Name _____ Test 3, Fall 2019

Part 1: Computational Skills

1) Find the integral below. (4 points)

$$\int 3x^4 dx$$

2) Let $f(x) = 3x^4$. Find the specific antiderivative $F(x)$ such that $F(1) = 4$. (4 points)

3) Find the limit below. (4 points)

$$\lim_{x \to \infty} \frac{5x^6 - 4x^3 + 2x + 1}{8x^6 + 5x^4 + x^2 + 6}$$

4) Find the integral below. (4 points)

$$\int \cos(4x)\, dx$$

5) Find the integral below. (6 points)

$$\int \frac{1}{x-5} dx$$

6) Find the integral below. (6 points)

$$\int_3^6 1dx$$

7) Let $b \neq 1$ be a constant. Find the integral below. (6 points)

$$\int_0^1 x^{4b} dx$$

8) Find the integral below. (6 points)

$$\int x^3(x^4 - 5)^3 dx$$

9) Find the integral below. (6 points)

$$\int \cos(x) \sin^5(x)\, dx$$

10) Find the integral below. (6 points)

$$\int \frac{1}{9+x^2}\,dx$$

11) Find the integral below. (6 points)

$$\int (e^x + x)(e^x + 1)\,dx$$

Part 2: Conceptual Understanding

12) Assume $f(x)$ and $g(x)$ are continuous functions such that $f(5) = 8, f'(5) = 3, g(5) = 8,$ $g'(5) = 2$. Use this information to find the limit below. (6 points)

$$\lim_{x \to 5} \frac{f(x) - g(x)}{x^2 - 25}$$

13) Find the value of the limit of the summation below. (4 points)

$$\lim_{n \to \infty} 3 \sum_{k=1}^{n} \frac{2}{n} \left(\frac{2k}{n}\right)^2$$

14) To the right is a table of values of a function. Create three estimates for the integral of $\int_2^{10} f(x)dx$ Each estimate must be better than the previous, so don't start with an estimate that is too good. (8 points)

Estimate 1:

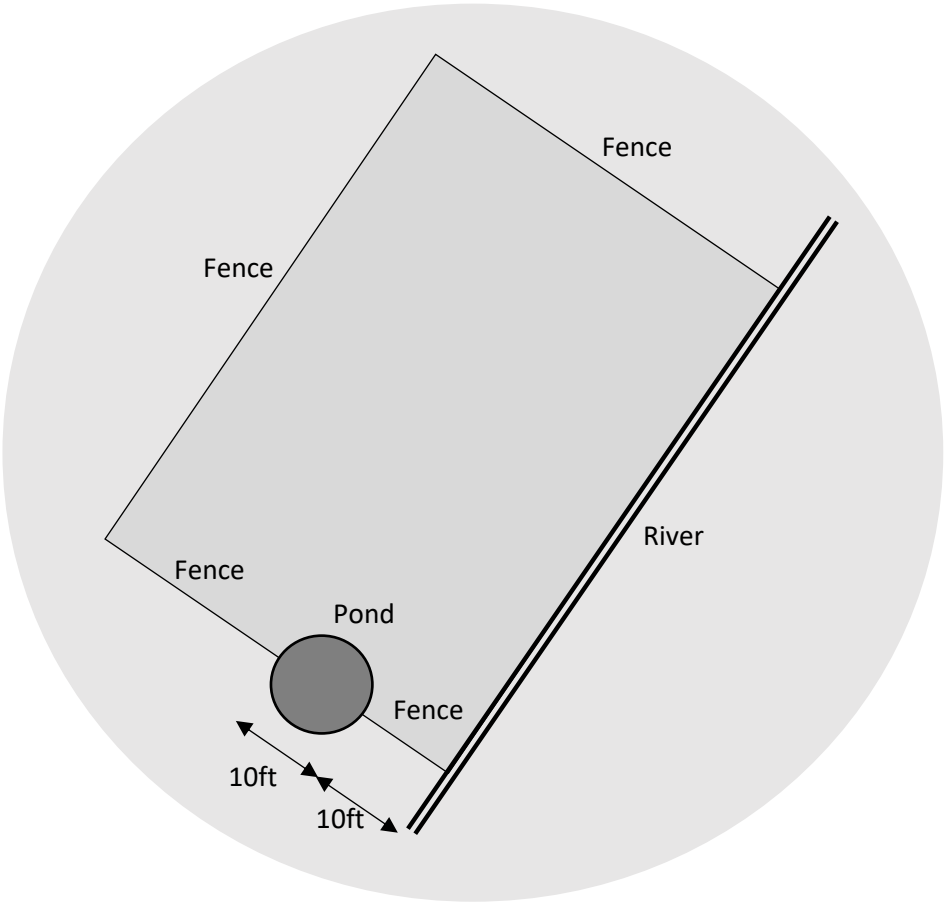
x	$f(x)$
1	13
2	4
3	3
4	6
5	8
6	10
7	7
8	5
9	3
10	6
11	11
12	12

