This is an overview of the most important skills and understanding I expect you to have developed. I don't promise that every exam problem will match with something on this sheet.

Exam questions might test your understanding of some of the following important terms and concepts:

the Pythagorean Theorem	polynomial long division
partial fraction decomposition	
numerical integration	error estimates for numerical integration
Trapezoid Rule	Simpson's Rule

The exam might reasonably test your ability to carry out some of the following procedures.

• Compute the center of mass of a thin sheet of material (or as your book calls it, a "homogeneous lamina").

• Compute the integral  $\int \sin^m x \cos^n x \, dx$  for any  $n \ge 0$  and  $m \ge 0$ .

Compute the integral ∫ tan<sup>m</sup> x sec<sup>n</sup> x dx for any n ≥ 0 and m ≥ 0 (except that I have promised only to give you problems where you can integrate just using tan<sup>2</sup> x + 1 = sec<sup>2</sup> x and basic integration facts).
Compute an integral using a trigonometric substitution.

• Compute the integral of a rational function using polynomial long division (if necessary) and then a partial fraction decomposition.

• Recognize when an integral is improper.

• Compute an improper integral.

## Trig identities/integrals:

$\sin^2 x + \cos^2 x = 1$	You need to know this. That's not memorization, that's just how life is.
$\tan^2 x + 1 = \sec^2 x$	You need to know this. One approach: remember that there is some relationship between $\tan^2 x$ and $\sec^2 x$ , and then get it by dividing $\sin^2 x + \cos^2 x = 1$ through by $\cos^2 x$ .
$\cos^2 x = \frac{1}{2}(1 + \cos(2x))$ $\sin^2 x = \frac{1}{2}(1 - \cos(2x))$	You don't need to memorize these. I will provide them at the top of the test. (If by some chance I forget to print them on the test, remind me and I'll write them on the board.)
$\frac{d}{dx}\sin x = \cos x$ $\frac{d}{dx}\cos x = -\sin x$ $\frac{d}{dx}\tan x = \sec^2 x$ $\frac{d}{dx}\cot x = -\csc^2 x$ $\frac{d}{dx}\sec x = \tan x \sec x$ $\frac{d}{dx}\csc x = -\cot x \csc x$	You need to know all of these, although it will be possible (depending on how you make trig substitutions) to completely avoid $\cot x$ and $\csc x$ . One approach: Remember the derivatives of $\sin x$ and $\cos x$ , and find the others using the quotient rule. If you have practiced enough, you may have accidentally memorized $\frac{d}{dx} \tan x$ and $\frac{d}{dx} \sec x$ .
	You also need to know all integrals that come from the differenti- ation facts above. Again, you can probably avoid cotangents and cosecants, but you'll need to know that $\int \sec^2 x  dx = \tan x + C$ and $\int \tan x \sec x = \sec x + C$ .

## **Challenge Problems:**

I will ask a few challenge questions at the end of the exam, worth very few points, and these problems are exempt from anything I have told you or will tell you about what I will or will not ask on the test.

Closed book, closed notes, no calculators.