

For all questions, answer choice (E) NOTA means that none of the given answers is correct. Good Luck!

- Melissa ordered 100 dog toys off Amazon. The toys came in a long rectangular box with the dimensions of 4 in.  $\times$  7 in.  $\times$  11 in. What is the length of the longest toy that can fit inside the box?  
(A) 11 inches                      (B)  $\sqrt{186}$  inches                      (C)  $11\sqrt{2}$  inches                      (D) 220 inches                      (E) NOTA
- Sruthi was running late to school! She is supposed to get to school at 7:20, so she normally wakes up at 6:17 AM, takes 14 minutes in the bathroom, 17 to make and eat breakfast, 9 to change her clothes and get ready, and 23 minutes to drive to school, in that order. If she woke up at 6:27 AM, what is the larger angle formed by the clock when Sruthi began to change her clothes?  
(A) 203                      (B) 157                      (C) 139                      (D) 221                      (E) NOTA
- Shrung was tasked with having to find out the schedules of all of his classmates. From all 150 of his classmates, he found that 37 people only took Intro to Cooking, 43 only took Modelling 101, 32 took Advanced Trigonometry, 11 took Intro to Cooking and Modelling 101, 8 of them took Intro to Cooking and Advanced Trigonometry, and 6 people both didn't take any of these classes and took both Modelling 101 and Advanced Trigonometry. How many people took all three classes?  
(A) 7                      (B) 8                      (C) 6                      (D) 9                      (E) NOTA
- What is the product of the first 10 whole numbers?  
(A) 3724600                      (B) 372460                      (C) 362880                      (D) 3628800                      (E) NOTA
- Ashley and Karina are both not paying attention in math class. The teacher asks them a question. She asks, "What is  $14 + 28 \times (-8 + 32)0.5$ ?" Ashley answers 255 and Karina answers 167. Find the average of the sum of Ashley's answer, how far Ashley's answer is from the correct answer, Karina's answer, how far Karina's answer is from the correct answer, and the correct answer.  
(A) 203                      (B) 157                      (C) 139                      (D) 210                      (E) NOTA
- Lauren is making some solutions for her chemistry class. She has 5% and 10% sodium hydroxide solutions. She needs 10 liters of a 9% solution. How much of the 10% solution must she mix?  
(A) 2 liters                      (B) 6 liters                      (C) 4 liters                      (D) 8 liters                      (E) NOTA
- Two tightrope walkers are set to cross New York City in a few days. Since NYC resembles the Cartesian plane, the walkers decided to string their tightropes as equations. One walker's tightrope goes along the line  $y = 3x + 2$ , and the other tightrope goes along the line  $y = 3x + 12$ . What is the shortest distance between the two tightropes?  
(A)  $\sqrt{5}$                       (B)  $\sqrt{10}$                       (C) 5                      (D) 10                      (E) NOTA
- Solve for  $x$ :  $|5x + 12| > 47$ .  
(A)  $x > 5$                       (B)  $x < -\frac{59}{5}$                       (C)  $x > -\frac{59}{5}$                       (D)  $x < 5$                       (E) NOTA

9. Simplify:  $\left(\frac{x^2y^3z}{x^{-4}y^7z^3}\right)^{\frac{1}{2}}$

- (A)  $\frac{x^3}{y^2z}$                       (B)  $\frac{x^{-1}}{y^2z}$                       (C)  $\frac{1}{xy^2z}$                       (D)  $x^3y^{-2}z^{-1}$                       (E) NOTA

10. What is the sum of all the prime factors of 2021?

- (A) 89                      (B) 108                      (C) 90                      (D) 97                      (E) NOTA

Michael was participating in a 100-meter dash. He wanted to compare his times with other participants, so he created a stem-and-leaf plot to predict how well he would do. This is the stem-and-leaf plot as follows:

Stem	Leaf
1	7 9 9
2	3 5 7 8
3	1 1 2 5 6 9
5	3 7 7 7 8 9

11. What is the median of the data?

- (A) 31                      (B) 32                      (C) 34                      (D) 26                      (E) NOTA

12. What is Michael's time if it was the average of the mode and mean, minus half the range?

- (A) 29                      (B) 47                      (C) 31                      (D) 26                      (E) NOTA

13. What is the least common multiple of 3, 7, and 15?

- (A) 56                      (B) 84                      (C) 105                      (D) 30                      (E) NOTA

14. Annika was driving home from the movie theater, but suddenly one of her tires popped and she was unable to drive further. She stopped at the point (2,10) and her house is at the point (7, -2). What is the shortest distance Annika has to travel to go home, assuming one unit is 20 feet?

- (A) 340                      (B) 260                      (C) 300                      (D) 220                      (E) NOTA

15. What is the degree of the following expression:  $2x^4y^3z + 3x^3y^2 + xy$ ?

- (A) 7                      (B) 15                      (C) 8                      (D) 4                      (E) NOTA

16. Calculate  $2(4x^y) - 5(2y^x) + 7(x^y)$  when  $x = 2$  and  $y = 6$ .

- (A) 690                      (B) 780                      (C) 960                      (D) 830                      (E) NOTA

17. Tanmay has an obsession with exponents and whenever he meets someone new he makes sure to present them with a math problem pertaining to exponents. Imagine you are meeting him for the first time, and he presents you with this question: Calculate the sum of the digits of  $2^{2022} \cdot 5^{2025} \cdot 7 \cdot 11$ . Assuming you don't want to spoil Tanmay's mood, what is the correct answer to this question?

