

Here is a list of types of problems you should be prepared to solve on the midterm.

1. Approximate the area under a curve using equal subintervals with left endpoints, right endpoints or midpoints.
2. Rewrite a definite integral as the limit of a Riemann sum.
3. Rewrite the limit of a Riemann sum as a definite integral.
4. Evaluate a definite integral by interpreting the integral as the area of a geometric object whose area formula is known, e.g. circle or triangle.
5. Find  $a > 1$  such that  $\int_0^a (x - 3)^3 dx = 0$ .
6. Given that:  $\int_1^0 f(x)dx = 5$ ,  $\int_5^0 f(x)dx = 2$ , and  $\int_1^5 g(x)dx = 8$ . |  
Find  $\int_1^5 [3f(x) + 4g(x)]dx$ .
7. Find the derivatives of functions defined as definite integrals, e.g.  $\frac{d}{dx} \int_2^{4x} e^{t^2} dt$ .
8. Evaluate definite integrals by using the fundamental Theorem of Calculus,  
 $\int_a^b f(x)dx = F(b) - F(a)$ , where  $F'(x) = f(x)$ .
9. Find antiderivatives of functions, both with and without initial conditions, e.g. find  $v(t)$  if  $v(0) = 10 \frac{ft}{s}$  and  $v'(t) = 5e^{-2t}$ .
10. Evaluate integrals using the substitution rule.
11. Use integration to find:
  - a) the total area between the graph of a function and the x-axis,
  - b) the area between the graphs of two functions,
  - c) the volume of a solid of revolution (disks, washers, or shells),
  - d) the total change in a quantity over an interval, given the rate of change of that quantity,
  - e) the work done lifting an object, pumping a fluid, or stretching a spring,
  - f) the average value of a function on an interval.