

1. 10 pts. Find the zeros of  $f(x) = -8x(x - 19)^9(x + 17)^4$ , and state the multiplicity of each.

2. 10 pts. Use the Intermediate Value Theorem to determine whether the function

$$f(x) = x^4 - 3x^2 + x - 1$$

has a real zero between  $-3$  and  $1$ .

3. 10 pts. Use long division to find the quotient  $Q(x)$  and remainder  $R(x)$  when  $P(x) = x^4 - 2x^2 + 3$  is divided by  $d(x) = x + 2$ . Express  $P(x)$  in the form  $d(x) \cdot Q(x) + R(x)$ .

4. 10 pts. Use synthetic division to find the quotient and remainder:

$$(4x^5 - 2x^2 - 5) \div (x + 1).$$

5. 15 pts. Factor the polynomial

$$f(x) = x^4 - 7x^3 + 9x^2 + 27x - 54,$$

then solve the equation  $f(x) = 0$ .

6. 10 pts. Find a polynomial of degree 4 with 0 as a zero of multiplicity 1, 3 as a zero of multiplicity 2, and  $-2$  as a zero of multiplicity 1.

7. 10 pts. Find a polynomial function of lowest degree with rational coefficients that has  $2 - i$  and  $-1$  as some of its zeros.

8. 15 pts. Find all the zeros of

$$f(x) = 2x^3 + 7x^2 + 2x - 8,$$

and factor  $f(x)$  into linear factors.

9. 20 pts. Sketch a graph of the rational function

$$G(x) = \frac{x^2 + 3x}{2x^3 - 5x^2 - 3x}.$$

To do this, first find the domain of  $G$ , as well as all intercepts and asymptotes.

10. 10 pts. each Solve each inequality, and state the solution set in interval notation.

(a)  $x^2 + 4x + 7 > 5x + 9$

(b)  $x^3 + x \leq 6 - 4x^2$

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