

A *polynomial function* is a function of the form

$$f(x) = a_n x^n + a_{n-1} x^{n-1} + \cdots + a_1 x + a_0,$$

where  $a_i \in \mathbb{R}$  and  $a_n \neq 0$ . The *degree* of  $f(x)$  is  $\deg(f) = n$ . The real numbers  $a_i$  are the *coefficients* of  $f(x)$ . The *leading coefficient* of  $f(x)$  is  $a_n$ . The *constant coefficient* of  $f(x)$  is  $a_0$ .

The *zeros*, or *roots*, of  $f(x)$  are the *complex* solutions to the equation  $f(x) = 0$ .

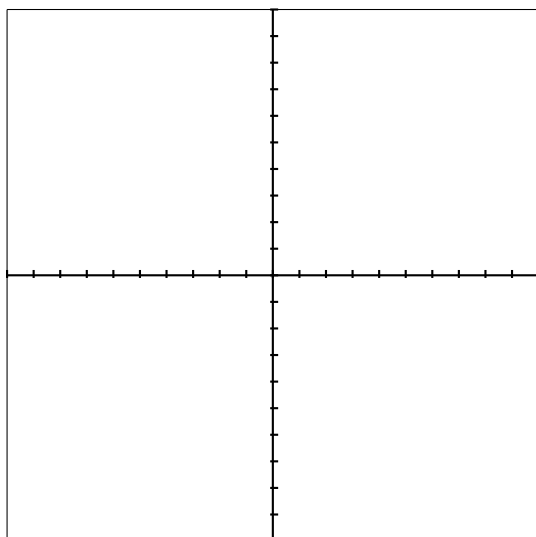
The *y-intercept* of  $f(x)$  is the point  $(0, f(0))$ .

The *x-intercepts* of  $f(x)$  are the points  $(r, 0)$ , where  $r$  is a *real* root of  $f(x)$ .

The *shape* of  $f(x)$  is

- (a)  $++$  if  $n$  is even and  $a_n > 0$ ;
- (b)  $--$  if  $n$  is even and  $a_n < 0$ ;
- (c)  $-+$  if  $n$  is odd and  $a_n > 0$ ;
- (d)  $+-$  if  $n$  is odd and  $a_n < 0$ .

Find the degree, leading coefficient, roots, intercepts, and shape of  $f(x)$ . Use the intercepts and the shape to sketch the graph of  $f(x)$ .



