA
39. Michael randomly picks a positive integer, squares it, and then divides it by 9. What is the probability that the remainder is 7?
40. 4/9 B) 3/9 C) 2/9 D) 1/9 E) NOTA
41. Grant the Virus Hunter downloads two programs onto his test computer. Each program independently has an 80% chance that it’s a virus. Given that at least one of the two programs is a virus, what is the probability that both programs are viruses?
42. 16/25 B) 3/4 C) 4/5 D) 9/10 E) NOTA
43. Lucas randomly picks a number *n* from the set containing the first fifty positive integers. What is the probability that *n*! ends with at least 6 zeroes.
44. 13/25 B) 3/5 C) 16/25 D) 3/4 E) NOTA
45. Ari has fifty turtles that will eat anything they can and a magical kale leaf that only one specific turtle in his group can eat. If he randomly picks turtles (without replacement) from his group to eat the magical kale leaf, what is the probability that the ninth turtle he picks will eat the kale leaf?
46. 9/41 B) 1/42 C) 9/50 D) 1/50 E) NOTA
47. Albert flips eight coins onto the floor. He chooses one coin at random and if it’s tails, he flips it to heads. What is the expected number of heads showing at the very end?
48. 4 B) 4.5 C) 5 D) 5.5 E) NOTA
49. HongVan is doing a photo shoot at South Beach with ten puppies. She starts by taking a photo of herself. Next, she takes a photo of each dog individually. Then she takes photos of every possible pair of dogs, every possible group of three dogs, every possible group of four dogs, and continues taking photos in this manner until she has taken a photo of all ten dogs together. Including the photo she took of herself, how many photos did HongVan take?
50. 55 B) 100 C) 121 D) 10! E) NOTA
51. How many four-digit numbers have a digit that repeats at least 3 times?
52. 171 B) 190 C) 333 D) 400 E) NOTA
53. The Miami Heat is competing against the Golden State Warriors in the NBA Finals of 2020. In the NBA Finals, the first team to win four games wins the championship. If the Heat has a 60% chance of winning any game they play against the Warriors, what is the probability that the Heat win the 2020 championship in exactly five games?
54. B) C) D) E) NOTA
55. Let X equal the number of ways that a group of ten ducks can be chosen from twenty distinct ducks and let Y equal the number of ways that an eleven person committee can be chosen from twenty candidates. What is the value of X + Y?
56. B) C) D) E) NOTA
57. If *x, y, z* are positive integers, how many solutions does the following equation have?
58. B) C) D) E) NOTA
59. Niels is on a game show! The host presents him with five doors labeled 1, 2, 3, 4, 5 and asks him to pick one; four of these doors have squirrels behind them and one of them has the Holy Grail behind it. Niels selects a door and the host opens three other doors to reveal squirrels behind them. The host then asks Niels if he’d like to switch doors. If Niels switches to the other unopened door, what is the probability that he picks the door with the Holy Grail behind it?
60. 1/5 B) 1/4 C) 1/2 D) 4/5 E) NOTA