MTH 103 Review Problems for Midterm Exam III

1. (3.1 #4) The set of all output values \( y \) in a function is called the ________ of the function.

2. (3.1 #28, modified) What is the domain of \( f(x) = \frac{\sqrt{2x + 3}}{x - 1} \)?

3. (3.1 #66) Compute the difference quotient \( \frac{f(x + h) - f(x)}{h} \) where \( f(x) = 3x^2 + 2x - 3 \) and simplify your answer as much as possible.

4. (3.1 #78) Graph the function \( f(x) = -x^2 + 3 \) and use the graph to determine the range of \( f(x) \).

5. (3.1 #112) The cost \( C \) of water is a linear function of \( n \), the number of gallons used. If 1,000 gallons cost $4.70 and 9,000 gallons cost $14.30, express \( C \) as a function of \( n \).

6. (3.2 #22) Determine the vertex of the parabola \( y = 7(x + 2)^2 + 8 \).

7. (3.2 #40) Graph the function \( f(x) = (x + 3)^2 - 1 \).

8. (3.2 #26, modified) Determine the vertex of the parabola \( y = -x^2 + 9x + 2 \) by completing the square. Show all of your work.

9. (3.2 #66) A wholesaler of appliances finds that she can sell \((2400 - p)\) flat-panel television sets each week when the price is \( p \) dollars. What price will maximize revenue?

10. (3.3 #2) Peaks and valleys on a polynomial graph are called ________ points.

11. (3.3 #20, modified) Graph the polynomial function \( f(x) = x^4 - 5x^2 + 4 \) and identify the \( x \)-intercepts, the \( y \)-intercepts, the turning points, the intervals on which the function is increasing, and the intervals on which the function is increasing. Give exact answers where possible. Use your calculator to help determine the answers.

12. (3.3 #26) Is the function \( f(x) = x^6 - x^2 \) even, odd, or neither?

13. (3.3 #49) Graph the piece-wise defined function \( f(x) = x + 2 \) if \( x < 0 \) and \( f(x) = 2 \) if \( x \geq 0 \).

14. (3.4 #9, modified) The graph of \( y = f(x/2) \) (shrinks / stretches) the graph of \( y = f(x) \) (horizontally / vertically) by multiplying each \( x \)-value / \( y \)-value by _________. Circle the correct choices and fill in the blank.

15. (3.4 #10, modified) The graph of \( y = (1/3)f(x) \) (shrinks / stretches) the graph of \( y = f(x) \) (horizontally / vertically) by multiplying each \( x \)-value / \( y \)-value by _________. Circle the correct choices and fill in the blank.
16. Suppose the semi-circle of radius 1 centered at (0, 0) is the graph of a function $f(x)$. Sketch the graph of the function $g(x) = -2f(x + 2) - 1$.

17. Suppose that the graph of $g(x)$ is the graph one obtains by first reflecting the graph of $f(x) = \sqrt{x}$ in the x-axis and then shifting it 2 units to the left. Write an expression for $g(x)$. Next, suppose that $h(x)$ is the graph one obtains by first shifting the graph of $f(x) = \sqrt{x}$ 2 units to the left and then reflecting the it in the x-axis. Write an expression for $h(x)$. Is $g(x) = h(x)$?

18. Practice using transformations to graph functions and recognize the equations of graphs by solving exercises 79-86 in section 3.4. The graphs are displayed there.

19. (3.5 #30, modified) Determine the vertical and horizontal asymptotes of $f(x) = \frac{2x}{2x + 5}$.

20. (3.5 #32, modified) Determine the vertical and horizontal asymptotes of $f(x) = \frac{x - 4}{x^2 - 16}$.

21. (3.5 #58) Find all vertical and horizontal asymptotes, x- and y-intercepts, and any symmetries, and then sketch the graph (using a calculator to help with your sketch) for the function $f(x) = \frac{3x + 2}{x^2 - 4}$.

22. (3.5 #60) Find all vertical and horizontal asymptotes, x- and y-intercepts, and any symmetries, and then sketch the graph (using a calculator to help with your sketch) for the function $f(x) = \frac{x^2 - 4}{x^2 - 9}$.

23. (3.6 #12, 14) Let $f(x) = 2x + 1$ and $g(x) = 3x - 2$. Find $(f - g)(x)$ and $(f/g)(x)$ and determine the domain of each function.

24. (3.6 #56, 58) Let $f(x) = \sqrt{x}$ and $g(x) = x + 1$. Find $(f \circ g)(x)$ and $(g \circ f)(x)$ and determine the domain of each function.

25. (3.6 #79-86) Try these exercises: graphs of $f(x)$ and $g(x)$ are given and you are to compute the values of various combinations of $f$ and $g$ at specific values of $x$.

26. (3.6 #87-90) Try these exercises: tables of values of $f(x)$ and $g(x)$ are given and you are to compute the values of various combinations of $f$ and $g$ at specific values of $x$. 