48th Lee Webb Math Field Day

California State University, Bakersfield
Department of Mathematics

February 23, 2019

Varsity Math Bowl

Varsity Math Bowl Round 1 Sample Question

2019 is not a prime. What is the next number that is also not prime?

Varsity Math Bowl Round 1 Question 1

Let $x = 23$ and $y = 37/43$. Simplify

$$((x/y)^e + y^2 - x + \pi^x)^0 + 43y$$

Varsity Math Bowl Round 1 Question 2

Suppose $f(x+3) = x+4$.
Evaluate $f(2019)$.

Varsity Math Bowl Round 1 Question 3

Suppose A is the greatest negative angle that satisfies

$$\sin A = \sqrt{3}/2.$$

Measured in degrees, what is $A + 360^o$?

Varsity Math Bowl Round 1 Question 4

At 5 o'clock, on an old-fashioned clock, the round kind with two hands, what is the angle, in degrees, between the minute and hour hands?

Varsity Math Bowl Round 1 Question 5

How many two letter strings are there that don't have repeated letters?

Varsity Math Bowl Round 1 Question 6

What is the average of the numbers:

$$5, 11, 17, 23, 29, 35?$$

Varsity Math Bowl Round 1 Question 7

What is the volume of a sphere that has radius equal to

$$3^{2/3}(2\pi)^{-1/3}$$

Varsity Math Bowl Round 1 Question 8

Suppose $\frac{1}{5}$ of 5^{10} equals 5^j. What is the value of j?

Varsity Math Bowl Round 1 Question 9

Simplify:

$$\frac{6!5!12!}{3!10!8!}$$

Varsity Math Bowl Round 1 Question 10

What are the first two digits of 20^{19}, after expanding?

Round 2

Varsity Math Bowl Round 2 Sample Question

If $\frac{20}{19}$ is written in decimal form, what is the first digit after the decimal point?

Varsity Math Bowl Round 2 Question 1

Solve for n:

$$n^n - (n-1)^{(n+1)} = 11$$

Varsity Math Bowl Round 2 Question 2

How many real solutions does the following equation have:

$$\frac{20}{t} = \frac{t}{19}$$

Varsity Math Bowl Round 2 Question 3

If all the numbers in the following list are doubled, then the average will go up by what number?

$$4, 4, 6, 6, 7, 7, 7, 8, 8, 10, 10$$

Varsity Math Bowl Round 2 Question 4

The sum of 2 numbers is 18. Their difference is 7. What is the larger of the two numbers?

Varsity Math Bowl Round 2 Question 5

Simplify

$$\frac{1}{(1-\frac{2}{3})(1-\frac{3}{4})(1-\frac{4}{5})(1-\frac{5}{6})}$$

Varsity Math Bowl Round 2 Question 6

Simplify

$$\sin(\arccos(\frac{8}{17}))$$

Varsity Math Bowl Round 2 Question 7

Suppose $f(x) = (-1)^x$ and $g(x) = x - 1$. What is

$$g(f(g(f(1))))?$$

Varsity Math Bowl Round 2 Question 8

Let

$$x = log_{20}19$$

Simplify

$$20^x/19.$$

Varsity Math Bowl Round 2 Question 9

A rhombus has width w (one diagonal) and height h (the other diagonal). A second rhombus has double the width and twice the height. What is the ratio of the area of the second rhombus to the area of the first rhombus?

Varsity Math Bowl Round 2 Question 10

Simplify

$$log_2\left(\frac{2^{3^4}}{4^{3^2}}\right)$$

Round 3

Varsity Math Bowl Round 3 Sample Question

What is $\frac{2019}{201}$, rounded to the nearest whole number?

Varsity Math Bowl Round 3 Question 1

Evaluate the following as a base 2 problem:

$$1000 - 1$$

Varsity Math Bowl Round 3 Question 2

Let

$$f(x) = x^4 - x^3 + x^2 - x + 1.$$

What is $f(10)$?

Varsity Math Bowl Round 3 Question 3

The infinite sum, $48 - 24 + 12 - 6 + \ldots$ converges to what number?

Varsity Math Bowl Round 3 Question 4

Solve for x:

$$\frac{5^{12x}}{5^{12x^2}} = 125$$

Varsity Math Bowl Round 3 Question 5

Evaluate

$$lim_{x \to 3} \frac{x^3 - 27}{x^4 - 81}$$

Varsity Math Bowl Round 3 Question 6

A function f is such that $f''(x) = 7$, $f'(4) = 0$, and $f(0) = 4$. What is $f(2)$?

Varsity Math Bowl Round 3 Question 7

What is the minimum value of

$$f(x) = x^4 - 8x^2$$

Varsity Math Bowl Round 3 Question 8

Three couples sit in a row of six seats. How many ways can they do this, with each person sitting next to his/her partner?

Varsity Math Bowl Round 3 Question 9

Solve for r

$$\int_0^5 \sqrt{25 - x^2}\, dx = r\pi$$

Varsity Math Bowl Round 3 Question 10

In the complex plane, how far apart are the roots of

$$x^2 - 4x + 13?$$

Round 4

Varsity Math Bowl Round 4 Sample Question

There are 104 musicians in the Queen's County Honor Orchestra. It takes them 40 minutes to perform Beethoven's 9th Symphony. If the orchestra were halved in size, how long would it take them to play Beethoven's 18th Symphony?

Varsity Math Bowl Round 4 Question 1

How many ways can the letters in

$$xxxyyzz$$

be rearranged?

Varsity Math Bowl Round 4 Question 2

For a tetrahedron, what is the sum of the number of vertices, edges, and faces?

Varsity Math Bowl Round 4 Question 3

Simplify

$$2019^2 - 2 \cdot 2019 \cdot 2018 + 2018^2$$

Varsity Math Bowl Round 4 Question 4

Let

$$f(x) = x^4 - x^3 + x^2 - x + 1.$$

What is $f(3) - f(2)$?

Varsity Math Bowl Round 4 Question 5

Solve:

$$\ln(2x + 13) = \ln(2) + \ln(x) + \ln(13)$$

Varsity Math Bowl Round 4 Question 6

Evaluate

$$\int_1^e \ln x \, dx$$

Varsity Math Bowl Round 4 Question 7

Gernerally, when a standard six-sided die is rolled, only three of the sides can be viewed from one perspective. What is the probability that if two standard dice are rolled, that an observer can see all six numbers?

Varsity Math Bowl Round 4 Question 8

Evaluate

$$\ln\left(\int_{5e}^{6e} e^{\cos(2x)} \cdot e^{2\sin^2 x}\, dx\right)$$

Varsity Math Bowl Round 4 Question 9

This matrix is composed of 1's, 2's, 3's, and 4's, with no repeated entries in any row or column. What is the bottom row (answer as one 4 digit number)?

$$\begin{bmatrix} 3 & * & 2 & 4 \\ * & 4 & * & 3 \\ * & * & * & 2 \\ * & * & * & * \end{bmatrix}$$

Varsity Math Bowl Round 4 Question 10

Evaluate

$$\sum_{n=1}^{\infty} \left(\sin\left(\frac{\pi}{n+1}\right) - \sin\left(\frac{\pi}{n+2}\right) \right)$$

The End

Please be patient while we calculate the scores.

Closing Ceremony to commence shortly