46th Lee Webb Math Field Day

California State University, Bakersfield
Department of Mathematics

March 4, 2017

Varsity Math Bowl

Varsity Math Bowl Round 1 Sample Question

Today is the fourth day of the third month of the year? How many positive divisors does 3^4 have?

Varsity Math Bowl Round 1 Question 1

What is the greatest common divisor of 120, 72, 48?

Varsity Math Bowl Round 1 Question 2

The sixth term of an 11-term arithmetic sequence is 2017. The common difference is 17. What is the sum of the terms in the sequence?

Varsity Math Bowl Round 1 Question 3

P is a convex 23-sided polygon. Q is a convex 25 sided polygon. In degrees, the sum of the angles in P is p and the corresponding sum in Q is q. What is the value of $q - p$?

Varsity Math Bowl Round 1 Question 4

If six numbers are chosen randomly from the set

$$\{1, 3, 5, 7, 9, 11, 13\},$$

what is the probability that their sum will be less than 37? (Answer needs to be a fraction in reduced form.)

Varsity Math Bowl Round 1 Question 5

Suppose $\frac{3}{x} + \frac{4}{y} = 5$ and $\frac{2}{x} + \frac{2}{y} = 2$, what is the value of y?

Varsity Math Bowl Round 1 Question 6

Three of the sides of a rectangular box have areas $18, 30, 60$. What is the volume of the box?

Varsity Math Bowl Round 1 Question 7

Simplify

$$6 + 6 \cdot 6 + 6 \cdot 6 \cdot 6 + 6 \cdot 6 \cdot 6 \cdot 6$$

Varsity Math Bowl Round 1 Question 8

Suppose

$$x + \frac{1}{x} = 7.$$

What is the value of

$$x^2 + \frac{1}{x^2}?$$

Varsity Math Bowl Round 1 Question 9

How many ways can the digits 2, 0, 1, 7 be arranged to form a four digit number that is even (no leading 0)?

Varsity Math Bowl Round 1 Question 10

A line divides a plane into two regions. Three lines divide a plane into at least p regions and at most q regions. What is $p + q$?

Round 2

Varsity Math Bowl Round 2 Sample Question

What is the cube root of the smallest positive perfect cube that ends in 3?

Varsity Math Bowl Round 2 Question 1

What is the length of the minor axis of the ellipse

$$\frac{(x+4)^2}{25} + \frac{(y-7)^2}{50} = 1$$

Varsity Math Bowl Round 2 Question 2

Solve for x:

$$x^3 - 6x^2 + 12x - 8 = 0$$

Varsity Math Bowl Round 2 Question 3

Let
$f(x) = (x-1)(2x-1)(3x-1)(4x-1)$.
Evaluate $f(2)$.

Varsity Math Bowl Round 2 Question 4

Given that $0 < x < 1$, solve:

$$\cos \pi x = \cos 2\pi x$$

Varsity Math Bowl Round 2 Question 5

Simplify:

$$\frac{10!}{8!} + \frac{6!}{4!} + \frac{2!}{0!}$$

Varsity Math Bowl Round 2 Question 6

A rhombus has side length 8 and one of its angles is 150 degrees. What is the area of the rhombus?

Varsity Math Bowl Round 2 Question 7

What is the value of x if $x > 0$ and

$$x^2 + 3y^2 + 3z^2 = 90$$

$$x^2 - 2y^2 - z^2 = 27$$

$$x^2 - y^2 - 2z^2 = 30$$

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 x-coordinate of the vertex of the parabola given by

$$y = (5x + 3)(7x - 4)$$

Varsity Math Bowl Round 2 Question 10

Three points are placed in the interior of a heptagon. Non-intersecting segments connecting the the 10 points, divide the interior into 9 subregions. How many segments were added.

Round 3

Varsity Math Bowl Round 3 Sample Question

What is $\frac{2017}{201}$, rounded to the nearest whole number?

