Exam #2 Information:

- The exam is on Friday, February 28
- The exam will cover chapter 7.2-7.6, 8.1-8.4
- You are allowed a one side sheet of paper with whatever you are wanting. (I will be collecting these)

Overview of the sections:

- 7.2: Integration by parts
  - important formula: $\int u\,dv = uv - \int v\,du$
  - we can use LIATE to help us pick our u and the rest is dv
    - for example: $\int xe^x\,dx$ has LIATE
      - $u = x$ (A), $dv = e^x dx$ (E)
  - After we pick u and dv, find du by taking derivative and find v by integrating dv
  - Then plug into formula and proceed from there
  - Note: there are some instances where you take 2 by parts i.e. apply by parts 2 times

- 7.3: Trigonometric Integrals
  - you will HEAVILY need to utilize identities in this section
  - we consider the cases
    1. $\int \sin^n x\,dx$ or $\int \cos^n x\,dx$
       - when n = odd, use $\sin^2 x + \cos^2 x = 1$
       - when n = even, use half angle formulas
    2. $\int \sin^m x \cos^n x\,dx$
       - If m or n is odd, factor out a term to make even and use $\sin^2 x + \cos^2 x = 1$ — i.e. reduce to type 1
       - for m and n even, use half angle formula
    3. $\int \sin mx \cos nx\,dx$, $\int \sin mx \sin nx\,dx$, $\int \cos mx \cos nx\,dx$
       - these are nice! they use an easy simplification
         - $\sin mx \cos nx = \frac{1}{2}[\sin[(m+n)x] + \sin[(m-n)x]]$
         - $\sin mx \sin nx = \frac{1}{2}[\cos[(m+n)x] - \cos[(m-n)x]]$
         - $\cos mx \sin nx = \frac{1}{2}[\cos[(m+n)x] + \cos[(m-n)x]]$
    4. $\int \tan^n x\,dx$, $\int \cot^n x\,dx$
       - for tan, use $\tan^2 x = \sec^2 x - 1$
       - for cot, use $\cot^2 x = \csc^2 x - 1$
    5. $\int \tan^m x \sec^n x\,dx$, $\int \cot^m x \csc^n x\,dx$
       - for n even, pull out $\sec^2 x$ and use $\sec^2 x = \tan^2 x + 1$. same for $\csc x$
       - for m odd, pull out $\sec x \tan x$. similar for other case.

- 7.4: Rationalizing substitutions
  - when we have $\sqrt{a^2 - x^2}$ we make the sub $x = a\sin t$
  - when we have $\sqrt{a^2 + x^2}$ we make the sub $x = a\tan t$
  - when we have $\sqrt{x^2 - a^2}$ we make the sub $x = a\sec t$
  - once applying the sub, plug it in for all x and then dont forget to differentiate the sub — your integral should be in terms of t!
  - at the end, resolve the sub for x

- 7.5: Partial Fractions
  - for the form: $\frac{D}{(x+a)(x+b)}$ we write $\frac{A}{x+a} + \frac{B}{x+b} = \frac{A(x+b) + B(x+a)}{(x+a)(x+b)} = D$ where D is whatever is in our numerator — ignore denominator and solve for A & B by comparing the order.
  - for the form: $\frac{D}{(x-1)^2}$ we write $\frac{A}{(x-1)} + \frac{B}{(x-1)^2} = \frac{A(x-1) + B}{(x-1)^2} = D$
  - for the form: $\frac{D}{x(x^2+1)}$ we write $\frac{A}{x} + \frac{Bx+C}{x^2+1} = \frac{A(x^2+1) + x(Bx+C)}{x(x^2+1)} = D$

- $\boxed{8.1}$ L'Hopitals for $\frac{0}{0}$

- check if we are in $\frac{0}{0}$ form
  - If so, apply L'H by taking derivative of top and bottom SEPARATELY
    - check if you are in $\frac{0}{0}$
  - If not, proceed as in calc 1 by taking limit

- $\boxed{8.2}$: L'Hopitals for $\frac{\infty}{\infty}$ and other forms
  - Apply chart but for $\frac{\infty}{\infty}$ instead of $\frac{0}{0}$
  - For $0 \cdot \infty$, write: $f(x)g(x) = \frac{f(x)}{1/g(x)}$ OR $\frac{g(x)}{1/f(x)}$ then do the limit either normally or using L'H
    - check $0/0$ or ∞/∞
  - For $\infty - \infty$, make common denominators
  - For $0^{\infty}, 1^{\infty}, \infty^{0}$, use natural log! $\lim f(x)^{g(x)} = L$ then $\lim g(x) \ln f(x) = \ln L$ then use above results

- $\boxed{8.3}$ Improper Integrals