**\*\*\*SOLUTIONS-MU STATE BOWL\*\*\***

**National Convention 2014**

**QUESTION 1** (Answer: 1)



For g(x), the limit at ∞ and ─∞ are the same, so the horizontal asymptote is y = 2.





**QUESTION 2** (Answer: )







**QUESTION 3** (Answer: )





Thus A + B(x,y)= 

**QUESTION 4** (Answer: 

For the trapezoidal trough, make a right triangle with one leg x, one leg h (the height of the water) and hypotenuse along the slanted side of the trough. Then using similar triangles, we know  So the smaller trapezoid made at any height *h* will have one base of length 30, and the other 30 + 2x=30 + *h*





**Question 5** 

**Question 6** (Answer: g(─1), g’(─2), g(1), g”(─2), g(─4), g(5) )

Given that g(1) =0, g(5) = (0.25)(4)(1)=2,



Now, *g’(x) = f(x)* by the Fundamental Theorem of Calculus, so *g’(─2) = f(─2) = ─1.* And *g”(─2) = f’(─2) =1,* since the slope of the line passing through the point where x= ─2 is 1. Thus in ascending order we have

 g(─1), g’(─2), g(1), g”(─2), g(─4), g(5) .

**Question 7** (Answer: -95/3)

A. The displacement is the integral of the velocity, which is

 

B. The total distance traveled is the integral of the speed which is C. The average velocity is .

D. The acceleration *a(t) = ─2t+8*, which is zero at *t* = 4. So the velocity at *t* = 4 is 4.

Our sum is: .

**Question 8**  (Answer: 2)

* We have 
* Now we are set, since  Note that a squeeze theorem argument could be made, since  (= 1)
* Note that . Since x = 0 is included in the domain of , it is easy to see that since the concavity changes there, x = 0 is a point of inflection. (= 1)
* And since  , the second derivative does not exist at x = 0. (= 1)

The answer is ─1 + 1 + 1 + 1 = 2

**QUESTION 9** (Answer: )

* If d is the distance from the origin to our point, we have . But since (A, B) lies on the line, we know B = 5A + 8. Furthermore, when minimizing distances we can minimize the square of the distance to make the calculation easier. So we have 

Then 

* 
* **(QUESTION 9 continued on next page)**



Since D = 0 would result in a trivial solution, we must have **D = 10**. Then ****.

* Let the point be on the parabola and the area. Then .



* Let the point  be on the ellipse and the rectangle. Then the area is given by



**Question 10** (Answer: 109)



**Question 11** (Answer: 1 + sin 1)



Thus A + B + C + D = 1 + sin 1

**Question 12** (Answer: )

 









**Question 13** (Answer: )







We can make a geometric argument, note that 20 ─ x=3x so the curves intersect when x = 5. Thus the area of the triangle created in the first quadrant is 0.5(20)(5) = 50. So D = 100.

The answer for 

**Question 14** (Answer: )

14.1 The point is (1, 3) and the slope is 2, so our line is y – 3 = 2(x – 1) or y = 2x + 1. Then A = 2, B = 1.





14.4 The point is (0, 1) and the slope is 1. The line is y = x + 1. Then G = H = 1

The answer is ABCFGH + DE = 

**\*\*\*ANSWERS-CALCULUS BOWL\*\*\***

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1. 1
2. 
3. 
4. The coordinate: 
5. 
6. g(─1), g’(─2), g(1), g”(─2), g(─4), g(5)
7. 
8. 2
9. 
10. 109
11. 1 + sin 1
12. 
13. 
14. 