MSLC 1148 Workshop 2: Combining and Modifying Functions

Problem 1: Transformations

1. What is the formula if we shift the graph of $f(x) = x^2$ to the right by 3 units?
2. What is the formula if we shift the graph of $g(x) = |x|$ down by 1 unit?
3. What is the formula is we stretch the graph of $h(x) = \sqrt{x}$ vertically by a factor of 2?
4. What is the formula if we reflect the graph of $g(x) = |x|$ across the x-axis?
5. What is the formula if we reflect the graph of $f(x) = x^2$ across the y-axis?
6. What is the formula if we shift the graph of $g(x) = |x|$ down by 1 unit and to the right by 3 units?
7. What is the formula if we shrink the graph of $h(x) = \sqrt{x}$ horizontally by a factor of 2 and then shift down by 1 unit?

Consider the function $w(x) = -2(3x + 1)^3 + 7$. What is the parent function of $w(x)$? What transformations are applied to the parent function, and in what order?

Problem 2: Quadratics

Given the quadratic function $q(x) = 2x^2 - 12x + 9$

1. Write $q(x)$ in vertex form by completing the square.
2. Find the vertex of $q(x)$.
3. Find the x- and y-intercept.
4. What are the domain and range of $q(x)$?

Problem 3: Function Algebra

Consider the following table representing the function $f(x)$.

x	$f(x)$
-2	2
-1	4
0	8
1	-21
2	0
3	9

Using the function $g(x) = \sqrt{x + 1}$, fill in the following values:

1. $(f + g)(3)$
2. $(g - f)(0)$
3. $(g \circ f)(-1)$
4. $(g \cdot f)(-1)$
5. $(g \cdot f)(-2)$
6. $\left(\frac{g}{f}\right)(1)$

Now consider $h(x) = 2 - x$.

1. Find the domain of $g(x)$.

2. Find the domain of $h(x)$.

3. Write down the formula for $(g + h)(x)$.

4. Find the domain of $(g + h)(x)$.

5. Write down the formula for $\left(\frac{g}{h}\right)(x)$.

6. Find the domain of $\left(\frac{g}{h}\right)(x)$.

7. Find the x and y intercepts of $\left(\frac{g}{h}\right)(x)$.

Problem 4: Anatomy of a Polynomial

Consider the polynomial $p(x) = (2x - 3)^4(1 - x)(x - 2)^3$.

The degree of $p(x)$ is _____.

The leading coefficient of $p(x)$ is _____.

As $x \to \infty, p(x) \to$ _____

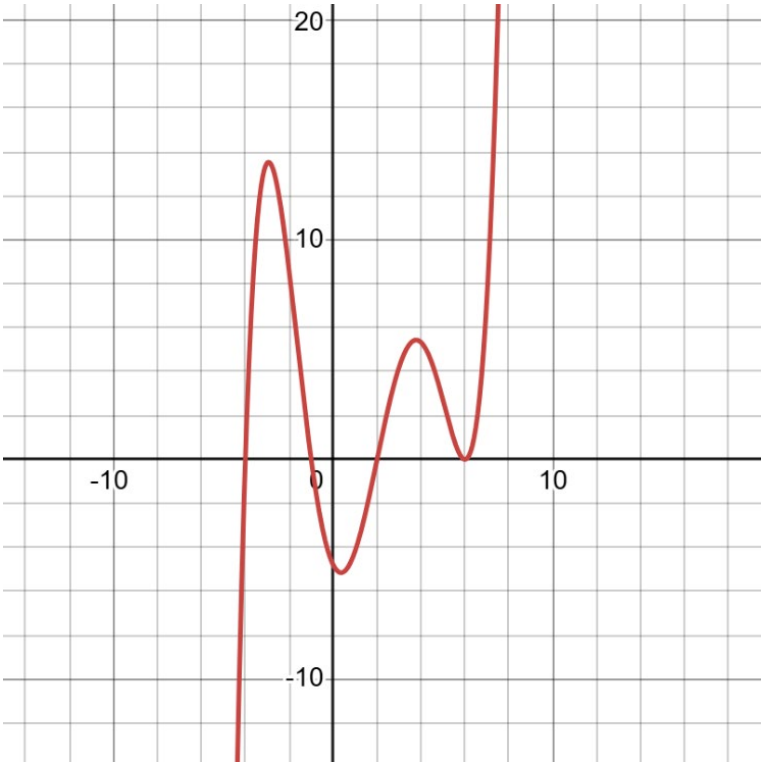
As $x \to -\infty, p(x) \to$ _____

List the y-intercept of $p(x)$: _____

List the x-intercepts of $p(x)$: _____

For each x-intercept, determine whether it is a touch point or a cross point.

Problem 5: More Polynomials



Find the minimum degree of the polynomials whose graph is given above.

Is the leading coefficient positive or negative? Is the polynomial even or odd degree?

Find the zeros of the function and determine their possible multiplicities.

Write a possible formula for a polynomial here: _____

Problem 6: Piecewise Functions

Graph the following piecewise function on the interval $[-1, 6]$:

$$f(x) = \begin{cases} 3 & \text{if } x \leq 0 \\ (x-1)^2 & \text{if } 0 < x \leq 3 \\ x - 2 & \text{if } 3 < x \end{cases}$$