47th Lee Webb Math Field Day

California State University, Bakersfield
Department of Mathematics

February 24, 2018

Varsity Math Bowl

Varsity Math Bowl Round 1 Sample Question

Evaluate

$$2 - 0 + 1 \cdot 8$$

Varsity Math Bowl Round 1 Question 1

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

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

Varsity Math Bowl Round 1 Question 2

Suppose $f(5x + 3) = x + 4$.
Evaluate $f(2018)$.

Varsity Math Bowl Round 1 Question 3

Suppose A is the greatest negative angle that satisfies

$$\sin A = 1/2.$$

Measured in degrees, what is the negative of A ?

Varsity Math Bowl Round 1 Question 4

The time is 6 o'clock on an old-fashioned clock, the round kind with two hands. If the clock mechanism were transparent and someone were reading it from the back, what o'clock would it seem to be?

Varsity Math Bowl Round 1 Question 5

How many 3-letter words can be made from a 4-letter alphabet?

Varsity Math Bowl Round 1 Question 6

What is the least value of n such that $n!$ is divisible by 2018?

Varsity Math Bowl Round 1 Question 7

The radius of a sphere is $\frac{6\sqrt{\pi}}{\pi}$ What is its surface area?

Varsity Math Bowl Round 1 Question 8

Suppose $\frac{1}{8}$ of 2^{30} equals 8^j. What is the value of j?

Varsity Math Bowl Round 1 Question 9

How many eight digit numbers are there that don't have a 0 and don't repeat any digits and have the digits in increasing order?

Varsity Math Bowl Round 1 Question 10

Let x be a solution of $3^x - 7 = 0$. Then evaluate

$$9^x - 7$$

Round 2

Varsity Math Bowl Round 2 Sample Question

If $\frac{20}{18}$ is written in decimal form, what is the 2018th digit after the decimal point?

Varsity Math Bowl Round 2 Question 1

Solve for n:

$$(n-1)^n - n^{(n-1)} = 17$$

Varsity Math Bowl Round 2 Question 2

What is the sum of the values of t such that

$$\frac{9}{t} = \frac{t}{10}$$

Varsity Math Bowl Round 2 Question 3

The function $f(x) = x - 6$ is evaluated for each of the values 21, 22, ... , 31. What is the average of the resulting values?

Varsity Math Bowl Round 2 Question 4

Scrabble. Vowels are 1 point; consonants B to J, 2 points, K to R 3 points, S to Z, 4 points. What is the highest score for a 5-letter (actual English) word from the letters: B A K E R S F I E L D ?

Varsity Math Bowl Round 2 Question 5

The polynomial $x^3 - 8$ has one real root and two complex roots. What is the sum of the two complex roots?

Varsity Math Bowl Round 2 Question 6

Simplify

$$\arccos(.23) + \arcsin(.23)$$

(answer in degrees).

Varsity Math Bowl Round 2 Question 7

In Camelot, pi has a value of 3. The height of an ice cream cone is 5 merlins; the circumference at the opening of the cone is 6 merlins. What is the surface area, in square merlins, of a spherical scoop of ice cream whose equator just fits the cone?

Varsity Math Bowl Round 2 Question 8

ABCDEFGHIJ is a regular decagon. What is the measure, in degrees, of angle AJB?

Varsity Math Bowl Round 2 Question 9

What is the largest angle x in degrees that is less than 1000^o and satisfies

$$\sin x = \sqrt{2}/2$$

Varsity Math Bowl Round 2 Question 10

One of the rows of Pascal's Triangle starts with the numbers 1 and 11. How many of the numbers in this row are divisible by 11 ?

Round 3

Varsity Math Bowl Round 3 Sample Question

What is $\frac{2018}{201}$, rounded to the nearest whole number?

Varsity Math Bowl Round 3 Question 1

Evaluate

$$\tan(\sin^{-1}(8/17)).$$

Varsity Math Bowl Round 3 Question 2

The sum of the squares of two consecutive odd integers is 130. What is the sum of the cubes of these two numbers?

