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. Consider the function \( f(x) = \frac{x^2 - x - 2}{|2 - x|} \)

   (a) Calculate \( \lim_{x \to 2^+} f(x) \) and \( \lim_{x \to 2^-} f(x) \).

   (b) Does \( \lim_{x \to 2} f(x) \) exist? Why or why not?

   (c) Is \( f(x) \) continuous? If not, determine where \( f(x) \) is discontinuous and describe the discontinuity.

2. For what real numbers \( A \) is the function \( f(x) = \begin{cases} \frac{|x-1|}{x^2-1} & x < 1 \\ Ax^2 + 6 & x \geq 1 \end{cases} \) continuous at \( x = 1 \)? Is there a choice of \( A \) which makes \( f(x) \) continuous everywhere?

3. The position of a particle in one-dimensional motion is given by \( s(t) = -10t^2 + 25t + \sqrt{t+2} \).

   (a) Calculate the average velocity of the particle on the time interval \([2, 7]\).

   (b) Calculate the average velocity of the particle on the time interval \([2, 2+h]\).

   (c) Send \( h \to 0 \) in part (b). What is the value of the limit? What does this describe?

   (d) Find the equation of the line tangent to \( h(t) \) at \( t = 2 \).

4. Evaluate the limits below. If the limit does not exist, indicate why.

   (a) \( \lim_{x \to 2} \frac{x^2 + x - 6}{x - 2} \)

   (b) \( \lim_{x \to 0} \left( \frac{1}{x} - \frac{1}{x^2 + x} \right) \)

   (c) \( \lim_{x \to 4} \sqrt{x^2 + 9 - 5} \)

5. Suppose \( 4x - 9 \leq f(x) \leq x^2 - 4x + 7 \) for all \( x > 0 \).

   (a) Is this sufficient information to calculate \( \lim_{x \to 4} f(x) \)? If so, what is the value of the limit? If not, explain why.

   (b) Is this sufficient information to calculate \( \lim_{x \to 1} f(x) \)? If so, what is the value of the limit? If not, explain why.

6. Evaluate the limits below. If the limit does not exist, indicate why.

   (a) \( \lim_{x \to \infty} e^x \)

   (b) \( \lim_{x \to \infty} e^{-x} \)

   (c) \( \lim_{x \to \infty} \ln(x) \)

   (d) \( \lim_{x \to 0^+} \ln(x) \)
7. Evaluate the limits below. If the limit does not exist, indicate why.

(a) \( \lim_{x \to \infty} \frac{7x^3 + x^2 - 5}{x^3 - 2x + 1} \)

(b) \( \lim_{x \to -\infty} \frac{4x^7}{3 - 2x^4} \)

(c) \( \lim_{x \to \infty} \frac{x - 3}{x^2 + 2x + 1} \)

(d) \( \lim_{x \to -\infty} \frac{2x^2 + 1}{3x - 5} \)

(e) \( \lim_{x \to \infty} e^{\tan^{-1}(x)} \).

8. The profit generated by selling \( x \) Florida Gators branded keychains is given by

\[ P(x) = 100x + \frac{10,000}{x + 1} \]

(a) Find the average change in profit if vendors go from selling \( x \) keychains to \( x + h \) keychains.

(b) How is profit changing when vendors are selling exactly 50,000 keychains?

9. Use (either) of the limit definition(s) of the derivative to calculate the derivatives of each function below.

(a) \( f(x) = x^2 \)

(b) \( g(x) = \sqrt{x} \)

(c) \( h(x) = \sin(x) \) \[\text{[Hint: } \sin(x+h) = \sin(x) \cos(h) + \sin(h) \cos(x), \lim_{h \to 0} \frac{\sin(h)}{h} = 1, \text{ and } \lim_{h \to 0} \frac{\cos(h) - 1}{h} = 0]\]

10. In this problem we will work with the functions from the previous problem.

(a) For what values of \( x \) (if any) do each of the functions have horizontal tangent lines?

(b) For what values of \( x \) (if any) do each of the functions have vertical tangent lines?

11. Calculate the following derivatives:

(a) \( \frac{d}{dx} e^3 \)

(b) \( \frac{d}{dx} (\pi x^2)^{23} \)

(c) \( \frac{d}{dx} \frac{1 - x}{\sqrt{x}} \)

(d) \( \frac{d}{dx} 7^x 49^x \)
12. Evaluate the limit \( \lim_{h \to 0} \frac{(27 + h)^{2/3} - 9}{h} \).

13. Find the equation for the tangent line to \( f(t) = \frac{t}{e^t - 1} \) at \( t = 1 \).

14. Which of the following derivatives requires the product or quotient rules? Which do not? Compute the derivatives.

(a) \( \frac{d}{dx} \pi^3 x^2 \)
(b) \( \frac{d}{dx} \frac{x^{1/3}}{e} \)
(c) \( \frac{d}{dx} \frac{e^{2x} - 7}{e^{x+1}} \)
(d) \( \frac{d}{dx} \frac{(e^x + 1)^2}{e^{-x}} \)
(e) \( \frac{d}{dx} \frac{(\sqrt{x} - x)^2}{x^{3/2}} \)
(f) \( \frac{d}{dx} \frac{(e^x + x)^2}{e^{-x}} \)

15. Suppose \( f(x) \) is a differentiable function such that \( f(\pi) = \frac{3\pi}{4} \) and \( f'(\pi) = 2017 \). Consider the composite function \( g(x) = \cot(f(x)) \).

(a) Calculate \( g'(\pi) \)
(b) Suppose additionally that \( f \) is an even function. Calculate \( g'(-\pi) \)
(c) Suppose additionally that \( f \) is an odd function. Calculate \( g'(-\pi) \)

16. Find the equation of the normal line to \( f(x) = x \cot(x) \) at \( x = -\frac{\pi}{6} \).

17. Find the slope for each of the following functions at the given point:

(a) \( f(x) = \cos(x) \) at \( x = \pi/4 \).
(b) \( h(x) = \frac{1}{x^2} \) at \( x = 2 \).