**Problem 1:**  $f(x) = \sqrt{5} - 2x$

**Degree:**

**Leading Coefficient:**

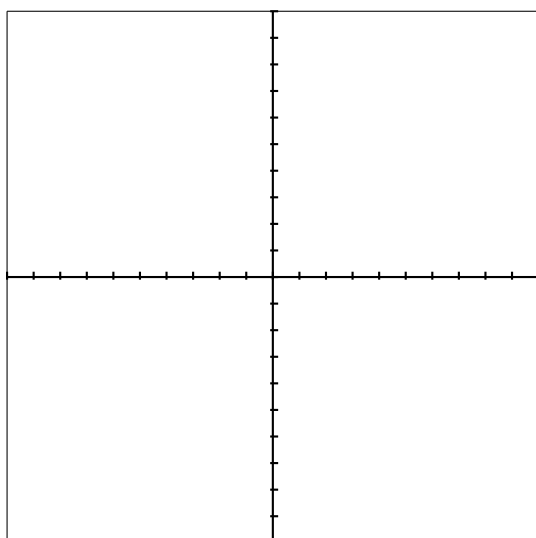
**Constant Coefficient:**

**Roots:**

**y-intercept:**

**x-intercepts:**

**Shape:**



**Problem 2:**  $f(x) = 9 - x^2$

**Degree:**

**Leading Coefficient:**

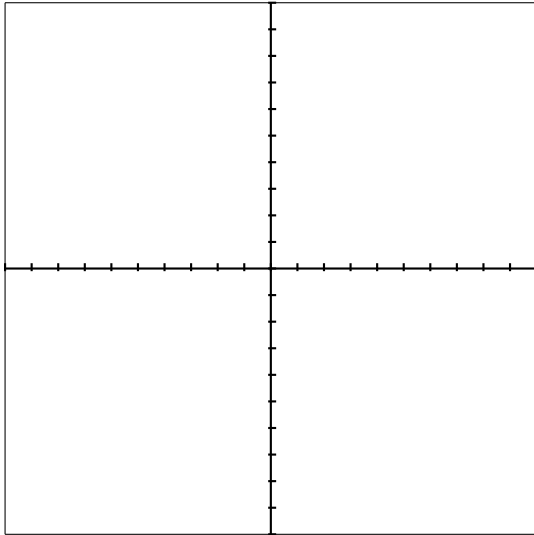
**Constant Coefficient:**

**Roots:**

**y-intercept:**

**x-intercepts:**

**Shape:**



**Problem 3:**  $f(x) = x^3 - 2x^2 - 7x + 14$

**Degree:**

**Leading Coefficient:**

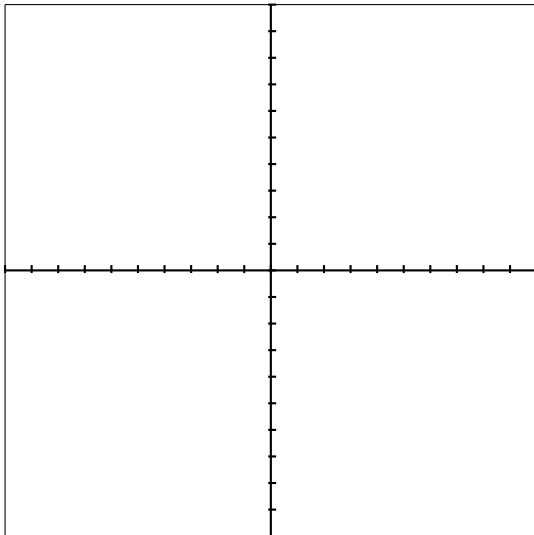
**Constant Coefficient:**

**Roots:**

***y*-intercept:**

***x*-intercepts:**

**Shape:**



**Problem 4:**  $f(x) = x^4 - 3x^2 + 2$

**Degree:**

**Leading Coefficient:**

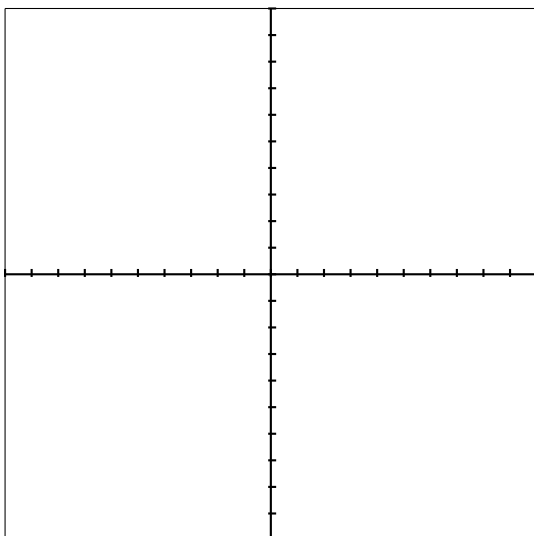
**Constant Coefficient:**

**Roots:**

***y*-intercept:**

***x*-intercepts:**

**Shape:**



**Problem 5:**  $f(x) = x^3 - 8x^2 + 5x + 50$

**Degree:**

**Leading Coefficient:**

**Constant Coefficient:**

**Roots:**

***y*-intercept:**

***x*-intercepts:**

**Shape:**

**Hint:** Guess a root  $r$  via the Rational Roots Theorem, find  $f(x) \div (x - r)$ , then factor.)