51st Lee Webb Math Field Day

California State University, Bakersfield
Department of Mathematics

February 17, 2024

Varsity Math Bowl

Varsity Math Bowl Round 1 Sample Question

2024 is not a prime. What is the smallest prime factor of 2024?

Varsity Math Bowl Round 1 Question 1

Determine the next number in the sequence:

$$1, 5, -3, 13, -19, 55, ...$$

Varsity Math Bowl Round 1 Question 2

Perhaps the most famous Pythagorean Triple is $3, 4, 5$, whose largest number is 5. What is the area of the triangle that corresponds with the next-most famous Pythagorean Triple - the one whose smallest number is 5?

Varsity Math Bowl Round 1 Question 3

Simplify:

$$\frac{\frac{2}{3} - \frac{1}{2}}{\frac{1}{2} - \frac{2}{3}}$$

Varsity Math Bowl Round 1 Question 4

Simplify

$$|||3-4|-5|+|6-7|-8|$$

Varsity Math Bowl Round 1 Question 5

ACME Delivery offers standard and express options. 75% of their packages are sent standard and 25% sent express. Standard delivery packages have an 80% chance of being delivered the next day, while the figure is 95% for express. For a randomly chosen package, what is the probability it will be delivered the next day? Answer in the form a reduced fraction

Varsity Math Bowl Round 1 Question 6

Evaluate:

$$(111)^2$$

Varsity Math Bowl Round 1 Question 7

The day of the month today is one **more** than a perfect square. What year is one **less** than the next year that is a perfect square?

Varsity Math Bowl Round 1 Question 8

We are currently in a leap month. During the month one day - Thursday - will occur 5 times. What is the day of the week that will occur 5 times in the next leap month?

Varsity Math Bowl Round 1 Question 9

The average of the the numbers $1, 2, 3, 4, x$ is $5x$. What is the value of x?

Varsity Math Bowl Round 1 Question 10

Simplify:

$$\frac{20^{24}}{20^{23} + 20^{23} + 20^{23} + 20^{23}}$$

Round 2

Varsity Math Bowl Round 2 Sample Question

If $\frac{20}{24}$ is written in reduced form, what is the sum of the numerator and denominator?

Varsity Math Bowl Round 2 Question 1

Suppose the average of a, b, and c is 27, while the average of b, c, and 13 is $\frac{d}{3}$. What is the average of a and d?

Varsity Math Bowl Round 2 Question 2

Simplify

$$\frac{log_8 2024}{log_2 2024}$$

Varsity Math Bowl Round 2 Question 3

Suppose that $x^3 = -1$. Evaluate x^{33}.

Varsity Math Bowl Round 2 Question 4

Solve for the real number that satisfies

$$(a-1)^{2024} = a^{2024}$$

Varsity Math Bowl Round 2 Question 5

At *Acme College*, 500 students enrolled in both Calculus I and Physics I. Of these students, 82 got an A in calculus, 73 got an A in physics - with 42 getting an A in both classes. How many students got an A in at least one of the classes?

Varsity Math Bowl Round 2 Question 6

Using the standard restricted domain for $sin(x)$ to define $sin^{-1}(x)$, evaluate

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

.

Varsity Math Bowl Round 2 Question 7

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

$$f(g(f(g(0))))?$$

Varsity Math Bowl Round 2 Question 8

Triangles ABC and XYZ are similar right triangles. The legs of the smaller triangle have lengths 3 and 4. The hypotenuse of the larger triangle is 15. What is the area of the larger triangle?

Varsity Math Bowl Round 2 Question 9

What is the smallest number that has at least 3 distinct prime factors, is a perfect square, and is odd?

Varsity Math Bowl Round 2 Question 10

Assuming that a and b are positive integers and that $a^2 + b^2 = 197$, what is the value of $a + b$?

Round 3

Varsity Math Bowl Round 3 Sample Question

What is distance between $\frac{2023}{2024}$ and the nearest integer?

