I expect that you will know from memory:

a. basic trig identities (definitions of all six trig functions from sine and cosine, three Pythagorean identities).
b. definition of $\cos^2 x$ and $\sin^2 x$ in terms of $\cos 2x$.
c. derivatives and integrals of all six trig. functions, exponentials and logarithms.
d. derivatives of the six inverse trig. functions.

I expect that you will be able to use the following integration techniques:

a. integration by parts (including the technique used for integrating $e^{ax} \sin bx$)
b. partial fractions decomposition
c. trig. substitution (all three varieties)
d. trig. integral techniques except the integration of odd powers of secant.
e. $u = \sqrt{ax + b}$ substitution.
f. completing the square.

You will be given formulae for any additional integration techniques needed (note that this includes odd powers of secant and the Weierstrass substitution).

**Integration Practice**

Use the [Big List of Integrals](#) I gave you at the beginning of the semester. Once you’re comfortable with those, you should be fine.
Integration Application Practice - from previous exams

1. Setup (but don’t evaluate) the necessary definite integrals to find each of the following (evaluation of the first two was given as a bonus problem).
   
   a) the volume of the solid of revolution produced by revolving the region bounded by $y = \text{sech}^2 x$, $y = 0$, $x = 0$ and $x = 1$ about the $y$-axis.
   b) the volume of the solid of revolution produced by revolving the region bounded by $y = \text{sech}^2 x$, $y = 0$, $x = 0$ and $x = 1$ about the $x$-axis.
   c) the surface area of the surface of revolution produced by revolving the curve $y = \text{sech} x$ between $x = -1$ and $x = 1$ about the $x$-axis.

2.
   
   a) A spring that has natural length 8 inches requires 20 foot-pounds to compress it to 6 inches. How much work will it require to stretch it to 11 inches?
   b) You have a thin plate which is made of a uniform material in the shape of the region between $y = 0$, $y = x \tanh x$ and $x = 3$. Set up the integral(s) necessary to find the location of the point on the $x$-axis where it would balance if it were standing up vertically (that is, find the $x$-coordinate of the centroid of this region). It is not necessary to actually calculate the integrals.