This is a random collection of sample problems; Problems unlike these may (will) be on the test, so prepare your own study guide.

1. Compute the following:

$$\text{(a)} \int \sin 2\theta + \theta^3 + e^{-\theta} d\theta, \qquad \text{(b)} \int_1^3 2x^3 - 5x dx,$$

$$\text{(c)} \int_1^2 x e^{x^2-1} dx, \qquad \text{(d)} \frac{d}{dx} \int_3^x \cos(t^2) - t^3 dt.$$

2. Using a suitable substitution, evaluate the following integrals:

$$\text{(a)} \int \frac{1}{x^2} \sin\left(1 - \frac{1}{x}\right) dx \qquad \text{(b)} \int_2^8 \frac{1}{x(\ln x)^2} dx$$

3. Set up the integral(s) for the following problems. **BUT DO NOT evaluate the integral(s)**. First, sketch the region bounded by the curves $y = x^2$ and $y = x^4 - 4x^2 + 4$ between $x = 0$ and $x = 2$.

   (a) Find the total area bounded by the curves between $x = 0$ and $x = 2$.

   (b) Find the volume if the region bounded by the curves between $x = 1$ and $x = 2$ is revolved around the x-axis.

   (c) Find the volume if the region bounded by the curves between $x = 1$ and $x = 2$ is revolved around the line $x = -1$.

4. Consider the function $f(x) = 2 - x^3$ on the interval $[0, 1]$. Set up in Σ-notation **BUT DO NOT evaluate** the Riemann sum for the following functions on the given interval using a partition into n equal subintervals and the given rule.

   (a) $f(x) = 2 - x^3$ on the interval $[0, 1]$ using the midpoint rule.

   (b) $g(x) = x + x^2$ on the interval $[1, 4]$ using the righthand rule.

   (c) $h(x) = \cos(x)$ on the interval $[0, \pi]$ using the lefthand rule.

5. A rectangular plot of land will be bounded on one side by a river and on the other three sides by an electric fence. If you have 400 m of fencing, what is the largest area that can be enclosed?

   Be sure to draw a relevant diagram and name your variables.

6. What point (a, b) on the parabola $y = x^2$ minimizes the distance to $(6, 3)$? Hint: minimize the square of the distance from (a, b) to $(6, 3)$.