Math 140 Exam 1 Review

Solutions to the problems marked with an asterisk can be found on Prof. Myers’ website (linked to from our course website), called “Practice Quizzes.” The problem numbers do not match up. Not all problems on the practice quizzes are given here. Solutions to the remaining problems can be found on our course website.

Lecture 1

*1. Find all real solutions of \( x \).
   \[ \sqrt{3 + 2x} + x = 0 \]

2. Find all real solutions of \( x \).
   \[ \frac{5}{x} - \frac{6}{x - 2} = -4 \]

*3. Solve for \( x \).
   \[ x - 2 \leq \frac{3}{x} \]

4. Solve for \( x \).
   \[ x^2 - 4x + 4 < 0 \]

Lecture 2

*5. Find the center and the radius of the circle \( x^2 - 6x + y^2 + 4y + 4 = 0 \)

6. Find the center and the radius of the circle \( x^2 + y^2 - 20x + 14y - 20 = 0 \).

*7. Find the equation for the line through \((-1, 4)\) and \((4, -2)\). Write the equation in slope-intercept form.

8. Find the equation for the line through \((-1, 6)\) and \((10, 6)\). Write the equation in slope-intercept form.

Lecture 3

*9. Find the domain of \( f(x) = \frac{1}{x - \sqrt{x + 30}} \).

10. Find the domain of \( g(x) = \frac{\sqrt{x}}{x - 2} \).

*11. Factor and find all roots given that \(-1\) is a root.
    \[ x^3 + x^2 - 3x - 3 = 0 \]

*12. Factor and find all roots given that \(2\) is a root.
    \[ 2x^3 - 11x^2 - x = -30 \]

Lecture 4

*13. Evaluate and simplify.
    \[ g(x) = \frac{1}{1 + x}, \quad \frac{g(x + h) - g(x)}{h} = \]

*14. Evaluate and simplify.
    \[ f(x) = x + \frac{1}{x}, \quad \frac{f(x + h) - f(x)}{h} = \]

*15. Graph \( h(x) \).
    \[ h(x) = \begin{cases} 
    x^2 & \text{if } x < -1 \\
    1 & \text{if } -1 \leq x \leq 1 \\
    1/x & \text{if } x > 1 
    \end{cases} \]

16. Graph \( u(x) \). Note: this is good practice for Lecture 5 as well.
    \[ u(x) = \begin{cases} 
    \sqrt{x - 2} & \text{if } x \geq 2 \\
    0 & \text{if } 0 \leq x < 2 \\
    -\sqrt{-x} & \text{if } x < 0 
    \end{cases} \]
Lecture 5

17. Graph \( f(x) \). \( \text{Note: reference graph is } \sqrt{1-x^2} \).
\[
f(x) = 1 - \sqrt{1 - (x + 2)^2}
\]

18. Graph \( g(x) \).
\[
g(x) = 2|x| + 4
\]

Lecture 6

19. For \( f(x) = x - \frac{1}{x} \), find \((f \circ f)(x)\) and simplify.

20. Find \((g \circ h)(x)\) and \((h \circ g)(x)\), where \(g(x) = 2x + 3\) and \(h(x) = x^2 - 5x\).

21. Write \( G(x) = (x^4 + 3)x^2 \) as a composition \( f(g(x)) \) of two polynomials \( f(x) \) and \( g(x) \).

22. Write \( F(x) \) (defined below) as a composition \( h(f(g(x))) \) of three simpler functions.
\[
F(x) = \left( \frac{1 - \sqrt{x}}{1 + \sqrt{x}} \right)^{10}
\]

Lecture 7

23. Find \( f^{-1}(x) \).
\[
f(x) = 2 - \frac{x}{1 - 2x}
\]

24. Find \( f^{-1}(x) \).
\[
f(x) = x^2 + 3x \text{ for } x \geq -3/2
\]

25. Are the following functions one-to-one?
   (a) \( f(x) = 3x - 4 \)
   (b) \( g(x) = x^2 + 9 \)
   (c) \( h(x) = 9 - |x| \)
   (d) \( k(x) = 3x^3 \)

Lecture 8

26. Find the vertex and intercepts, and graph \( y = x^2 - 2x - 15 \).

27. Find the vertex and intercepts, and graph \( y = x^2 - 4x + 5 \).

Lecture 9

28. Graph the polynomial.
\[
y = (2x - 3)^3(x + 1)(x - 4)^2
\]

29. Graph the polynomial.
\[
y = x^2(2 - x)^2(x + 3)
\]

Lecture 10

30. Sketch a graph, and identify the intercepts and asymptotes of \( y = \frac{x + 1}{x(1 - x)} \).

31. Sketch a graph, and identify the intercepts and asymptotes of \( y = \frac{x(1 - x)}{x + 1} \).

32. Sketch a graph, and identify the intercepts and asymptotes of \( y = \frac{3x - 6}{x^2 - 1} \).