Varsity Math Bowl Round 3 Question 1

In base 5, what is 2024 doubled?

Varsity Math Bowl Round 3 Question 2

Let

$$f(x) = \sum_{n=1}^{4} nx^n$$

What is $f(10)$?

Varsity Math Bowl Round 3 Question 3

How many combinations of dimes, nickels, and pennies are there with a total value equal to 1 quarter?

Varsity Math Bowl Round 3 Question 4

Let S be the set of positive integers less than 2024. Let O be the subset of S containing only the odd integers. Let x be the sum of all the elements of O. Determine the value of

$$\sqrt{x}.$$

Varsity Math Bowl Round 3 Question 5

The side lengths of a rectangle are prime numbers. The perimeter is 122. What is the area of the rectangle?

Varsity Math Bowl Round 3 Question 6

At *Acme College*, 500 students enrolled in both Calculus I and Physics I. Of these students, 82 got an A in calculus, 73 got an A in physics - with 42 getting an A in both classes. What is the probability that a randomly chosen student (from among the 500) got less than an A in at least one of the courses?

Varsity Math Bowl Round 3 Question 7

Suppose α is an acute angle and $\sin\alpha = \frac{2}{7}$, then what is $\sec\alpha$? Answer in simplified radical form.

Varsity Math Bowl Round 3 Question 8

Suppose the average of x, y, and z is $3x+2$, then what is the average of y and z, in terms of x ?

Varsity Math Bowl Round 3 Question 9

Suppose $f''' + f' = 0$ and $f(\pi) = 10$ and $f(2\pi) = 20$. What is $f(3\pi)$?

Varsity Math Bowl Round 3 Question 10

In the complex plane, there are three solutions to the equation $z^3 = 216$. What is the sum of these three values?

Round 4

Varsity Math Bowl Round 4 Sample Question

Calculate

$$2023[\cos(\frac{2024}{2025})].$$

Here $[x]$ represents the greatest integer function.

Varsity Math Bowl Round 4 Question 1

In how many ways can the letters

B A N A N A

be arranged?

Varsity Math Bowl Round 4 Question 2

At *Acme College*, 500 students enrolled in both Calculus I and Physics I. Of these students, 82 got an A in calculus, 73 got an A in physics - with 42 getting an A in both classes. Find the probability that a randomly chosen student (from among the 500) got A in physics but not in calculus.

Varsity Math Bowl Round 4 Question 3

Evaluate

$$tan(cos^{-1}(\frac{12}{13}))$$

Varsity Math Bowl Round 4 Question 4

A family has 2 children. Given that at least one of them is a boy, what is the probability that both children are boys?

Assume the children in this problem are binary

Varsity Math Bowl Round 4 Question 5

What is the unit's digit of

$$\frac{11^6 - 1}{10}?$$

Varsity Math Bowl Round 4 Question 6

A is a 10x6 matrix with the property that the sum of the numbers in the jth row is j. What is the sum of all the numbers in A?

Varsity Math Bowl Round 4 Question 7

Let $x = \prod_{n=1}^{2024} p_n$, where p_n is the *nth* prime number. I.e. x is the product of the first 2024 primes. How many zeros are at the end of the decimal representation of x.

Varsity Math Bowl Round 4 Question 8

Estimate the value of

$$\sum_{n=1}^{\infty} \frac{1}{n!}$$

to two significant digits.

Varsity Math Bowl Round 4 Question 9

The function $f(x) = x^x$ is defined for positive real x. The minimum of the function occurs when $x = x_m$. What is the value of $\ln x_m$?

Varsity Math Bowl Round 4 Question 10

Evaluate

$$\int_{e^{20}}^{e^{24}} \frac{x^{2023} - 1}{x^{2024} - x} dx$$

The End

Please be patient while we calculate the scores.

Closing Ceremony to commence shortly