REVIEW SHEET FOR
MATH 132 MIDTERM #2, SPRING 2002

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Disclaimer: This review sheet serves to give a **highlight** of the topics to be covered in Midterm #2. It does NOT replace your textbook and/or your lecture notes.

Comments about the practice exams/homework:

- practice exams are on the course website — these are taken verbatim from old exams and may NOT cover the same materials as we do
- YOUR exam is 90 minutes long; the old practice exams are two hours long
- the practice exams are intended to give you an IDEA what the questions are like; your homework problems are indented to give you a chance to LEARN the course materials. The actual exam MAY contain problems DIFFERENT from those in the practice exams and/or homeworks!
- for additional practice: try the end-of-chapter review problems

Other comments about your exams:

- any request for makeup/conflict/LDSS/special request: TWO WEEKS OF NOTICE!
- calculator is **not allowed** for symbolic test!
- **SHOW YOUR WORK!**
- study the examples in your textbook

6.2:

- basic formula for volume by slices: $\int_a^b A(x)dx$, where $A(x)$ denotes the area of the cross section at x
- determine $A(x)$ BASED ON your situation. Do NOT randomly put in a 'πx^2' !! For example: if the cross section is a disc: πx^2; an annulus: $\pi(R^2 - r^2)$; squares: x^2, etc.

7.1:

- integration by parts: $\int udv = uv - \int vdu$
- you might have to apply IBP **multiple times** to finish the problem (e.g. $\int x^n e^x dx$)
- watch out for problems where you apply IBP **twice** and recover the original integral, with a **minus sign** (e.g. $\int e^x \sin x dx$)

7.2:

- basic stragety for $\int \sin^m x \cos^n x$:

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- if **one of** m, n is odd (**say** cos), split off one copy of this odd power and use $\sin^2 x + \cos^2 x = 1$a
- if **both** m, n are even, use the double angle formula

$$\sin^2 x = (1 - \cos 2x)/2, \ \cos^2 x = (1 - \cos 2x)/2.$$

- for $\int \tan^m x \sec^n x dx$:
  - if the power of sec is even, save a factor of $\sec^2 x$ and use $1 + \tan^2 x$
  - if the power of tan is odd, save a factor of $\sec x \tan x$ and use $\tan^2 x = \sec^2 x - 1$
  - you need to know

$$\int \tan x dx = \ln|\sec x| + C, \quad \int \sec x dx = \ln|\tan x + \sec x| + C.$$

7.3:

- first and foremost, you use trig substitution **only** when you have the **square root** of a **degree** 2 **polynomial**
- three basic type:

$\sqrt{a^2 - x^2}: \quad x = a\sin\theta;$ $\qquad \sqrt{a^2 + x^2}: \quad x = a\tan\theta$ $\qquad \sqrt{x^2 - a^2}: \quad x = a\sec\theta$

7.8:

- two basic types of improper integrals:
  - Suppose f 'blows up' at $x = a$; then $\int_a^b f(x)dx := \lim_{\alpha \to a^+} \int_\alpha^b f(x)dx$. Similarly, if f 'blows up' at $x = b$, then $\int_a^b f(x)dx := \lim_{\beta \to b^-} \int_a^\beta f(x)dx$.
  - $\int_{-\infty}^b f(x)dx := \lim_{a \to -\infty} \int_a^b f(x)dx; \quad \int_a^\infty f(x)dx := \lim_{b \to +\infty} \int_a^b f(x)dx$
- if f 'blows up' at some point between $[a, b]$ then we have to split up $\int_a^b f(x)dx$ into a sum of integrals over subintervals so that the blowup points are endpoints of these subintervals; cf. example 7

10.1, 10.2, 10.3:

- for the parametric curve $(x(t), y(t))$,

$$\frac{dy}{dx} = \frac{dy/dt}{dx/dt}; \qquad \frac{d^2y}{dx^2} = \frac{d}{dx}\Big(\frac{dy/dt}{dx/dt}\Big) \boxed{\neq \frac{d^2y/dt^2}{d^2x/dt^2} \text{ !!!!}}$$

- arc length formula: $\int_a^b \sqrt{\Big(\frac{dy}{dt}\Big)^2 + \Big(\frac{dx}{dt}\Big)^2} dt$
- surface area formula: $\int_a^b 2\pi y \sqrt{\Big(\frac{dy}{dt}\Big)^2 + \Big(\frac{dx}{dt}\Big)^2} dt$

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