Name ____________________________________

1. Illustrate the two major problems of calculus by considering the function $y = f(x) = \sin x$.
   a. Find the equation of the tangent line to the sine curve at the value $x=\pi/6$.
   b. Find the area between one hump of the sine curve and the x-axis (using a definite integral).
   c. Use the calculus features on the graphing calculator (on the TI86 it's 2nd Calc) to check the slope and height in part a and the area in part b. Write the command used and the result below.

2. Find this antiderivative.

$$\int \frac{x^4 + \sqrt{x} + 1}{x^2}\, dx$$

3. Solve the initial value problem

$$y' = 12x^2 + 10x - 1, \quad y(1) = 2$$

.

4. Suppose the acceleration of a charge in an electric field is given by the formula

$$a(t) = 6t - 8, \text{ where } v(0) = 30 \text{ and } s(0) = 100$$

Solve to find $v(t)$ and $s(t)$.

5. Find this antiderivative using a change of variable (substitution).

$$\int \frac{x\,dx}{(4x^2 - 5)^4}$$

6. Use the right endpoint rule to approximate the area under the curve $y = \sin x$ on the interval $[0,\pi]$ using $n=6$ rectangles. (Compare the answer to problem 1b and 1c.)

7. Find the exact area under the parabola, $f(x) = x^2 - 4x + 6$, on the interval [2,5] by the definition of area ("lim sum") using the right endpoint rule. (You may check it using the FTC2, but you must use sigma and take limits as n goes to infinity for credit.)

8. Estimate the value of the definite integral of a function from 2 to 3.6 numerically using n=4 iterations if the information about the function is given in the tabular form below.

x	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6
y	5	3	2	4	7	10	13	14	12	8	4	1	0	1	5	7	6

a. Use the left endpoint rule.

b. Use the midpoint rule.

c. Use the trapezoidal rule.

d. Use lower rectangles.

9. Distinguish between definite integral in general and area in particular. Tell which is more general, and why.

10. Carefully state both parts of the Fundamental Theorem of Calculus. Use your text.

11. Evaluate this definite integral using the Fundamental Theorem of Calculus part 2.

$$\int_1^3 (5x^2 - 2x + 3)\, dx$$

12. Find these derivatives using the Fundamental Theorem of Calculus part 1.

a. $\dfrac{d}{dx} \displaystyle\int_{1}^{x} \tan(t^2+1)\ dt$

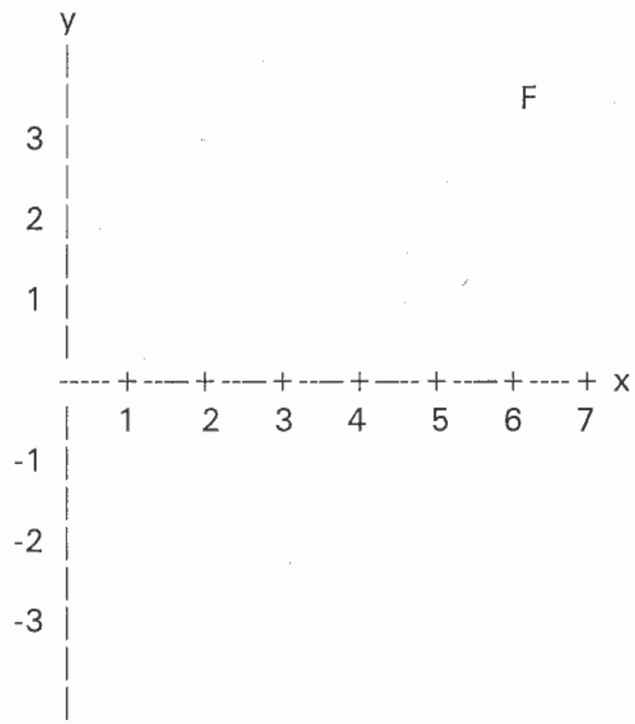
b. $\dfrac{d}{dx} \displaystyle\int_{4x}^{x^3} \sqrt{(2t^2+5)}\ dt$

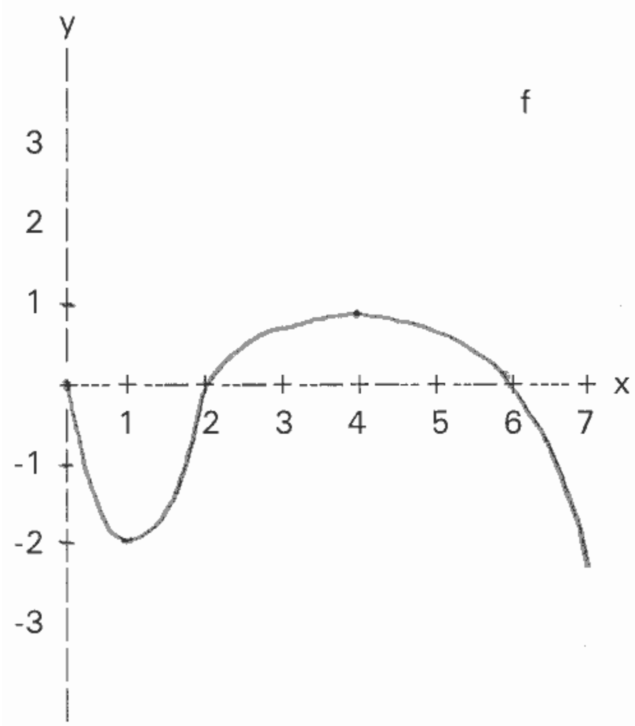
13. Make a change of variable and a change of limits of integration for the following definite integral, and then evaluate the new integral.

$$\int_{0}^{2} \sqrt{12x^2 + 1}\ x\ dx$$

14. Apply the total change theorem to find the mass in kg of a 9 meter rod. The rod has a density given by $\rho(x) = 4 + 3\sqrt{x}$ kg/m where x is the distance measured in meters from one end.

15. On the empty axes below, sketch the graph of the antiderivative F of the given function f that satisfies the initial condition, F(2) = 1.





16. Below is given the direction field for a function f. Use it to sketch the graph of the antiderivative F that satisfies F(0) = 1