Varsity Math Bowl Round 3 Question 1

Two numbers that are 3 apart sum to 2017. What is the larger of the two numbers?

Varsity Math Bowl Round 3 Question 2

A regular cone has radius of $10/\sqrt{\pi}$ and the slant height is $20/\sqrt{\pi}$. What is the surface area of the cone's slanted part?

Varsity Math Bowl Round 3 Question 3

Two sides of a triangle have lengths 3 and 8. The cosine of the angle between these sides is $\frac{\sqrt{7}}{4}$. What is the area of the triangle?

Varsity Math Bowl Round 3 Question 4

With a standard shuffled deck of cards, what is the probability that the top two cards form a "blackjack?" I.e. what is the probability that one of the cards is an ace and the other is a 10, Jack, Queen, or King?

Varsity Math Bowl Round 3 Question 5

Solve:

$$\log_3(x-1) - \log_3(x-4) = \log_3(37+63)$$

Varsity Math Bowl Round 3 Question 6

An object leaves the origin of a two-dimensional Cartesian coordinate system at time t=0. Its x-coordinate is governed by a parametric equation, $x = 32t$. The y-coordinate is given by $y = x - 16t^2$. When - for what value of t - will the object cross the x-axis?

Varsity Math Bowl Round 3 Question 7

P is a convex polygon whose exterior angles alternate 1^o, 2^o, 1^o, 2^o, 1^o, 2^o, etc (with an equal number of each). How many sides does P have?

Varsity Math Bowl Round 3 Question 8

Evaluate:

$$1^2 + 2^2 + 3^2 + \ldots + 100^2$$

Varsity Math Bowl Round 3 Question 9

Evaluate exactly:

$$\cos(\pi/12)\cos(5\pi/12)$$

Varsity Math Bowl Round 3 Question 10

What is the median of the first 2017 odd numbers?

Round 4

Varsity Math Bowl Round 4 Sample Question

Which one of the following famous people does not belong with the others - answer by the corresponding fraction.
1/1. William Shakespeare, 1/2. Geoffrey Chaucher, 1/3. Charlotte Bronte, 1/4. Isaac Newton, 1/5. Albert Einstein, 1/6. George Washington, 1/7. Andrew Jackson, 1/8. Harry Truman, 1/9. Marie Curie

Varsity Math Bowl Round 4 Question 1

For $n = 11$, evaluate

$$\sum_{k=1}^{n}(k-5).$$

Varsity Math Bowl Round 4 Question 2

How many times does the graph of

$$y = (x-1)(x^2-2)(x^2+3)(x-4)^4?$$

cross the x-axis?

Varsity Math Bowl Round 4 Question 3

Let $f(x) = x + \cos x$. Given that, to six significant figures, $f(-1) = -0.459698$, what is $f(1)$, to five significant figures?

Varsity Math Bowl Round 4 Question 4

Calculate the smaller of these two quantities:

$$2^{3^4} \quad \text{or} \quad 4^{3^2}$$

Varsity Math Bowl Round 4 Question 5

Solve:

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

Varsity Math Bowl Round 4 Question 6

In the following equation, assume each letter represents a distinct digit. What is the value of J?

$$ABCDEFGH \times AJ = BBBBBBBBB$$

Varsity Math Bowl Round 4 Question 7

How many times do the graphs of the following two equations intersect?

$$y = x^2 - 6x$$

$$y = \frac{6}{x} - 11$$

Varsity Math Bowl Round 4 Question 8

What is the product of all solutions of

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

that satisfy $0 < x < 1$,

Varsity Math Bowl Round 4 Question 9

What is the average of the smallest set of 7 positive, consecutive integers whose sum is greater than 2017?

Varsity Math Bowl Round 4 Question 10

On the interval $(-1, 1)$, the average value of the funtion

$$f(x) = \frac{1}{1 + x^2}$$

is what multiple of π?

The End

Please be patient while we calculate the scores.

Closing Ceremony to commence shortly