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. 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) \( \frac{d}{dx} 7^x 49^x \)

2. Evaluate the limit \( \lim_{h \to 0} \frac{(27 + h)^{2/3} - 9}{h} \).

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

4. 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) \( \frac{d}{dx} \frac{(\sqrt{x} - x)^2}{x^{5/2}} \)
   (f) \( \frac{d}{dx} \frac{(e^x + x)^2}{e^{-x}} \)

5. Suppose \( f(x) \) is a differentiable function such that \( f(\pi) = \frac{3\pi}{4} \) and \( f'(\pi) = 2018 \). 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 \( g'(-\pi) \)

6. Find the equation of the normal line to \( f(x) = x \cot(x) \) at \( x = -\frac{\pi}{6} \).
7. Find the slope for each of the following functions at the given point:
   (a) \( f(x) = \cos(x) \) at \( x = \pi/4 \).
   (b) \( g(x) = \ln(x - 1) \) at \( x = e \).
   (c) \( h(x) = \frac{1}{x^2} \) at \( x = 2 \).

8. Let \( f(x) = e^{\frac{1}{3}x^3 - x} \).
   (a) At what points \((x, y)\), if any, does \( f(x) \) have a horizontal tangent line?
   (b) Find the equation for the tangent line to \( f(x) \) at \( x = 0 \).

9. At how many points does the curve \( 2y^3 + y^2 - y^5 = x^4 - 2x^3 + x^2 \) have horizontal tangent lines?

10. Follow the steps below to find the derivative of \( f(x) = \tan^{-1}(e^{x^2}) \)
    (a) Begin by writing \( y \) for \( f(x) \), i.e., \( y = \tan^{-1}(e^{x^2}) \)
    (b) Observe that the result from part (a) is equivalent to \( \tan(y) = e^{x^2} \).
    (c) Differentiate the expression from part (b) implicitly, and find \( f'(x) \).
    (d) Does \( f(x) \) have any horizontal tangent lines? If so where?

11. Let \( f(x) = \frac{(x^2 + 4) \cos(\pi x)e^{3x}}{\sin(3\pi x)\sqrt{x + 3}} \). Find \( f'(x) \).  Hint: use logarithmic differentiation

12. Calculate the following derivatives.
    (a) \( \frac{d}{dx} \ln(\ln(x)) \)
    (b) \( \frac{d}{dx} \ln(\ln(\ln(x))) \)
    (c) \( \frac{d}{dx} \ln(\ln(\ln(\ln(x)))) \)

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13. Evaluate the following derivatives.

(a) \( \frac{d}{dx} \sin^{-1}(2\sqrt{x}) \)
(b) \( \frac{d}{dx} \sec^{-1}(x^2) \)
(c) \( \frac{d}{dx} 2x \tan^{-1}(x) \)
(d) \( \frac{d}{dx} \sqrt{\cos^{-1}(x)} \)

14. Evaluate the limit \( \lim_{h \to 0} \frac{\cos^{-1}\left(\frac{\sqrt{2}}{2} + h\right) - \frac{\pi}{4}}{h} \).

15. 

(a) \( f(x) = \tan^{-1}(2x - 1) \)
(b) \( e(x) = (1 + x^2) \tan^{-1}(x) \)
(c) \( f(x) = \tan^{-1}(\sin(x)) \)

16. 

(a) \( f(x) = \csc(5x) \)
(b) \( g(x) = -4\sin^2(2x) \)
(c) \( f(x) = 2x \cot(x) \)
(d) \( g(x) = \cos^3(2x^2-1) \)
1) Differentiate the following functions.
   a) \( f(x) = x\sqrt{x^2 - 3} \)
   b) \( g(x) = \frac{x^3 + 2}{x^2 + 1} \)
   c) \( h(x) = (3x^2 - 1)\left(x^2 - \frac{1}{x}\right) \)
   d) \( r(x) = \frac{x^3 + 2x^2 + x - 1}{\sqrt{x}} \)

2) Differentiate the following functions:
   a) \( h(x) = \frac{x^2-x+1}{(x-1)^{2/3}} \)
   b) \( k(x) = \begin{cases} \frac{x^2-1}{x+2}, & x > -1 \\ \frac{x^2+1}{x-2}, & x \leq -1 \end{cases} \)
   c) \( n(x) = \sin^2(\cos(4x)) \)

3) Find... \( \lim_{h \to 0} \frac{\sqrt{x + h} - \sqrt{x}}{h} \)

4) Given \( f(x) = 3x^2\sqrt{4 - x^2} \)
   a) Find \( \frac{df}{dx} \)
   b) Where are the horizontal and vertical tangents?

5) For the following equation: \( 5x^2y - y^3 = 1 + x^2 \)
   a) Find \( \frac{dy}{dx} \)
   b) Find the equation of the tangent line to the curve at the point (1,2).

6) Find the derivatives of the following functions:
   a) \( f(x) = \frac{x}{x+3} \)
   b) \( g(x) = \sin(3x) \)

7) For what values of \( x \) does the function \( g(x) = x + 2 \sin(x) \) have horizontal tangent lines?

8) Suppose \( f(x) = ax^2 + bx + c \) and that the tangent lines at \( x = 1 \) and \( x = -1 \) have slopes \(-8\) and \(-1\) respectively, and that the point \((2,15)\) is a point on the graph. What are the values of \( a, b, \) and \( c \)?

9) Find the values of \( a \) so that the tangent line to \( y = x^2 - 2\sqrt{x} + 1 \) is perpendicular to the line \( ay + 2x = 2 \) at \( x = 4 \).

10) Find the \( x \) values where the curve represented by the following equation has horizontal tangent lines.
    \( x^2 + xy + y^2 = 6 \)

11) Take the derivatives of the following functions [using logarithmic differentiation]:
    a) \( f(x) = 5\tan^2(x) \)
    b) \( g(x) = x^\sin(x) \)
    c) \( h(x) = \frac{e^{3x+1}(x^2+3)^3}{\sqrt{x-1}} \)