This review, produced by the Broward Teaching Center, contains a collection of questions which are representative of the type you may encounter on the exam. Other resources made available by the Teaching Center include:

- Walk-In tutoring at Broward Hall
- Private-Appointment, one-on-one tutoring at Broward Hall
- Walk-In tutoring in LIT 215
- Supplemental Instruction
- Video resources for Math and Science classes at UF
- Written exam reviews and copies of previous exams

The teaching center is located in the basement of Broward Hall:

You can learn more about the services offered by the teaching center by visiting https://teachingcenter.ufl.edu/
1. Determine the area of the largest rectangle that can be inscribed in a circle of radius 4.

2. Locate the point/s on the curve \( y = x^2 + 1 \) which is/are nearest to \((0, 2)\).

3. Calculate the most general antiderivative for each of the following functions.
   (a) \( f(x) = x^{6/7} - \sec^2(\pi x) \).
   (b) \( g(x) = \frac{x - 3}{x + 1} - \cos(2x) \).
   (c) \( h(x) = \frac{\sqrt{x} + x^2 + x^4}{x^3} \).

4. Suppose \( f'(x) = x^{3/2} - \frac{2}{x} \), and \( f(1) = 1 \). Determine \( f(x) \).

5. Gleb leaves for a trip at 3:00PM and drives due South. His velocity (in miles per hour) is given by \( v(t) = 60 - \frac{t}{2} \) where \( t \) is measured in hours.
   (a) Set up a definite integral whose value is the distance Gleb travels in \( x \) hours.
   (b) For how long must Gleb drive to travel 119 miles?

6. Find an expression for the area under the graph of \( y = \frac{1}{x} \) from \( x = 1 \) to \( x = e \) as a limit of a Riemann sum.

7. Express \( \int_0^2 \sin(x) \, dx \) as a limit of a Riemann sum.

8. Evaluate the limit of the Riemann Sum explicitly by expressing each as a definite integral.
   (a) \( \lim_{n \to \infty} \sum_{i=1}^{n} \left\{ 3 \left( \frac{i}{n} \right) - 6 \left( \frac{i}{n} \right)^2 \right\} \frac{1}{n} \)
   (b) \( \lim_{n \to \infty} \sum_{i=1}^{n} \sin \left( \frac{i\pi}{n} \right) \frac{\pi}{n} \)
9. Evaluate the definite integrals below.
   (a) \( \int_{1}^{4} \frac{x^3 - 3\sqrt{2x}}{x^{3/2}} \, dx \)
   (b) \( \int_{-\pi}^{\pi} (\cos(x) - \sin(x)) \, dx \)

10. Suppose \( f(x) \) is a non-negative function having absolute max \( M \) and absolute min \( m \) on the interval \([a, b]\).
   (a) What is the largest possible value of \( \int_{a}^{b} f(x) \, dx \)?
   (b) What is the smallest possible value of \( \int_{a}^{b} f(x) \, dx \)?

11. Use the fundamental theorem of Calculus to evaluate the expressions below
   (a) \( \frac{d}{dx} \int_{5}^{x} e^{t^2} \, dt \)
   (b) \( \frac{d}{dz} \int_{e}^{1+z^2} (\ln(x) + 1) \, dx \)

12. Find the area bounded by \( f(x) = x^3 \) and the \( x \)-axis on the interval \([-1, 1]\). Sketch the region to see if your answer makes sense.

13. At time \( t = 0 \) a bolt falls from a helicopter which is hovering at an altitude of 4096 feet. Due to gravity, the bolt experiences a constant acceleration towards the earth, \( a(t) = -32 \, \text{ft./s}^2 \).
   (a) Assuming the bolt was at rest when it began to fall, construct its velocity function, \( v(t) \).
      [Hint, the bolt had no initial velocity]
   (b) Construct the bolt’s displacement function \( s(t) \).
      [Hint, the bolt’s initial displacement is the altitude of the helicopter]
   (c) After how long will the bolt hit the ground?
14. Evaluate the following integrals. Some will benefit from a substitution, others will not.

(a) \[ \int \frac{\sin(2x)}{\sin(x)} \, dx \]  
(b) \[ \int_{0}^{3\pi/2} |\sin(x)| \, dx \]  
(c) \[ \int \cos \theta \sin^{5/2} \theta \, d\theta \]  
(d) \[ \int_{0}^{1} \frac{e^{z} + 1}{e^{z} + z} \, dz \]  
(e) \[ \int \left( x^{2} + 1 + \frac{1}{x^{2} + 1} \right) \, dx \]  
(f) \[ \int_{1}^{e} \frac{\ln x}{x} \, dx \]

15. Find the area between the given curves \( f \) and \( g \) on the given intervals.

(a) \( f(x) = \sqrt{x} \) and \( g(x) = \sqrt[3]{x} \) on the interval \([0, 1]\)
(b) \( f(x) = \sqrt{x} \) and \( g(x) = \sqrt[3]{x} \) on the interval \([0, 2]\)
(c) \( f(x) = 2x \) and \( g(x) = x^{2} + 1 \) on the interval \([0, 4]\).
1) Suppose it is known that \( \int_{1}^{5} f(x) \, dx = -1 \), \( \int_{1}^{7} f(x) \, dx = 4 \), and \( \int_{1}^{7} f(x) \, dx = 6 \).
   a) Find \( \int_{1}^{5} 5f(x) \, dx - 2 \, dx \).
   b) Find \( \int_{1}^{7} f(x) \, dx \), \( \int_{3}^{7} f(x) \, dx \), and \( \int_{5}^{7} f(x) \, dx \).
   c) Find the total area between the graph of \( f(x) \) and the x-axis if you are told that \( f \) is positive on the set \((1,3) \cup (5,7)\) and negative on the set \((3,5)\).

2) Evaluate the following integral using common area formulas.
   \[
   \int_{-2}^{2} \sqrt{4 - x^2} + 2 \, dx
   \]

3) Evaluate \( \int_{-2}^{\pi} g(x) \, dx \) where...
   \[
   g(x) = \begin{cases} 
   1 - x^2, & x < 0 \\
   \cos(x), & x \geq 0
   \end{cases}
   \]

4) Find the antiderivatives of the following expressions:
   a) \( \frac{4}{t^2 + 1} \)
   b) \( (y - 1)(2y + 1) \)
   c) \( \sec(x)(\sec(x) - \tan(x)) \)
   d) \( \frac{\sec(x) - \tan(x)}{\sec(x)} \)

5) Simplify the following expression, using the Fundamental Theorem of Calculus:
   \[
   f(x) = \frac{d}{dx} \int_{3}^{e^{-x}} t \ln(t) \, dt
   \]

6) Consider the following function on the interval \([-1,2]\):
   \( f(x) = 4 - x^2 \)
   a) Find an approximation of the area under the curve using Riemann Sums with 6 subintervals and right endpoints.
   b) Find an approximation of the area under the curve using Riemann Sums with \( \pi \) subintervals and \( \omega \) endpoints.

7) Rewrite the following limit of Riemann Sums as a definite integral expressing the same quantity and then evaluate it.
   \[
   \lim_{n \to \infty} \sum_{i=1}^{n} \left[ \cos \left( 2 + \frac{i}{n} \right) \right] \frac{1}{n}
   \]