

2019 Who Wants to Be a Mathematician Round One Qualifying Test
KEY

1. What is the ones (units) digit of $2019^2 - 2018^2$?
a. 1 b. 3 c. 5 d. 7 **d.**
2. What is the area in the first quadrant bounded by the graph of $x + 2y = 4$ and the x - and y -axes?
a. 1 b. 2 c. 4 d. 8 **c.**
3. Let $f(x) = x^2 + 7$. What is $f(f(2))$?
a. 11 b. 107 c. 121 d. 128 **d.**
4. The radius of a sphere is 6 cm. What is the sphere's volume divided by its surface area (ignore units)?
a. 1.5 b. 2 c. 2.5 d. 3 **b.**
5. Which of the following is the closest integer to the cube of $\tan(\pi/3)$? ($\pi/3$ is in radians, not degrees)
a. 5 b. 6 c. 7 d. 8 **a.**
6. Let n represent a positive integer greater than 1. The number of points of intersection of the graphs of $y = x^n$ and $y = n^x$ is
a. always odd b. always even c. odd when n is even and even when n is odd
d. even when n is even and odd when n is odd **c.**
7. On a flat surface, a bug walks 1 foot north, 2 feet west, 3 feet south, 4 feet east, 5 feet north, and 6 feet west. It then walks straight back to its original starting point. How far did the bug walk total, in feet?
a. 21 b. 24 c. 26 d. $21 + \sqrt{5}$ **c.**
8. Double the sum of the first 1,111 positive integers and subtract 1,111. What is the result?
a. 616,605 b. 1,234,321 c. 1,423,231 d. 1,432,231 **b.**
9. Suppose $\log_{10} 8 = r$ and $\log_{10} 9 = s$. What is $\log_{10} 5$ in terms of r and/or s ?
a. $\sqrt[3]{r} + \sqrt{s}$ b. $(\sqrt[3]{r})(\sqrt{s})$ c. $(r/3) + (s/2)$ d. $1 - (r/3)$ **d.**
10. Which of the following is closest to the number of ordered pairs of points (m, n) , where m and n are both between 1 and 100 inclusive and relatively prime (their greatest common divisor is 1)? [(2,3) and (3,2) count as two such points.]
a. 5,000 b. 6,000 c. 7,000 d. 8,000 **b.**