

Name: \_\_\_\_\_

School: \_\_\_\_\_

Score: \_\_\_\_\_

1. \_\_\_\_\_ Compute  $92 \cdot 11 + 2(i^{25} + 7) + 3 - \frac{4}{2}$ .
2. \_\_\_\_\_ What is half of the circumference of a circle (in units) that has an area of 100 square units?
3. \_\_\_\_\_ How many ways can nine distinguishable people sit at a circular table, if two of them, Ananya and Sruthi, must sit next to each other because they are best friends?
4. \_\_\_\_\_ When you raise the cube root of the number of sides an octagon has to the fourth power, you get the side length of octagon  $O$ . Find the area of octagon  $O$ .
5. \_\_\_\_\_ How many days are in 9613 hours? Round your answer to the nearest whole number.
6. \_\_\_\_\_ What is the largest prime factor of  $6! + 7! + 8!$ ?
7. \_\_\_\_\_ The equation of line  $A$  is  $y = 6x + 7$ . Line  $B$  is perpendicular to line  $A$ , and it passes through the point  $(6, 7)$ . What is the  $y$ -intercept of line  $B$ ?
8. \_\_\_\_\_ Compute  $2019 + 2 + 0 + 1 + 9 + 20 + 19$ .
9. \_\_\_\_\_ What is the positive difference between the 13<sup>th</sup> and the 15<sup>th</sup> prime numbers?
10. \_\_\_\_\_ How many trailing zeroes does  $99! \cdot 101!$  have?
11. \_\_\_\_\_ How many space diagonals does an octahedron have?
12. \_\_\_\_\_ What is the maximum possible product of two integers, given that their sum is 2019?
13. \_\_\_\_\_ Evaluate  $\langle 20, -5, 21 \rangle \cdot \langle 2, 10, 19 \rangle$ .
14. \_\_\_\_\_ Compute  $\sin(2^{2019}\pi) + \cos(2^{2019}\pi) + \tan(2^{2019}\pi)$ .
15. \_\_\_\_\_ If  $(-1)^x = y$ , and  $x$  and  $y$  are integers, then what is the maximum possible value of  $(-1)^y$ ?
16. \_\_\_\_\_ Find the area of a square, which has a diagonal with length 10.
17. \_\_\_\_\_ What is the constant term in the expansion of  $\left(3x - \frac{2}{x^2}\right)^3$ ?
18. \_\_\_\_\_ Which positive integer is the only number that is one more than a perfect square and one less than a perfect cube?
19. \_\_\_\_\_ Which mathematician proved the fact stated in the previous problem?
20. \_\_\_\_\_ What is the volume of a sphere with radius  $\pi$ ?
21. \_\_\_\_\_ What is the sum of the first three perfect squares above 300?
22. \_\_\_\_\_ Evaluate  $\det(A)$ , where  $A = \begin{bmatrix} i & i^2 & i^3 \\ i^4 & i^5 & i^6 \\ i^7 & i^8 & i^9 \end{bmatrix}$
23. \_\_\_\_\_ What is the greatest common factor of 143, 176, and 1001?
24. \_\_\_\_\_ What is the sum of the prime factors of  $2^{10} + 1$ ?
25. \_\_\_\_\_ For what abscissa is the first derivative of the function  $f(x) = -x^2 + 10x + 2019$  neither non-negative nor non-positive?
26. \_\_\_\_\_ When you completely simplify  $\sqrt{2019^{2019}}$  to get  $a\sqrt{b}$ , what is the value of  $\log_b a$ ?
27. \_\_\_\_\_ How many ones does the binary representation of 2019 have?
28. \_\_\_\_\_ Compute  $5^3 - 6^3 + 2^7 - 6^2$ .

29. ----- What is the sum of the square roots of the 8<sup>th</sup> and 9<sup>th</sup> triangular numbers? (Express your answer in simplest radical form.)
30. ----- Compute  $19^3 - 2019$ .
31. ----- What is the units digit of  $2019^{2019} + 2019! + 20^{20} + 19^{19}$
32. ----- Akash really wants some delicious Taco Bell. A full meal at Taco Bell consists of an appetizer, a choice between a burrito or a soft taco, fries, and a drink. Taco Bell offers 3 different appetizers, 4 different types of burritos, 6 different soft tacos, 5 types of fries, and 8 types of drinks. How many full meal combinations are there for Akash, considering that he is vegetarian, and instead only has two choices for burritos and four choices for soft tacos?
33. ----- Which number is greater,  $e + 2\pi$  or 9?
34. ----- What is the largest integer less than  $\frac{1}{\sqrt{1}} + \frac{1}{\sqrt{2}} + \frac{1}{\sqrt{3}} + \frac{1}{\sqrt{4}}$ ?
35. ----- How many prime numbers are between 50 and 100, inclusive?
36. ----- In a randomly shuffled, regular deck of 52 cards, what is the probability of choosing a card with a prime number on it, but it is not a spade?
37. ----- Choose a non-zero, real number. Multiply it by 3 and add 4 to your result. Divide this new number by your original number. Which number(s) could you not have gotten?
38. ----- How many ways are there to rearrange the letters in the word *TESLA*?
39. ----- Compute  $91 \cdot 43$ .
40. ----- In an isosceles triangle, how many of the following centers lie on its Euler line: incenter, circumcenter, orthocenter, centroid, nine-point center?