The tests are cumulative and can include Pre-Calculus material mentioned in the MATH 2301 Calculus I handbook. This guide gives some sample questions for Sections 4.5, 4.6, 4.7, and 5.1. In some cases part of the problem is deciding which method to use, so you may be able to do the problem using methods from earlier sections. Doing these problems does not replace doing homework problems.

1. A fence must be built to enclose a rectangular area of 200m^2. On the north and south sides, the fence will consist of a single strand of barbed wire. On the east and west sides, the fence will have two strands of barbed wire. Find the dimensions of the fence that minimizes the amount of barbed wire used.

2. What is the maximum vertical distance between the line $y = x + 2$ and the parabola $y = x^2$ for $-1 \le x \le 2$?

3. A company wishes to manufacture a box with a volume of 6 m^3 that is open on top and has a square base. The material for the bottom of the box costs \$3 per m^2, while the material for the sides costs \$2 per m^2. Find the dimensions of the box that will lead to minimum total cost. What is the minimum total cost?

4. A company wishes to manufacture a box with a volume of 32 cm^3 that is open on top and has a square base. Find the dimensions of the box that minimize the amount of material used.

5. A Norman window has the shape of a rectangle surmounted by a semicircle. (Thus the diameter of the semicircle is equal to the width of the rectangle.) If the perimeter of the window is 30ft, find the dimensions of the window so that the greatest possible amount of light is admitted.

6. Use Newton's method with the specified initial approximation x_1 to find x_2, the second approximation to the root of the given equation. Leave the answer as a fraction.

$$\frac{1}{3}x^3 + \frac{1}{2}x^2 = -3\,, \quad x_1 = -3\,.$$

7. Find the function f for $x > 0$ that has $f''(x) = x^{-2}$, $f(1) = 0$, and $f(2) = 0$.

8. Use the Midpoint Rule and the left endpoints rule with $n = 4$ to approximate the integral (i.e. find M_4 and L_4).

$$\int_0^8 \sin(\sqrt{x})dx\,.$$

Oops. We do not learn the notation $\int$ until Section 5.2. The equivalent problem in Section 5.1 is:

Estimate the area under the graph of $f(x) = \sin(\sqrt{x})$ from $x = 0$ to $x = 8$ using four rectangles and midpoints, and then using left endpoints.

9. 4-methylcyclohexanemethanol (MCHM) leaked from a tank at a rate of $r(t)$ liters (l) per hour (h). The rate decreased as time passed and the values of the rate at two-hour intervals are shown in the table. Find lower and upper estimates for the total amount of MCHM that leaked out. What is the integral that expresses this amount?

$t(h)$	0	2	4	6	8	10
$r(t)$ (l/h)	8.7	7.6	6.8	6.2	5.7	5.3