Assignment 4 (Part II)

1. Let x and y be real numbers with $|x| < \frac{1}{2}$. Show that $|xy - x| < \frac{|y|+1}{2}$.

2. Let x be a real number with $|x| \leq 3$. Determine if the following inequality is true or not.

$$|x^2 - 4| \geq 5|x + 2|$$

   Explain your answer.

3. Let x and y be real numbers with $x > 1$ and $y < -2$. Determine if the following inequality is true or not.

$$1 + \frac{|y|}{x} > \frac{4 - y}{2|x|}$$

   Explain your answer.

4. Find the solution set for each of following inequalities.

   (a) $1 < |x - 1| \leq 6$

   (b)
$$\frac{(|x| + 5)(x - 1)}{|x - 2| + x^2 + x + 1} \geq 0$$

   (c)
$$2x + \frac{1}{|x|} \geq 1$$

   (d)
$$\frac{|2 - x|}{x^3 + 3x^2 + 11x + 18} \leq 0$$

   (e)
$$\frac{x^2 + 1 - |x - 1|}{5 - |x + 3|} \leq 0$$

5. (Optional) Find the solution set for each of the following inequities.

   (a) $|x - 1| < 7$
   (b) $3 < |x + 2| < 4$
   (c) $|2x + 3| \leq 2$
   (d) $|3x - 1| \geq 1$
   (e) $\frac{|x+2|}{2} > |x|$
   (f) $|x + 1| - |2x - 1| < 0$
   (g) $|2 - x| - x \leq 0$
   (h) $|x + 1| > 3 - |x|$
   (i) $x^2 - 2 \geq \frac{1}{2}|x - 1|$
   (j) $|x + 3| \geq 2 - x$

(k) $|2x^2 + x - 1| \geq 2$

(l) $\frac{|x|}{2} + 3 > x^2$

(m) $|x| > \frac{2}{|x+1|}$

(n) $\frac{x^2}{x+1} < |x|$

(o) $\frac{4}{|x|} \leq \frac{1}{|x|}$

(p) $|x^2 + 1| < |x + 1|$

(q) $(x^2 + 1)(|x + 2| - |x|) \geq 0$

(r) $\frac{|1-x|}{x^3+2x^2+5x+4} \leq 0$