Honors Calculus, Math 1450- HW 5 (due Thursday 22nd October)

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All section references are to Stewart 6th edition. Show all working and write your answers neatly. Staple your work.

(1) Show by induction that
   (i) \( \sum_{j=1}^{n} j = \frac{n(n+1)}{2} \)
   (ii) \( \sum_{j=1}^{n} j^2 = \frac{n(n+1)(2n+1)}{6} \)

(2) Use the results of (1) to show that \( \int_0^a x \, dx = \frac{a^2}{2} \) and \( \int_0^a x^2 \, dx = \frac{a^3}{3} \) by using Riemann sums consisting of partitions of \([0, a]\) into \( n \) equal subintervals of length \( \frac{a}{n} \) and taking the limit as \( n \) goes to infinity. \textit{Hint: Take the right endpoint as } x_i^* .

(3) Section 5.2: 52, 54

(4) Section 5.3: 24, 28, 36, 40, 54, 56, 66, 68, 70
(5) In the following indefinite integrals you may need to use method of substitution or integration by parts (or both).

(i) \[ \int e^x \sin(e^x) \, dx \]

(ii) \[ \int \log x \frac{dx}{x} \]

(iii) \[ \int \frac{x}{\sqrt{1-x^4}} \, dx \]

(iv) \[ \int x^2 \sin(x) \, dx \]

(v) \[ \int x\sqrt{1-x^2} \, dx \]

(vi) \[ \int (\log x)^2 \, dx \]

(vii) \[ \int \sqrt{x} \log(x) \, dx \]

(viii) \[ \int \frac{1}{x \log x} \, dx \]

(6) Section 7.1: 18, 28, 32, 36, 48