- (A) 22                      (B) 16                      (C) 65                      (D) 42                      (E) NOTA

18. Shubham was driving back from an intense swim meet when he was met with a barrier in the middle of the road. The barrier requires that he solve a math problem in order to safely move past it. The problem on the barrier reads: "Find the least prime factor of  $13^9 + 19^7$ ." The catch is that if Shubham gives the wrong answer, the barrier will fall on his car and put him in critical condition. In order for Shubham to get home safely, what answer should he give?
- (A) 7                      (B) 11                      (C) 67                      (D) 73                      (E) NOTA
19. Akhil was extremely hungry and decided to drive to Subway. He then realizes that his car is about to run out of fuel, so he drives to the nearest gas station, which is located exactly in the middle of the path from his house to Subway. Assuming these locations are all on the Cartesian plane, find the abscissa of the point at which the gas station lies, if Akhil's house is at the point (4,5) and Subway is at the point (13, 9). Express your answer as an improper fraction in simplest form.
- (A)  $\frac{7}{3}$                       (B)  $\frac{17}{2}$                       (C)  $\frac{8}{5}$                       (D)  $\frac{9}{7}$                       (E) NOTA
20. Calculate the number of distinct ways to arrange the letters in the word CALCULUS.
- (A) 120                      (B) 4096                      (C) 5040                      (D) 349                      (E) NOTA
21. Karthik is thinking of a certain number and he presents you with a hint. He says, "4 less than triple my number is equal to 8 more than double my number." What number is Karthik thinking of?
- (A) 9                      (B) 14                      (C) 20                      (D) Not enough information                      (E) NOTA
22. Which of the following lines is symmetric to  $f(x) = (x + 2)^2 + (4x + 17)$ ?
- (A)  $x = 2$                       (B)  $x = -4$                       (C)  $y = 3$                       (D)  $x = 6$                       (E) NOTA
23. Rectangle AOMG is similar to rectangle ROCK. Rectangle AOMG has length 2 and width 4. The ratio of the area of AOMG to the area of ROCK is equal to  $\frac{1}{9}$ . Find the perimeter of rectangle ROCK.
- (A) 12                      (B) 16                      (C) 24                      (D) 36                      (E) NOTA
24. Evaluate the expression  $\sqrt{-12} \cdot \sqrt{-25}$ .
- (A)  $10\sqrt{3}$                       (B)  $-10i\sqrt{3}$                       (C)  $-10\sqrt{3}$                       (D)  $10i\sqrt{3}$                       (E) NOTA
25. The volume of a certain sphere is  $288\pi$ . What is the absolute value of the difference between the volume and surface area of the sphere, in terms of  $\pi$ ?
- (A)  $144\pi$                       (B)  $36\pi$                       (C)  $108\pi$                       (D)  $27\pi$                       (E) NOTA
26. Navya has decided to pursue her passion and enter a Ritz cracker eating contest for a chance to win a lifetime supply of crackers. She must finish as many crackers as she can in 4 minutes. Navya can generally eat  $\frac{1}{6}$  of a cracker in 1.25 seconds. If she needs to finish 55 crackers during her turn in order to beat the competition, how many more crackers per second must Navya eat compared to her usual rate in order to win?
- (A)  $\frac{100}{169}$                       (B)  $\frac{13}{18}$                       (C)  $\frac{1}{16}$                       (D)  $\frac{169}{720}$                       (E) NOTA
27. Mr. Cameron enjoys being sarcastic. The number of sarcastic comments he makes every 5 minutes is equal to two times the sum of the reciprocals of the roots of  $6x^2 - 26x + 8$  (fractional comments are valid). How many sarcastic comments does Mr. Cameron make every hour?
- (A) 39                      (B) 78                      (C) 6.5                      (D) 60                      (E) NOTA
28. Given the following system of equations:

$$\frac{x+3}{2} + \frac{2y-2}{3} = 2$$
$$4x - 2y = 24$$

What is  $2(x - y)$ ?

- (A) 6                      (B) 7                      (C) 12                      (D) -14                      (E) NOTA

29. Geetika really likes right triangles. Her favorite right triangle has a hypotenuse equal to the shortest diagonal of a regular hexagon with side length 6. Find the sum of the squares of the remaining two side lengths of Geetika's favorite right triangle.

- (A) 72                      (B) 36                      (C) 108                      (D) 144                      (E) NOTA

30. Manjari is at her favorite boba tea shop and is trying to decide what to order. There are 8 flavors of tea, 6 types of jelly, of which she will choose 2, and 4 types of boba pearls. How many distinct ways are there for Manjari to order her tea?

- (A) 480                      (B) 240                      (C) 2880                      (D) 192                      (E) NOTA