Problems #1, Math 8, Dr. M. Bohner/Mrs. F. Dik. Jan 13, 98. Due Jan 28.

1. Problems from the Textbook: 1, 3, 10, 13, 20, 29, 49, 57, 59, 61, 66, 72, 79, 80, 90, 97, 105 (0.1); 2, 3, 7, 9, 17, 23-25, 29 (0.2); 3, 9, 12, 13, 17, 25, 29, 33, 36 (0.3); 1, 5, 7, 11, 17, 23 (0.4); 1, 2, 3, 5, 7, 8 (1.1); 1, 4, 5, 8, 10, 12, 13, 17, 19, 21-23, 26, 27, 30 (1.2); 4-6, 13-16, 21, 22, 27, 29, 32, 36, 38, 39, 41, 49, 57, 58, 60, 65, 73 (1.3).

2. Let $X = \{x_1, x_2, x_3, x_4\}$, $Y = \{y_1, y_2, y_3, y_4\}$, $Z = \{z_1, z_2, z_3\}$, and define $f : X \to Y$, $g : Y \to Z$, $h : Z \to X$ by $f(x_1) = y_1$, $f(x_2) = y_3$, $f(x_3) = y_4$, $f(x_4) = y_2$, $g(y_1) = z_1$, $g(y_2) = z_1$, $g(y_3) = z_3$, $g(y_4) = z_2$, $h(z_1) = x_1$, $h(z_2) = x_2$, and $h(z_3) = x_4$.

   (a) Draw an arrow diagram.
   (b) Find $h \circ g$, $g \circ f$, and $h \circ g \circ f$.
   (c) Find $g(\{y_1, y_3\})$, $h(Z)$, $f^{-1}(\{y_1, y_3\})$, and $h^{-1}(\{x_3, x_4\})$.
   (d) Is f one-to-one, onto, or invertible? How about g and h? Find the inverse functions of whatever functions are invertible.
   (e) Find $(h \circ g \circ f)(X) \cap \{x_2, x_3, x_4\}$, $h^{-1}(X) \cup g(Y)$, and $Z \setminus g(Y)$.

3. Given are the following functions:

$$f(x) = 2x + 1, \quad g(x) = -3x + 6, \quad q(x) = x^2 - 2x + 4,$$

$$h(x) = \frac{2x^2 - x - 1}{x - 1}, \quad \tilde{h}(x) = \frac{x^2 + 1}{x^2 - 1}, \quad \alpha(x) = \frac{x^3 - 3x^2 + 2x}{5x^2 - 6x - 7},$$

$$r(x) = \begin{cases} f(x) & \text{for } x \le 1 \\ q(x) & \text{for } x > 1 \end{cases}, \quad s(x) = \begin{cases} f(x) & \text{for } x < 2 \\ h(x) & \text{for } x \ge 2 \end{cases}, \quad \tilde{s}(x) = s(|x|).$$

   (a) Sketch f.
   (b) Find the equation of the line perpendicular to f that has zero 3.
   (c) Where do f and g intersect?
   (d) What is the domain of q?
   (e) Where are the zeros of q?
   (f) Find the intersection points of f and q.
   (g) Sketch r.
   (h) Find $\lim_{x \to 1} r(x)$ if it exists.
   (i) What is the value of $\tilde{s}(-5)$?
   (j) Find $\lim_{x \to 2} s(x)$ if it exists.
   (k) What are the zeros of h?
   (l) What is the domain of h?
   (m) Find $\lim_{x \to 1} h(x)$ if it exists.
   (n) Find $\lim_{x \to 4} \tilde{h}(x)$ if it exists.
   (o) Find $\lim_{x \to 1} \tilde{h}(x)$ if it exists.
   (p) What are the zeros of α?
   (q) What is the domain of α?
   (r) Write $(f \circ g)(x)$ in the form $ax + b$.
   (s) Write $(g \circ f)(x)$ in the form $ax + b$.

4. Find a polynomial of the form $ax^4 + bx^3 + cx^2 + dx + e$ that has zeros 1, -2, 3, -4.