

Last Name (please print): _____

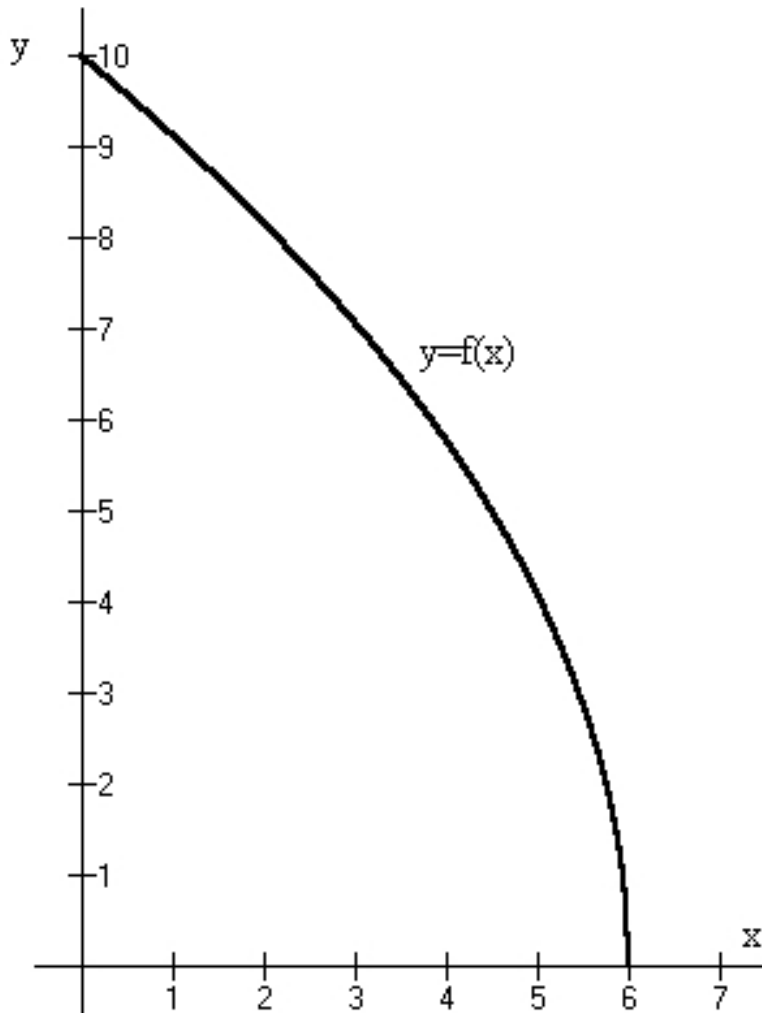
First Name (please print): _____

Student Number: _____

Instructor: B. Kadonoff I. Mercer

Do not write in this table!	
Question	Marks
1	/6
2	/4
3	/4
4	/6
5	/5
6	/5
Total	/30

1. Given the graph of f below, estimate the area under the graph of f on $[0, 6]$ using Riemann sum with a regular partition of the given interval into 6 subintervals and right endpoints. In your estimates, use integers to the nearest unit. Illustrate your method on the graph. **[4 marks]**



2.

a) Given $f(x) = \int_{-4}^{x^3} [e^u + \cos(2u)] du$, find $f'(x) = \frac{df(x)}{dx}$. **[4 marks]**

b) If h' is a cedar tree's rate of growth in centimeters per year, circle all of the following expressions which represent the increase in the tree's height in centimeters between the years 10 and 20? No explanation needed. **[2 marks]**

i) $20 - 10$

ii) $\left. \frac{dh'}{dt} \right|_{t=20} - \left. \frac{dh'}{dt} \right|_{t=10}$

iii) $h(20) - h(10)$

iv) $h'(20) - h'(10)$

v) $\int_{10}^{20} h(t) dt$

vi) $\int_{10}^{20} h'(t) dt$

3. Compute the indefinite integrals. Show your substitution. [**4 marks**]

a) $\int \tan^3 x \sec^2 x \, dx$

b) $\int \sec^3 x \tan x \, dx$

4. Consider the definite integral $\int_0^2 \sqrt{1+24x} dx$. [**6 marks**]

a) Use the trapezoidal approximation with $n = 2$ subintervals to estimate the value of the integral.

b) Find the exact value of the integral. Is the exact value greater or less than the estimate in part a)?

5. Use the method of cross-sections to calculate the volume of the solid generated by rotating the region bounded by $y = e^x$, $y = e^{-x}$ and $x = 1$ about the x -axis.
[5 marks]

6. Use the method of cylindrical shells to calculate the volume of the solid generated by rotating the region bounded by $y = x^2$ and $y = x$ about the line $x = -1$. **[5 marks]**