1. [10 pts.] Form a polynomial function of degree 5 that has zeros -2 (with multiplicity 2) and 4 (with multiplicity 3).

2. Let $f(x) = 2x^3 - 3x^2 - 17x + 30$.

   (a) [5 pts.] List the possible rational zeros of f.

   (b) [10 pts.] Find all zeros of f using synthetic division. Give exact values.

   (c) [5 pts.] Fully factor $f(x)$.

3. [10 pts.] Find all the zeros of $p(x) = x^3 + 13x^2 + 57x + 85$, including any complex zeros.

4. [10 pts.] Find the vertical, horizontal, and oblique asymptotes, if any, of the rational function

$$r(x) = \frac{2x^2 - 5x - 12}{3x^2 - 11x - 4}.$$

5. [10 pts. each] Solve each inequality algebraically.

   (a) $x^3 + 2x^2 - 3x > 0$.

   (b) $\dfrac{x+2}{x-4} \geq 1$.

6. [12 pts.] Given that

$$f(x) = \frac{3}{x-1} \quad \text{and} \quad g(x) = \sqrt[3]{x},$$

   find $(f \circ g)(8)$, $(g \circ f)(2)$, $(f \circ f)(-3)$, and $(g \circ g)(-64)$.

7. [6 pts. each] Let

$$f(x) = x^2 + 4 \quad \text{and} \quad g(x) = \sqrt{x} - 2.$$

   (a) Find $f \circ g$ and its domain.

   (b) Find $g \circ f$ and its domain.

   (c) Find $g \circ g$ and its domain.

8. [10 pts. each] Each function is one-to-one. Find its inverse.

   (a) $f(x) = x^3 + 9$.

   (b) $h(x) = -\dfrac{2x}{x-1}$.