Varsity Math Bowl Round 3 Question 3

The infinite sum,
$1/3 - 1/6 + 1/12 - 1/24 + \ldots$ can be expressed in decimal form with one digit. What is that digit?

Varsity Math Bowl Round 3 Question 4

Three positive integers, a,b,c, having the property that $a^2 + b^2 = c^2$ is called a Pythagorean Triple. An example is 15, 36, 39. If the three numbers have no common factor the triple is called primitive. Suppose a,b,c form a primitive Pythagorean Triple and one of the numbers is 15. What is the minimum possible value of $a + b + c$?

Varsity Math Bowl Round 3 Question 5

What is the coefficient of x^4 when

$$\frac{x^{12} - 27}{x^4 - 3}$$

is simplified?

Varsity Math Bowl Round 3 Question 6

In Mathopia, the avenues run north-south and the streets run east-west. Without backtracking, how many ways are there to get from First Avenue and 42nd Street to Fifth Avenue and 48th Street?

Varsity Math Bowl Round 3 Question 7

Zoe runs the first half of a race in 1 minute and 4 seconds. She runs the next quarter of the race in in 32 seconds, and the next eighth of the race in 16 seconds. If this pattern continues, she will finish the race in 2 minutes and how many seconds?

Varsity Math Bowl Round 3 Question 8

In the interval $(0, \pi/2)$, the equation

$$\sin x + \tan x + \sec x = \cos x + \cot x + \csc x$$

has one solution. The solution can be written in the form $r\pi$ for some rational number r. What is the value of r?

Varsity Math Bowl Round 3 Question 9

Evaluate:

$$lim_{x \to 2} \frac{x^4 - 16}{x^7 - 128}$$

Varsity Math Bowl Round 3 Question 10

How many positive integer values of n satisfy

$$(10n)^{50} > n^{100} > 2^{200}$$

Round 4

Varsity Math Bowl Round 4 Sample Question

To prepare for a bridge tournament, Alex brought 48 standard (no jokers) decks of cards. How many cards are there?

Varsity Math Bowl Round 4 Question 1

What is the sum of the prime factors of 2018?

Varsity Math Bowl Round 4 Question 2

Monopoly. Instead of a board, the playing area is a cube with a railroad in the middle of each edge. The fee for one ride is $25 for each RR owned. How many dollars would you get per ride if you owned all the RRs.

Varsity Math Bowl Round 4 Question 3

Suppose $P(n)$ equals the greatest prime factor of n. What is the greatest two digit number such that $P(n) = \sqrt{n}$?

Varsity Math Bowl Round 4 Question 4

Alice's drawer always has an equal number of three colors of socks. Each morning, Alice grabs two socks at random. If they match, she puts them on. If not, she puts them back, and draws again, and so on, until a match occurs. This goes on for many years. What is the average number of daily draws?

Varsity Math Bowl Round 4 Question 5

Solve:

$$\ln(x+7) = \ln(x) + \ln(7)$$

Varsity Math Bowl Round 4 Question 6

Two squares each have area 1 and their intersection is a square of area 1/4. What is the perimeter of total figure?

Varsity Math Bowl Round 4 Question 7

The number 4114 is a palindrome - it reads the same forwards and backwards. How many 4-digit numbers (without leading 0's) are palindromes?

Varsity Math Bowl Round 4 Question 8

What is the product of all solutions of

$$\cos \pi x = \sin(2\pi x)$$

that also satisfy $0 < x < 1$.

Varsity Math Bowl Round 4 Question 9

Suppose $m \cdot n = 10000$ but neither m nor n is a multiple of 10. What is $m + n$?

Varsity Math Bowl Round 4 Question 10

Evaluate

$$\int_{.18}^{.20} 2018^{\tan^2 x - \sec^2 x + 1}\, dx$$

Answer with 2 decimal place accuracy.

The End

Please be patient while we calculate the scores.

Closing Ceremony to commence shortly