**Name:** _____           **TA's Name:** _____

**Instructions:** You must show supporting work to receive full and partial credits. No text book, notes, formula sheets allowed.

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|------|---|---|---|---|---|---|-------|
| Score | | | | | | | |

**1(12pts)** (a) For the definite integral $\int_0^1 x^2 dx$, find (not by your calculator program) the right point Riemann sum $R_4$.

(b) Use the **definition** to find the integral. (*Suggestion*: Evaluate the limit of the right end point Riemann sum $R_n$ as the number of partition $n$ tends to infinity. Usable identity: $1^2 + 2^2 + \cdots + n^2 = \frac{(2n+1)n(n+1)}{6}$)

*(Continue on Next Page ... )*

**2(14pts)** Sketch a graph of a function that satisfies the following conditions:

(i) $\lim_{x \to 1^-} f(x) = -\infty$, $\lim_{x \to 1^+} f(x) = \infty$, $\lim_{x \to \infty} f(x) = 0$, $\lim_{x \to -\infty} f(x) = 1$.

(ii) $f(0) = 1$.

(iii) $f'(0) = f'(-2) = 0$, $f'(x) > 0$ on $(-2, 0)$ and $f'(x) < 0$ on $(-\infty, -2), (0, 1), (1, \infty)$.

(iv) $f''(x) > 0$ on $(-3, -1)$, $(1, \infty)$ and $f''(x) < 0$ on $(-\infty, -3), (-1, 1)$.

**3(10pts)** (5 points each) (a) Determine if this function $f(x) = \dfrac{\sin(\pi x)}{2x^2 - 3x + 1}$ has a vertical asymptote. If so what is it? If not why not? (Do not sketch the curve and an answer based on calculator work does not receive any credit.)

(b) Determine if the function $f(x) = \dfrac{\sin(\pi x)}{2x^2 - 3x + 1}$ has a horizontal asymptote. If so find them all.

**4(8pts)** The following graph represents the temperature fluctuation (in °C) during a period of 4 hours this morning. Find the **average** temperature over that period.
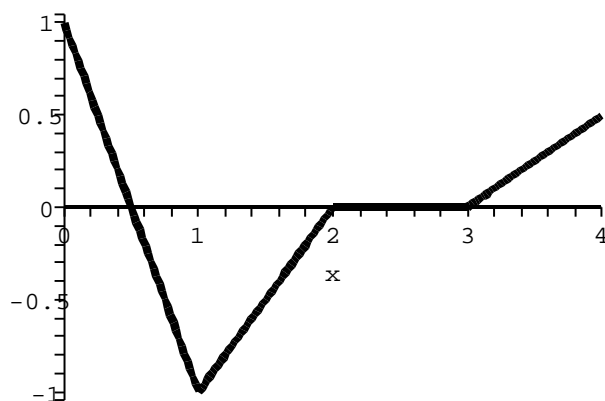
**5(20pts)** (5 points each) Find the antiderivatives of the following functions: (No calculator is allowed on these problems.)

(a) $f(x) = \sec^2 x + 3\sqrt{x}$

(b) $g(x) = \dfrac{x^{1.2} + 1.2}{x}$

(c) $h(x) = (x^2 + 1)^2$

(d) $k(x) = \dfrac{3x^2}{x^3 + 3}$

**6(6pts)** (3 points each) (a) If $f(t) = \dfrac{e^{t^2}}{t}$, what is $\displaystyle\int f'(t)dt$?

(b) If $\displaystyle\int_0^1 f(x)dx = 3$ and $\displaystyle\int_1^3 f(x)dx = 2$, what is $\displaystyle\int_0^3 f(x)dx$?

**7(14pts)** (3 points each except for the last) Some values of a function $f(x)$ is given below:

| $x$ | 1 | 1.25 | 1.5 | 1.75 | 2 | 2.25 | 2.5 |
|------|-----|------|------|-------|-------|-------|------|
| $f(x)$ | 0.2 | -0.1 | -.2 | -0.32 | -0.58 | -0.58 | -0.6 |

Approximate the value of the integral $\displaystyle\int_1^{2.5} f(x)dx$ by the following Riemann sums:

(a) The left point sum $L_3$.

(b) The right point sum $R_3$.

(c) The midpoint sum $M_3$.

(d) The trapezoid sum $T_3$.

(e) The Simpson sum $S_3$.

**8(16pts)** A three-sided fence is to be built next to a straight section of a barn. The enclosed are is to equal 2000 ft². Find the dimensions of the enclosure that minimize the fencing material.

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**2 Bonus Points**: Fill in the blank: If you can dodge a wrench you can _____. (… *The End*)