1. Two ordinary dice are rolled. What is the probability that the resulting sum is an even number?

   (A) 17/36 **(B)** 1/2 **(C)** 5/9 **(D)** 7/12 **(E)** NOTA

2. Let $\mathcal{U} = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$. Suppose an element of $\mathcal{U}$ is randomly selected. What is the probability that it belongs to $\{3, 4\} \cup \{4, 5, 6, 7\} \cup \{6, 7, 8\}$.

   (A) 0.4 **(B)** 0.5 **(C)** 0.6 **(D)** 0.7 **(E)** NOTA

3. A card is randomly selected from an ordinary deck of 52 playing cards. What is the probability that it is a red face (Jack, Queen or King) card?

   (A) 3/52 **(B)** 3/26 **(C)** 3/13 **(D)** 1/2 **(E)** NOTA

4. Suppose A, B, and C are events such that $P(A) = 1/3, P(B) = 1/2$, $P(C) = 1/4$, $P(A \cup B) = 3/4$, $P(B \cup C) = 1/2$, and $P(A \cup C) = 5/12$. Which one of the following pairs of events are disjoint (ie, mutually exclusive)?

   (A) A, B **(B)** A, C **(C)** B, C **(D)** $A \cup B, C$ **(E)** NOTA

5. Suppose A, B, and C are events such that $P(A) = 1/3, P(B) = 1/2$, $P(C) = 1/4$, $P(A \cap B) = 1/6$, $P(B \cap C) = 1/6$, and $P(A \cap C) = 1/10$. Which one of the following pairs of events are independent?

   (A) A, B **(B)** A, C **(C)** B, C **(D)** $A \cap B, C$ **(E)** NOTA

6. How many of the four-digit integers can be written using exactly three digits?

   (A) 2880 **(B)** 3888 **(C)** 4000 **(D)** 4320 **(E)** NOTA

7. A digit is randomly selected from the set of digits comprising the decimal representation of 1/81. What is the probability that the digit is 9?

   (A) 1/10 **(B)** 1/9 **(C)** 1/5 **(D)** 2/9 **(E)** NOTA

8. Six integers $a, b, c, d, e,$ and f are randomly selected. What is the probability that some pair of them differ by a multiple of 5?

   (A) 1/2 **(B)** 2/3 **(C)** 3/5 **(D)** 1 **(E)** NOTA

9. Three integers $a, b,$ and c are randomly selected. What is the probability that some pair of them differ by a multiple of 5?

   (A) 12/25 **(B)** 1/2 **(C)** 13/25 **(D)** 1 **(E)** NOTA

10. A bag of 20 marbles has five red, five green, five blue, and five yellow marbles. Four marbles are randomly selected (without replacement). What is the probability that two or more marbles are the same color?

    (A) 800/969 **(B)** 4219/4845 **(C)** 864/969 **(D)** 844/969 **(E)** NOTA

11. How many scoring sequences are possible if the Fortyniners won their soccer game by a score of 5 to 4 and they were never behind in the game?

    (A) 36 **(B)** 38 **(C)** 40 **(D)** 42 **(E)** NOTA

12. In the game *Candy*, a random cost in the range 1 cent to 1 dollar inclusive is selected. The contestant wins if he has in his pocket coins that will pay exactly the selected cost (with no change required). Steve has 2 pennies, 3 dimes and a quarter. For example, if the selected cost was 32 cents, Steve would win because he could buy the Candy bar, but if the cost was 34 cents, he would lose. What is the probability that Steve wins the game?

    (A) 0.23 **(B)** 0.28 **(C)** 0.29 **(D)** 0.30 **(E)** NOTA

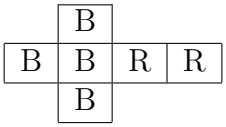
13. In a carnival game, a contestant tosses a 1-inch diameter circular disk onto a grid of squares two inches on a side. The contestant wins if the disk falls entirely inside one of the squares. Given that the disk lands in the grid (that is, the center of the disk lies in one of the squares), what is the probability that the contestant wins?

