MATHEMATICS

1. MATHEMATICS

Writer: American Heritage

Toss Up: Short Answer

If f(x) = sqrt[(e^x)*tan(x) + 1], find f(x)*f'(x) [read as If f(x) equals the square root of quantity e to the power of x times tangent of x plus one, closed quantity, find f of x times f prime of x.

Bonus Answer: [e^x*(tanx+sec^2x)]/2. Accept: (e^x*tanx+e^x*sec^2x)/2, or e^x(tan^2+tanx+1)/2

Bonus: Short Answer

If f(x) is an even function such that the integral from 0 to 4 of f(x)dx equals 31, and the integral from 0 to 8 of f(x)dx equals 42, evaluate the integral from -4 to -8 of f(x)dx

Bonus Answer: 9

==========

2. MATHEMATICS

Writer: American Heritage

Toss Up: Short Answer

A car travels at 20mph for the first half of its trip, and 30 mph for the second half. What is the average speed for the trip in miles per hour?

Bonus Answer: 24 mph

Bonus: Short Answer

Christopher takes 4 hours to paint a wall by himself. Tyger being lazy takes 6 hours to paint the same wall by himself. If Christopher and Tyger work together, but take a 1 hour break to play Super Smash Bros, how long does it take them to finish the wall?

Bonus Answer: 3 hours and 24 minutes (Accept 17/5 hours)

==========

3. MATHEMATICS

Writer: American Heritage

Toss Up: Short Answer

Evaluate the intergral from negative pi to pi of (x^2)*sinx dx

Bonus Answer: 0

Bonus: Multiple Choice

Evaluate the limit as x approaches zero of the fraction with numerator e^x - cos(x) and denominator sin(x).

W) 1

X) 0

Y) -1

Z) DNE

Bonus Answer: X

==========

4. MATHEMATICS

Writer: Stuyvesant

Toss Up: Multiple Choice

What statistical average is most appropriate to use when the quantities being averaged when one or more of the quantities are not necessarily bounded?

W) Geometric Mean

X) Median

Y) Harmonic Mean

Z) Arithmetic Mean

Toss Up Answer: Z

Bonus: Short Answer

You pick two cards at random without replacement from a standard, 52 card deck. Compute the probability that exactly one is a heart.

Bonus Answer: 13/34

==========

5. MATHEMATICS

Writer: Stuyvesant

Toss Up: Multiple Choice

Which of the following expressions in x grows fastest?

W) (3)^x

X) 2^(2x)

Y) (x)^2

Z) 10*(3/2)^x

Toss Up Answer: X

Bonus: Short Answer

Given 504=2^3 x 3^2 x 7 [504 equals 2 cubed times 3 squared times 7], compute the sum of the positive divisors of 504.

Bonus Answer: 1560

==========

6. MATHEMATICS

Writer: Stuyvesant

Toss Up: Multiple Choice

If the test scores of Mr. Coco's Calculus test are assumed to have a normal distribution, and if the mean test score was 91, what can be said about the median test score of that test?

W) The median was lower than 91

X) The median was higher than 91

Y) The median was 91

Z) The median cannot be determined

Toss Up Answer: Y

Bonus: Multiple Choice

The z-score for Steven's physics test grade was found to be 0.375. If he scored a 94 on the test, and the standard deviation was 8, what was the mean test score on the physics test?

W) 91

X) 95

Y) 92

Z) 98

Bonus Answer: W

==========

7. MATHEMATICS

Writer: Stuyvesant

Toss Up: Multiple Choice

Simplify (sin15cos75-cos15sin75)/(cos15cos75+sin15sin75)

W) negative square root of 3

X) 1/2

Y) -1/2
Z) square root of 6 minus square root of 2 all over 2
Toss Up Answer: W

Bonus: Short Answer
Compute (2+2sqrt(3)i)^6. [the quantity 2+2 times the square root of 3 time i to the 6th power]
Bonus Answer: 4096

==========

8. MATHEMATICS

Writer: Centennial
Toss Up: Short Answer
If X and Y are independent random variables with standard deviations of a and b respectively, what is the standard deviation of the quantity X+2Y?
Bonus Answer: Sqrt(a^2+4b^2)

Bonus: Short Answer
If X and Y are independent random variables with expected values c and d respectively, what is the expected value of the quantity X+2Y?
Bonus Answer: c+2d

==========

9. MATHEMATICS

Writer: Centennial
Toss Up: Short Answer
What is the name for the group of four datasets with nearly identical summary statistics, but drastically different scatterplots?
Bonus Answer: Anscombe's quartet

Bonus: Short Answer
X is a random variable with a uniform distribution with width w of values. In terms of w, what is the standard deviation of X?
Bonus Answer: Sqrt(w^2/12)

==========

10. MATHEMATICS

Writer: Centennial
Toss Up: Short Answer
What is the exact average value of x^2+3x-2 from x=3 to x=6?
Bonus Answer: 195/6

Bonus: Multiple Choice
With which of the following nth terms will an infinite series converge?
W) 1/n
X) ln n
Y) sin n
Z) 1/n^3

Bonus Answer: Z

==========

11. MATHEMATICS

Writer: Granada Hills
Toss Up: Short Answer

What is the sum of coefficients of the expression (x+1)^3 (cubed)

Bonus Answer: 8

Bonus: Short Answer

A student is riding a roller coaster. The track resembles the equation y= sin(t), where y is the height and t is the time elapsed in seconds . At what time, rounded to the nearest second, does the student reach the first peak of the roller coaster? Assume degrees.

Bonus Answer: 90

==========

12. MATHEMATICS

Writer: Granada Hills

Toss Up: Short Answer

Assuming random chance decides admission, and the acceptance rate for University A is 10% and the acceptance rate for University B is 20%, what is the probability that a student will be rejected from both to the nearest hundredth.

Bonus Answer: 0.72 (Accept 72%)

Bonus: Multiple Choice

A teacher wants to buy pizza for the very hardworking kids of Science Bowl. Which of the following options will provide the least square inches of pizza per dollar?

W) 2 10 inch diameter pizzas for $15
X) 2 square pizzas with side length 10 inches for $20
Y) 1 14 inch diameter pizza for $12
Z) 1 12 inch diameter pizza for $10

Bonus Answer: X

==========

13. MATHEMATICS

Writer: Brooklyn Tech

Toss Up: Short Answer

In a triangle, the sides are 13, 14, and 15. Find the altitude of the triangle.

Bonus Answer: 12

Bonus: Multiple Choice

What is 2017 to the second power?
W) 4068290
X) 4068269
Y) 4068279
Z) 4068289

Bonus Answer: Z

==========