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 \( f(x) = x^2 - 6x + 9 \).
   (a) Find, if it exists, the \( y \)-intercept of \( f(x) \).
   (b) Find, if any exist, the \( x \)-intercepts of \( f(x) \).
   (c) Find the max/min, if any exist, of \( f(x) \).

2. Let \( g(x) \) be the function whose graph is obtained by applying the following transformations to the graph of \( f(x) = (x + 1)^4 \):
   • Reflection across the \( y \)-axis,
   • Translation down by 3 units,
   • Translation left by 2 units,
   • Vertical compression by a factor of 2.
   What is the \( y \)-intercept of \( g(x) \)?

3. Graph the piecewise function \( f(x) = \begin{cases} 
  |x| & \text{for } -2 \leq x < 0 \\
  1 & x = 0 \\
  \sqrt{x} & x > 0
\end{cases} \).
   (a) Find the domain and range of \( f(x) \).
   (b) Is \( f(x) \) one-to-one?
   (c) On what intervals is \( f(x) \) increasing?
   (d) On what intervals is \( f(x) \) decreasing?
   (e) Is \( f(x) \) constant on any intervals?

4. Let \( f(x) \) be an odd function, and \( g(x) \) be an even function. Suppose the point \((2, 4)\) lies on the graph \( y = f(x) \), and the point \((-2, 5)\) lies on the graph \( y = g(x) \).
   (a) Find \((f + g)(2)\)
   (b) Find \(\left(\frac{f}{g}\right)(-2)\)
   (c) Suppose that \( f(x) \) is one-to-one, and let \( h(x) = 2\sqrt{x - 1} \). Do we have enough information to compute \((f^{-1} \circ h \circ g)(2)\)? If so, what is the value? If not, explain why.
5. Consider the function \( f(x) = \sqrt{x} \).
   (a) Sketch the graph of \( f(x) \).
   (b) What is the average rate of change of \( f(x) \) on the interval \([4, 9]\)?
   (c) Suppose \( b > 0 \). Find a formula for the average rate of change of \( f(x) \) on the interval \([0, b]\).
      For what value of \( b \) is the average rate of change equal to \( 1/2 \)?

6. Let \( f(x) = -3 \sqrt{x} - 1 \).
   (a) What is the parent function for \( f(x) \)?
   (b) Describe the transformations which one must apply to the graph of the parent function to obtain the graph of \( f(x) \).
   (c) Sketch graphs for both \( f(x) \) and its parent function.

7. Let \( A = \{0, \zeta, 2, P, \aleph\} \) and \( B = \{\Box, 3, Z, 1776, \aleph\} \). Which of the following relations defines a function from \( A \) to \( B \)? Of those, which are one-to-one?
   A. \( \{ (\zeta, 1776), (P, \Box), (0, 3), (\aleph, Z) \} \)
   B. \( \{ (\aleph, \Box), (P, 3), (2, 1776), (\zeta, Z), (0, \aleph) \} \)
   C. \( \{ (0, \Box), (\aleph, 1776), (\zeta, Z), (\aleph, \Box), (P, 3), (2, \aleph) \} \)
   D. \( \{ (\zeta, \aleph), (P, \Box), (2, 1776), (\aleph, \Box), (0, Z) \} \)

8. Determine whether each of the following functions is one-to-one. If not, specify a subset of their domain upon which the function is one-to-one. Having done either of these things, find the inverse function.
   (a) \( f(x) = \frac{x - 1}{x} \)
   (b) \( g(x) = \sqrt[3]{2x - 1} \)
   (c) \( h(x) = -(x + 1)^{-2} \)
   (d) \( s(t) = -2t^2 + 12t - 19 \)

9. Find constants \( b \), and \( c \) such that \( f(x) = x^2 + bx + c \) has a min at \((1, -1)\), and passes through the origin.

10. Write the equation for a quadratic function \( f(x) \) with integer coefficients that has the given roots. Assume that \( b \) is a positive integer.
    (a) \( \pm \sqrt{b} i \)
    (b) \( a \pm bi \)
11. Let \( f(x) = -\frac{3}{8x} \) and \( g(x) = \frac{9}{64 - 16x^2} \).
   (a) Find the domain of both functions.
   (b) Calculate the composition \( (f \circ g)(x) \).
   (c) Find the domain of \( (f \circ g)(x) \).

12. Write the polynomial \( x^6 - x^5 - 9x^4 + 13x^3 + 8x^2 - 12x \) as a product of linear factors. [Hint: the rational roots theorem and synthetic division will help.]

13. The profit made by selling Florida Gators key-chains at a football game is modeled by the function \( P(x) = 480 + 8x - 2x^2 \) where \( x \) is the number of units sold. If there are 100 keychains in 1 unit, how many key-chains should the vendor sell in order to maximize her profit?

14. Express the following complex numbers in the form \( a + bi \) where \( a \) and \( b \) are real numbers.
   (a) \( \frac{1}{i} \)
   (b) \( \frac{1}{-i + 1} \)
   (c) \( (2 + i)^2(3 - i) \)

15. Let \( f(x) = -6x^6 + 20x^5 - 3x^4 - 21x^2 - 20x - 2 \). Use the polynomial remainder theorem to determine \( f(3) \).

16. For what choice of \( k \) will \( x = 2 \) be a root of \( f(x) = 2x^4 - 3x^3 + 2x^2 - 5x + k \)?

17. Write the equation for a polynomial function \( f(x) \) with integer coefficients that has the given roots:
   (a) -1, 2, 3
   (b) 1, 2i
   (c) -2, 4, 1-i

18. Find the domain, vertical asymptotes, and horizontal asymptotes for the following rational functions.
   (a) \( f(x) = \frac{6x^3}{x^3 - 1} \)
   (b) \( g(x) = \frac{2x}{x^2 - 1} \)
   (c) \( h(x) = \frac{3x^2 + x - 5}{x^2 + 1} \)
19. Suppose \( f(x) \) is a polynomial with real coefficients having the following roots and multiplicities

- \( x = 0 \) with multiplicity 3
- \( x = -2 + 3i \) with multiplicity 4
- \( x = 3 + 7i \) with multiplicity 1
- \( x = -2 \) with multiplicity 1

What is the least possible degree of \( f(x) \)?

20. Rewrite \( f(x) = \frac{-9x^3 - 2x - 6}{3x^2 - 2x + 5} \) as a proper rational function. [Hint, polynomial long division will help.]

21. Simplify the expressions below.

(a) \( \frac{5}{i^{59}} \) 

(b) \( (2 + 3i)^2 \) 

(c) \( \frac{-2i}{2 + i} + \frac{i}{3 - 2i} \) 

(d) \( \frac{(3 + \sqrt{-4})(4 - \sqrt{-9})}{\sqrt{-5}\sqrt{-20}} \)

22. Let \( f(x) = x^4 - 18x^2 + 81 \).

(a) Find the zero’s (\( x \)-intercepts) of \( f(x) \).

(b) Determine the end behavior of \( f(x) \). Hint: use the leading coefficient test

(c) Determine the intervals on which \( f(x) \) is positive, negative.

(d) Sketch the graph of \( f(x) \).