    (A) 1/4 **(B)** 1/3 **(C)** 1/2 **(D)** $1/\pi$ **(E)** NOTA

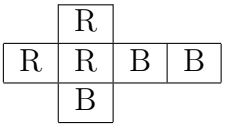
14. A point P is randomly selected from the square with vertices $(1, 1), (-1, 1), (1, -1), (-1, -1)$. What is the probability that P is closer to $(0, 0)$ than it is to $(1, 1)$?

    (A) 1/8 **(B)** 3/8 **(C)** 5/8 **(D)** 7/8 **(E)** NOTA

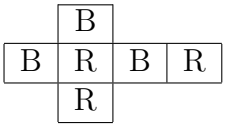
15. Each face of three cubes is colored either B(lue) or R(ed). One of the three cubes, whose planar representations (i.e., *nets*) are given below is randomly selected and rolled. What is the probability that the color 'red' is rolled?



CUBE 1



CUBE 2



CUBE 3

(A) 4/9 **(B)** 1/2 **(C)** 5/9 **(D)** 2/3 **(E)** NOTA

16. A point P is randomly selected from the rectangle with vertices $A = (0, 0), B = (2, 0), C = (2, 1)$, and $D = (0, 1)$. What is the probability that the angle APB is obtuse?

(A) $\frac{\pi}{4}$ **(B)** $\frac{4-\pi}{2}$ **(C)** $1 - \frac{\pi}{4}$ **(D)** $\frac{\pi}{2} - 1$ **(E)** NOTA

17. A deck of n cards consists only of red and green cards. When two cards are selected simultaneously and without replacement, the probability that they are both green is twice the probability that they are both red. What is the smallest possible value of n?

(A) 6 **(B)** 7 **(C)** 8 **(D)** 9 **(E)** NOTA

18. A particle moves among four states probabilistically according to the matrix given. For example, if the particle is in state D, it moves to state B with probability 1/3. What is the probability that, starting in A, the particle is in D after exactly 3 moves?

	A	B	C	D
A	0	1/2	1/2	0
B	1/2	0	0	1/2
C	1/2	0	0	1/2
D	0	1/3	1/3	1/3

.

(A) 1/12 **(B)** 1/6 **(C)** 1/3 **(D)** 5/12 **(E)** NOTA

19. The faces of a cube are colored red and blue, one at a time, with equal probability. What is the probability that the resulting cube has a vertex P such that all three faces containing P are colored red?

(A) 1/4 **(B)** 5/16 **(C)** 27/64 **(D)** 1/2 **(E)** NOTA

20. A real number θ is randomly selected from the interval $[0, \pi)$. What is the probability that $(\sin\theta + \cos\theta)^2 \leq 1$?

    (A) 0 **(B)** 1/2 **(C)** $1/\pi$ **(D)** 1 **(E)** NOTA

21. How many distinguishable cubes can be built using a supply of blue and red faces?

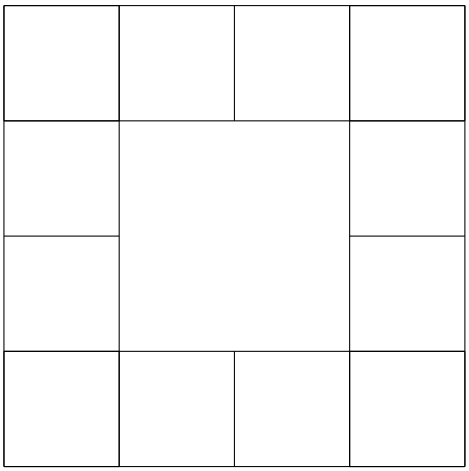
    (A) 6 **(B)** 7 **(C)** 10 **(D)** 12 **(E)** NOTA

22. Three sets of Mu Alpha Theta students, M, A, and T satisfy the following properties: $|MAT| = |MA\overline{T}| = |M\overline{A}T| = |\overline{M}AT| = |M\overline{A}\,\overline{T}|$ and $|M| = 20$, $|A| = 17$, and $|T| = 19$. What is $|M \cup A \cup T|$? Recall that UV refers to $U \cap V$.

