Test 1   Name:_____

Show your work and circle your answers! Answers that do not have a justification will receive no credit.

1. (25 points) Compute the following integrals exactly and simplify your answers

(a) $\int_{-1}^{2} (3 - 2t^2 + 4t^3) \, dt$

(b) $\int_{-10}^{0} e^x \, dx$

(c) $\int_{\pi/2}^{\pi} \cos(\theta) \, d\theta$

(d) $\int_{0}^{b} e^{-5t} \, dt$ (where $b > 0$ is a constant.)

(e) $\int_0^{\pi/\alpha} \sin(\alpha x) \, dx$ (where $\alpha > 0$ is a constant.)

(f) $\int_{-1}^1 2^v \, dv$

(g) $\int_1^4 \frac{3}{\sqrt{v}} \, dv$

2. (10 points) The following is the graph of the power consumption of a home during a five hour period.

Given upper and lower bounds for total energy used by the home during this five hour period.

3. (10 points) If you approximate $\int_1^2 \sqrt{t^3 + 8}\, dt$ by the left Riemannian sums based n equally space intervals, then how large do you have to take n to insure that your answer is accurate to 3 decimal places?

4. (15 points) The Forestry service employs student volunteers to plant trees. These students each plant 20 trees per hour. On one of the days the number of students working as a function of time t in hours (starting at 6:00AM) is

$$S(t) = \begin{cases} 3, & 0 \le t < 4 \\ 1, & 4 \le t < 5 \\ 4, & 5 \le t \le 8. \end{cases}$$

(a) Graph how the number of staff hours accumulate as a function of time:

(b) What was the total number of trees planted by the students?

5. (5 points)   (a) Compute $\sum\limits_{k=2}^{6}(2k-1)$

(b) Write $3^2 + 1 + 4^2 + 1 + 5^2 + 1 + 6^2 + 1 + 7^2 + 1$ in $\sum$ notation.

6. (5 points) What is the average value of the function $f(x) = 4x - x^2$ on the interval $[0, 4]$?

7. (10 points) (a) Compute the following derivative $F(x) = \int_{-3}^{x} e^{\sin(2t)}\, dt$

$F'(x) =$

(b) Find the critical points of $A(x) = \int_{0}^{x}(t^2 - 1)\, dt$ determine if they are local maximums or minimums.

8. (10 points) Write the solutions to the following initial values problems as accumulation function (that is as an integral with a variable upper limit of integration)

(a) $y' = e^{-x^2}$, $\qquad y(0) = 0$

(b) $y' = e^{-x^2}$, $\qquad y(1) = -2$.

9. (10 points) Let $f(x)$ have the graph as shown:

Then compute (a) $\int_{-3}^{6} f(x)\, dx$

(b) The average value of $f(x)$ on $[-3, 6]$.

Extra credit: (5 points). If $f(x) = \int_0^{\sin(x)} \sqrt{1 + t^2}\, dt$ then compute $f'(x)$.