**Midterm Practice Problems**

*Disclaimer: I in no way suggest that this is comprehensive. Students should review their notes, assignments and sample problems in conjunction with these practice problems. Sample midterms are on the wiki.*

For reference, you may need some or all of the following formulas

$$\sum_{i=1}^{n} i = \frac{n(n+1)}{2} \qquad \sum_{i=1}^{n} i^2 = \frac{n(n+1)(2n+1)}{6} \qquad \sum_{i=1}^{n} i^3 = \frac{n^2(n+1)^2}{4}$$

1) Using the definition of an integral (with right endpoints in the Riemann sums), evaluate
   i. $\int_0^4 3dx$
   ii. $\int_0^1 (2x+3)dx$
2) Integrate $\int \sec^3(x)dx$ (Hint: Try by parts splitting up the secant terms)
3) Integrate all of the below.
   (i) $\int_1^2 \frac{1+u^2}{u^3}du$
   (ii) $\int (u^2-1)^2 du$
   (iii) $\int \arctan(x)dx$
   (iv) $\int \tan(x)dx$
   (v) $\int_0^{\frac{\pi}{4}} \sec^2(t)dt$
   (vi) $\int e^u \sin(u)du$
   (vii) $\int \frac{\ln(x)}{x^2}dx$
   (viii) $\int_1^2 \frac{e^{x^{-1}}}{x^2}dx$
   (ix) $\int \frac{1}{2x}dx$
   (x) $\int \frac{1}{\sqrt{1-x^2}}dx$
   (xi) $\int_0^{\pi} \sec(x)\tan(x)dx$
   (xii) $\int 10^u du$
   (xiii) $\int_{-1}^1 x^2 \sin(x)dx$
   (xiv) $\int_0^1 \frac{4}{t^2+1}dt$
   (xv) $\int \sec(t)dt$
   (xvi) $\int_1^4 \frac{1}{x^3}dx$
   (xvii) $\int \frac{t^9}{1+t^{20}}dt$
   (xviii) $\int x\ln(x)dx$
   (xix) $\int_{-1}^1 |x^3-x|dx$
   (xx) $\int \frac{x^2}{1+x^2}dx$
   (xxi) $\int_0^{\pi} \sin(x)dx$
   (xxii) $\int \frac{3}{t\ln(t)}dt$
   (xxiii) $\int_0^{\pi} \cos(x)dx$
   (xxiv) $\int x^2 e^x dx$
   (xxv) $\int \frac{4x^3+1}{x^4+x}dx$

(xxvi) $\int 4x^2\sqrt{x^3+2}dx$

(xxvii) $\int \ln(t)dt$

(xxviii) $\int_{-5}^{3} |x^2-4|dx$

(xxix) $\int 2t\log_3(t)dt$

(xxx) $\int_{-10}^{10}(2x^3+5x^7+11x^{13}+17x^{19}+23x^{29})dx$

(xxxi) $\int 6dt$

(xxxii) $\int_0^{\ln(3)} \frac{e^t}{e^t+1}dt$

(xxxiii) $\int x^3\cos(4x^4+10)dx$

(xxxiv) $\int_{-1}^{3}(x^2+x+1)dx$

(xxxv) $\int \frac{x}{1+x^4}dx$

(xxxvi) $\int \sec^2(t)dt$

(xxxvii) $\int x\sin(x)dx$

(xxxviii) $\int_{e^2}^{e^3}(\ln(x))^2dx$

(xxxix) $\int u\arctan(u)du$

(xl) $\int \frac{1+x}{1+x^2}dx$

(xli) $\int xe^{-x}dx$

(xlii) $\int \cos(x)e^{\sin(x)}dx$

(xliii) $\int \cos(x)\sin(x)dx$

(xliv) $\int x^2\cos(x)\,dx$

(xlv) $\int e^x\sin(x)\,dx$

(xlvi) $\int \tan^5(x)\,dx$

(xlvii) $\int \frac{x+27}{x^2-9}\,dx$

(xlviii) $\int \frac{x+27}{x^2+9}\,dx$

(xlix) $\int \sec^2(x)\sqrt{5+\tan(x)}\,dx$

(l) $\int \cos^2(x)\,dx$

(li) $\int x^2\sqrt{4-x^2}\,dx$

(lii) $\int x^2\sqrt{4+x^2}\,dx$

(liii) $\int x^2\sqrt{x^2-4}\,dx$

(liv) $\int \frac{2x+1}{x(1-x)}\,dx$

(lv) $\int(\csc(x)+\cot(x))^2\,dx$ **

(lvi) $\int \sin^{10}(x)\cos^5(x)\,dx$

(lvii) $\int \cos^2(x)\,dx$

(lviii) $\int \sin^2(x)\,dx$

(lix) $\int \ln^2(x)\,dx$

(lx) $\int 5^x\,dx$

(lxi) $\int \frac{7x-26}{x^2-6x-16}\,dx$

(lxii) $\int \left(\frac{\tan(x)}{\cos(x)}\right)^3 dx$

(lxiii) $\int_{-1}^{1} \frac{1}{x}\,dx$

(lxiv) $\int_{-1}^{1} x\,dx$

(lxv) $\int_{-1}^{1} \frac{1}{x^{0.999}}\,dx$

(lxvi) $\int e^{\sqrt{x}}\sqrt{x}\,dx$

(lxvii) $\int \sqrt{x^2+6x}\,dx$

(lxviii) $\int \tan^4(x)\sec^4(x)\,dx$

(lxix) $\int_{1/2}^{1} \frac{1}{\sqrt{2x-x^2}}\,dx$

(lxx) $\int \frac{1}{e^x\sqrt{e^{2x}-9}}\,dx$

(lxxi) $\int \frac{\sec^2(x)}{\tan^2(x)-\tan(x)}\,dx$

(lxxii) $\int \frac{1}{x^4-16}\,dx$

(lxxiii) $\int \frac{1}{x^4+4}\,dx$

(lxxiv) $\int \frac{1}{x^2+4}\,dx$

(lxxv) $\int \frac{1}{\sqrt{x}(\sqrt{x}+1)}\,dx$

(lxxvi) $\int \sec^3(x)\,dx$ **

(lxxvii) $\int \frac{1}{x\sqrt{1+x^2}}\,dx$

(lxxviii) $\int_{-1}^{2} |e^x - 1|$

(lxxix) $\int_{6}^{8} \frac{4}{(x-6)^3}\,dx$

(lxxx) $\int_{0}^{1} \arcsin(x)\,dx$

(lxxxi) $\int \arccos(x)\,dx$

(lxxxii) $\int_{0}^{1} \frac{3}{x^5}\,dx$

(lxxxiii) $\int \frac{4x^2-2x}{(x-1)(x^2+1)}\,dx$

(lxxxiv) $\int \tan(x)\sec^3(x)\,dx$

(lxxxv) $\int \frac{1}{\sqrt{x^2+2x+2}}\,dx$

(lxxxvi) $\int \cos(\pi x))\,dx$

(lxxxvii) $\int \sin(x)\cos^5(x)\,dx$

(lxxxviii) $\int \frac{1}{x\sqrt{x}}\,dx$

(lxxxix) $\int \sin^5\cos^2(x)\,dx$

(xc) $\int \frac{x^4+3x^2+1}{x^5+5x^3+5x}\,dx$

4) Find the centroid of the region bounded by

(i) $x + y = 2$, $x = y^2$.

(ii) $y = 1 + \sin(x)$ between $x = -\pi/2$ and $x = \pi/2$ and the $x$-axis.

(iii) $y = 5x$ between $y = -1$ and $x = 2$.