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.
   \( \int_1^4 \frac{x^3 - 3\sqrt{2x}}{x^{3/2}} \, dx \)
   \( \int_{-\pi}^\pi (\cos(x) - \sin(x)) \, dx \)

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, \( a(t) = -32 \, \text{ft.}/\text{s}^2 \).
   (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 \( \int_1^5 f(x) \, dx = -1 \), \( \int_3^5 f(x) \, dx = 4 \), and \( \int_1^7 f(x) \, dx = 6 \).

a) Find \( \int_1^5 5f(x) - 2 \, dx \).

b) Find \( \int_1^3 f(x) \, dx \), \( \int_3^5 f(x) \, dx \), 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.

\[
\int_{-2}^{2} \sqrt{4 - x^2} + 2x \, dx
\]

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 \( \frac{\pi}{4} \) endpoints.

7) Rewrite the following limit of Riemann Sums as a definite integral expressing the same quantity and then evaluate it.

\[
\lim_{n \to \infty} \sum_{i=1}^{n} \left( \cos \left( 2 + \frac{i}{n} \right) \right) \frac{1}{n}
\]