Estimate 2:

Estimate 3:

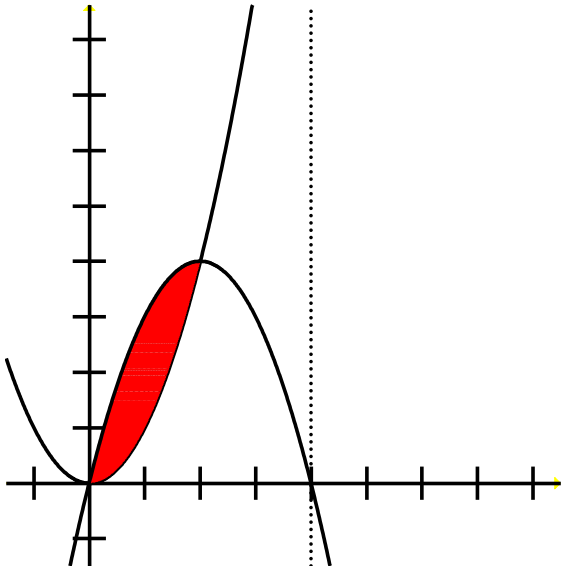
Part 3: Applications

15) A farmer's pasture consists of a field with a circular pond and a straight river. The farmer would like to create a pasture as large as possible using only the 390 feet of fencing he has available. Hence he will create a 3-sided pasture, using the pond to save some fencing as shown. What is the dry-land-area of the largest such pasture he can make? (6 points)



16) Set up the integral(s) for volume of the following object. The region bounded by $y = x^2$ and the curve $y = 4x - x^2$ is rotated around the line $x = 4$. (6 points)

The diagram here illustrates this region. Do not ask which curve is which, you should be able to figure that out.

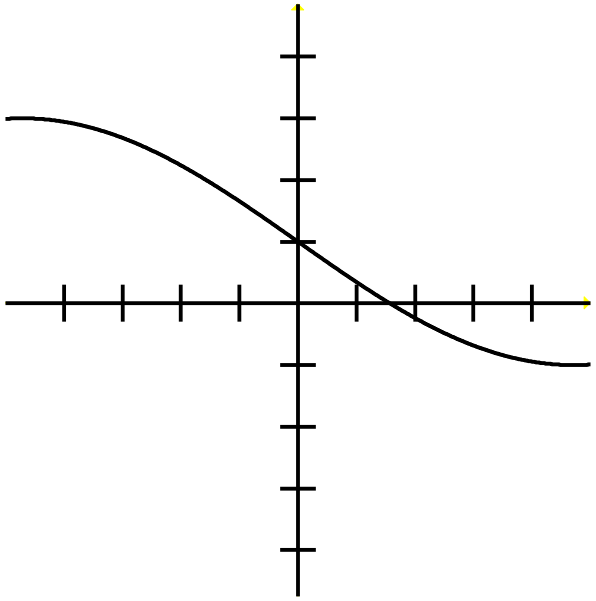


Part 4b: Extra Credit Problems

17) Set up the integral(s) for surface area of the following object from the previous problem. (2 bonus points)

Part 4: Review Problems

18) Estimate the largest value of the derivative of the function shown to the right (4 points)



19) Find the derivative of the function $f(x) = 4x^3 - 3x$ at the point $x = 2$. (4 points)

20) Find the following: (4 points)

$$\frac{d}{dx}\left(\frac{d}{dx}(x\sin(5x))\right)$$