    (A) 23 **(B)** 25 **(C)** 27 **(D)** 31 **(E)** NOTA

23. A square whose edges are a subset of the gridlines in the figure shown is randomly selected. The smallest squares in the grid are unit squares. Let m/n denote the probability that the selected square has area at least 4, and m/n is reduced. What is $m + n$?

    (A) 1/4 **(B)** 1/3 **(C)** 1/2 **(D)** 5/17 **(E)** NOTA



24. Three points are randomly selected on the circumference of a circle. What is the probability that the triangle having these points as vertices contains the center of the circle?

    (A) 1/4 **(B)** 1/3 **(C)** 1/2 **(D)** 2/3 **(E)** NOTA

25. A coin is biased so that the probability of landing heads exactly twice when flipped three times is 2/9. Assuming that the probability that the coin lands heads is rational, what is the probability that all three flips land heads?

    (A) 1/27 **(B)** 1/9 **(C)** 1/3 **(D)** 1/2 **(E)** NOTA

26. An urn consists entirely of blue and red marbles. When two marbles are randomly selected (without replacement), the probability that they are different colors is 10/21. Given that the number of blue marbles is an integer multiple of the number of red marbles, which of the following could be the number of marbles in the urn?

    (A) 7 **(B)** 14 **(C)** 15 **(D)** 16 **(E)** NOTA

27. In a round-robin holiday basketball tournament, four teams play one another on three successive days. Each team plays the other three. Each game is evenly matched and there are no ties. What is the probability that after three days, all four teams have different records?

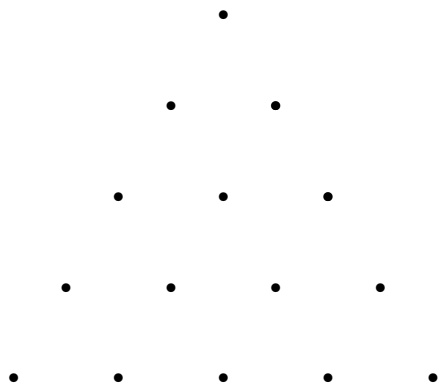
    (A) 1/8 **(B)** 1/4 **(C)** 3/8 **(D)** 1/2 **(E)** NOTA

28. A four-digit number *abcd* is called 'non-decreasing' if each digit after the first one is at least as large as the one to its left. For example, 1336 is non-decreasing. How many four-digit non-decreasing numbers are there? Note that 0123 is not a four-digit number.

    (A) 126 **(B)** 210 **(C)** 330 **(D)** 495 **(E)** NOTA

29. How many right triangles have all three of their vertices among the 15 dots of the hexagonal lattice?

    (A) 30 **(B)** 60 **(C)** 66 **(D)** 96 **(E)** NOTA



30. Charlie plays the game *Magcam* by repeatedly rolling a standard die. Charlie rolls until a 1 appears. His payoff in dollars is the number of rolls of the die. For example, the sequence $2, 4, 3, 1$ would earn Charlie \$4. What is Charlie's expected gain from playing this game? In other words, what would be a fair price to pay for playing this game once?

    (A) \$2 **(B)** \$3 **(C)** \$4 **(D)** \$6 **(E)** NOTA

tiebreaker 1 Row zero of Pascals triangle consists of a single entry, row one has two entries, etc. How many of the entries in rows 0 through 1023 of Pascal's triangle are odd numbers?

tiebreaker 2 For how many of the first 100 is positive integers n does the decimal representation of $n!$ ends with an even number of zeros?