Summation Formulas

(a) $\sum_{i=1}^{n} c = cn$

(b) $\sum_{i=1}^{n} i = \frac{n(n+1)}{2}$

(c) $\sum_{i=1}^{n} i^2 = \frac{n(n+1)(2n+1)}{6}$

(d) $\sum_{i=1}^{n} i^3 = \frac{n^2(n+1)^2}{4}$

SCORE_____

1. Find the most general antiderivative of

$$f'(x) = 6x^5 + 5x^2 - 3e^x$$

[6 points]

2. Find f, given the following:

$$f'(x) = 4x - 10x^4, \;\; f(2) = 4$$

[6 points]

3. (a) Using four rectangles and right endpoints estimate the area of the region lying between the graph of $f(x) = -x^2 + 4$ and the x-axis between $x = 0$ and $x = 2$.

[8 points]

(b) Write an expression, using limit and summation notation, for the exact area of $f(x)$ over the interval [0,2].

[6 points]

(c) Evaluate the limit, using sum and limit rules, for the exact area of $f(x)$ on [0,2].

[8 points]

4. Using the limit process, find the area of the region bounded by the graph $f(x) = x^2$ and the x-axis between $x = 1$ and $x = 2$.

[15 points]

5. State the Fundamental Theorem of Calculus, Part 1 & Part 2.

[8 points]

6. Evaluate the following using integral rules and the Fundamental Theorem of Calculus.

(a) $\int x\sqrt{x^2+2}\ dx$

[7 points]

(b) $\int_1^2 (t^2-3)\ dt$

[7 points]

(c) $\int_0^1 z^3(1+z^4)^3\ dz$

[7 points]

(d) $\dfrac{d}{dx}\displaystyle\int_{-2}^{x} \sqrt{t^2+1}\ dt$

[7 points]

(e) $\displaystyle\int_0^{\pi} \cos x \; dx$

[7 points]

(f) $\displaystyle\frac{d}{dx}\int_2^{x^4} \sin\sqrt{x} \; dx$

[7 points]

Bonus. Use the properties of integrals to verify the inequality.

$$\int_0^1 x^2 \cos x \; dx \leq \frac{1}{3}$$

[5 points]