

The choice (E) NOTA means that none of the other answers are correct. Good luck!

1. Chris is flipping a fair, standard coin. Given that he obtains a head on the first flip, what is the probability that he will obtain a tail on the second flip?

- (A) $\frac{1}{4}$ (B) $\frac{1}{2}$ (C) $\frac{3}{4}$ (D) 1 (E) NOTA

2. If 3 corsairs are worth 4 overlords, and 3 overlords are worth 4 hydralisks, how many hydralisks are worth 9 corsairs?

- (A) 9 (B) 12 (C) 16 (D) 18 (E) NOTA

3. Consider the function $f(x) = ax^n + bx^{n-1} + cx^{n-2} + \dots + C$, where terms are listed in order of decreasing degree and the coefficients are rational. Which of the following expressions correctly gives the product of the zeroes of $f(x)$ for all positive integral values of n ?

- (A) $\frac{C}{a}$ (B) $\frac{-b}{a}$ (C) $\frac{C}{a}(-1)^{n+1}$ (D) $\frac{C}{a}(-1)^n$ (E) NOTA

4. Which of the following is/are true when considering the statement:

‘If you live in the state of Montana, then you live in the United States’?

I. Inverse II. Converse III. Contrapositive

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

5. Simplify: $\sqrt{5 - 2\sqrt{6}}$.

- (A) $1 - \sqrt{6}$ (B) $\sqrt{2} - \sqrt{3}$ (C) $\sqrt{3} - \sqrt{2}$ (D) $\sqrt{6} - 1$ (E) NOTA

6. Pratik’s Stamp Store sells only 5 and 11 cent stamps. What is the largest whole number of cents in stamps that you cannot obtain with a combination of these two stamps?

- (A) 17 (B) 34 (C) 39 (D) 48 (E) NOTA

7. Let a , b , and m be integers, and consider that $a \equiv b \pmod{m}$ if and only if $a - b$ is divisible by m . All integer solutions to the equation $7x \equiv -2 \pmod{3}$ can be written in the form $x = \alpha n + \beta$, where α and β are positive integers, and n represents the set of all integers. What is the least possible value of $\alpha + \beta$?

- (A) 3 (B) 4 (C) 8 (D) 9 (E) NOTA

8. Evaluate $\sqrt{2 + \sqrt{2 + \sqrt{2 + \dots}}}$.

- (A) 1 (B) $\sqrt{2}$ (C) 2 (D) $2\sqrt{2}$ (E) NOTA

9. Given that $M = \log 2$ and $N = \log 3$, find $\log 45$ in terms of M and N .

- (A) $M + 2N$ (B) $2M - N + 1$ (C) $M + 2N + 1$ (D) $-M + 2N + 1$ (E) NOTA

10. In a cross-country meet, the time taken to complete the course is denoted by a , b , c , and d for Alex, Blake, Chris, and Dhyan, respectively. Consider the following relations, and determine who won the race.

$$\begin{array}{rcl} a > c & d < c \\ b < d & c > b \end{array}$$

- (A) Alex (B) Blake (C) Chris (D) Dhyan (E) NOTA

11. Let k be the answer to this question. What is $1 + \sqrt{2k + 1}$?

- (A) 0 (B) 4 (C) 0 or 4 (D) not enough info (E) NOTA

12. Evaluate $\sum_{i=0}^n (-1)^i$, where n is a positive integer.

- (A) 0 (B) 1 (C) $(-1)^n$ (D) $(-1)^{n+1}$ (E) NOTA

13. There are five public high schools in Leon County: Chiles, Godby, Leon, Lincoln and Rickards. A student wishes to attend one school for x years, and another school for y years. On how many possible ways can this be accomplished, if x and y , not necessarily distinct, are chosen from the set $\{1, 2, 3\}$ and the student attends high school for a total of four years?

