AP Calculus Name_____
Fundamental Theorem of Calculus Party Integration Day 5

Discovering the Fundamental Theorem of Calculus

Directions: For the functions in the table below, find each of the following to complete the chart.

1. Use a midpoint Riemann Sum with $\Delta x = 0.5$ to approximate the definite integral, $\int_a^b f(x)dx$
2. Find the antiderivative, F(x), of the given function.
3. Evaluate the antiderivative at each of the limits of the definite integral (find F(a) and F(b)).

f(x)	**a**	**b**	$\int_a^b f(x)dx$ **(value)**	**F(x) (function)**	**F(a)**	**F(b)**
x^2	0	2				
x^3	1	2				
$4x$	1	5				
$\sin x$	0	π				
$x + 5$	2	6				
$3x^2 + 2x$	1	2				

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Analysis:

1. Compare the values of $\int_a^b f(x)dx$ to the value of F(a) and F(b). What relationship exists between these three values?

2. The first Fundamental Theorem expresses the definite integral as a function of the antiderivatives F(a) and F(b). What do you think the First Fundamental theorem says?

3. Test your "theory" from part 2 on the definite integral $\int_1^3 x^4 dx$.

   a. According to your theory, what value would your integral equal? _____

   b. Check to see if your theory holds by graphing on your calculator. Calculate the definite integral by using 2nd Calc 7: $\int_a^b f(x)dx$. Choose x =1 as the lower limit and x = 3 as the upper limit. If your theory was incorrect, go back and revise and recheck it.

4. The Fundamental Theorem of Calculus only holds for continuous functions over [a, b]. In your own words and using the integral notation we've learned, state the First Fundamental Theorem of Calculus as a hypothesis (what conditions must be true) and a conclusion (what are you guaranteed will happen under those conditions).