- (A) 30 (B) 45 (C) 60 (D) 90 (E) NOTA

14. When factored completely over the integers, the expression $a^6 - a^4b^2 + 4a^2b^4 - 4b^6$ has how many factors?

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

15. Solve for b , where the subscripts indicate bases: $33_4 + 53_6 = 48_b$.

- (A) 9 (B) 10 (C) 11 (D) 12 (E) NOTA

16. Four bunnies can eat 12 carrots in 16 minutes. If all bunnies eat at the same, constant rate, how many minutes will it take for 6 bunnies to eat 9 carrots?

- (A) 8 (B) 12 (C) 16 (D) 18 (E) NOTA

17. Consider triangle ABC with medians drawn from each vertex to the opposite side that intersect at point D . The median from A , that passes through point E on BC , is extended to a point F such that line CF is parallel to line AB . What is the ratio of the area of triangle BDE to the area of triangle BEF ?

- (A) $1 : \sqrt{3}$ (B) $1 : 2$ (C) $1 : 3$ (D) $1 : 6$ (E) NOTA

18. Find the sum of the solutions of the equation: $3x^5 - 6x^3 + 4x^2 + x = 6$.

- (A) -2 (B) 0 (C) 1 (D) 2 (E) NOTA

19. Solve for x : $\ln e^x = 3$.

- (A) e^3 (B) $\ln e^3$ (C) $\ln 3$ (D) $\ln(\ln 3)$ (E) NOTA

20. If $x = \frac{2009^3 - 2000^3 - 9^3}{2009 \cdot 2000 \cdot 9}$, then:

- (A) $x \leq 1$ (B) $1 < x \leq 3$ (C) $3 < x \leq 2009$ (D) $x > 2009$ (E) NOTA

21. Find the volume of a sphere with surface area 36, ignoring units.

- (A) 36 (B) 36π (C) $\frac{36}{\sqrt{\pi}}$ (D) 54π (E) NOTA

22. Two integers (not necessarily distinct) are picked at random from 1 to 10 inclusive. What is the probability that the second number picked is greater than the first?

- (A) $\frac{1}{5}$ (B) $\frac{2}{5}$ (C) $\frac{9}{20}$ (D) $\frac{1}{2}$ (E) NOTA

23. Find the sum of the squares of the roots of the equation $x^5 + 4x^4 - 5x^3 + 2x^2 - 4x + 10 = 432$.

- (A) -4 (B) -1 (C) 6 (D) 11 (E) NOTA

24. Evaluate the sum $1 + \frac{2}{3} + \frac{3}{9} + \frac{4}{27} + \dots$

- (A) $\frac{9}{4}$ (B) $\frac{5}{2}$ (C) 3 (D) $\frac{9}{2}$ (E) NOTA

For the following two questions, consider the function $f(x) = \frac{\pi^x}{x!}$.

25. Evaluate $f(0)$.

- (A) undefined (B) 0 (C) 1 (D) π (E) NOTA

26. Evaluate $\left[\left[\ln \left(\sum_{x=0}^{\infty} f(x) \right) \right] \right]$, where $[[n]]$ denotes the greatest integer function.

- (A) 0 (B) 1 (C) 2 (D) 3 (E) NOTA

27. How many solutions to the equation $2^x = x^2$ are real numbers?

- (A) 0 (B) 1 (C) 2 (D) 3 (E) NOTA

28. A circle has circumference x cm and area x cm². What is the diameter of this circle?

- (A) 1 cm (B) $\sqrt{2}$ cm (C) 2 cm (D) π cm (E) NOTA

29. Given that $0^\circ < \theta < 90^\circ$ and $\cot \theta = a$, find $\sin(90^\circ - \theta)$.

- (A) $\frac{1}{a}$ (B) a (C) $\frac{1}{\sqrt{a^2 + 1}}$ (D) $\frac{a}{\sqrt{a^2 + 1}}$ (E) NOTA

30. tenwrohsusinsdioteqittesah. Hint: rcadsrki \rightarrow rickards and mteisctmha \rightarrow mathematics.

- (A) a (B) b (C) c (D) d (E) e