Section 5.2 Part a: Polynomial Functions

- General Notation of a Polynomial
  - Degree
  - Leading Coefficient
  - Constant Term
- End Behavior
- Domain
- Intercepts
- Parent Polynomial Functions
  - Zero $f(x) = 0$
  - Constant $f(x) = b$, where $b \neq 0$
  - Linear $f(x) = x$
  - Quadratic $f(x) = x^2$
  - Cubic $f(x) = x^3$

Pr 1. Determine if the given function is a polynomial function. If the answer is yes, state the degree, leading coefficient, and constant term.

(a) $f(x) = -42x^{-1} + 3x^{\pi} - 6x^{3.1}$

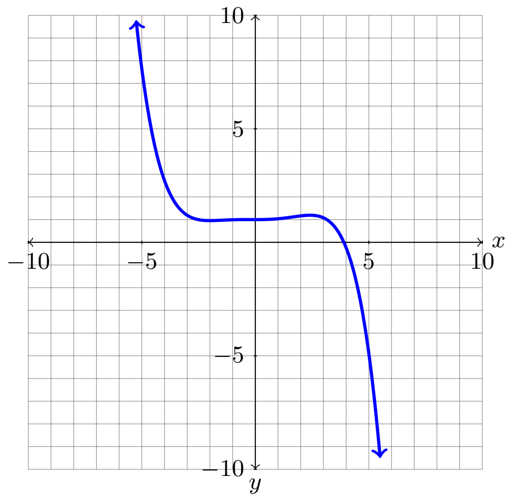
(b) $g(w) = \sqrt{3}w^2 - w^3 + \frac{1}{7}w - 21$

Pr 2. Describe the end behavior of each polynomial function, both symbolically and with a quick sketch of the end behavior.

(a) $f(x) = -x^4 + x^3 - 6x - 2048$

(b) $g(x) = 12x^4 - 9 + 9x^7 - x^2$

Pr 3. Describe the end behavior symbolically for the polynomial function, $f(x)$, graphed below.



Pr 4. State the domain of each polynomial function.

(a) $f(x) = 2x^{13} - 6x^2 - 40x$

(b) $g(w) = 15w^2 - w^3 + 5w - 12$

Pr 5. Determine all exact real zeros, the x-intercept(s), and y-intercept of each given polynomial function, if possible.

(a) $f(x) = -5(2 - 3x)(4x + 9)$

(b) $g(x) = 6x^3 - 3x^2 - 18x = 3x(2x + 3)(x - 2)$

(c) $h(w) = 5w^2 - w^3 + 4w - 20$

(d) $k(x) = (x^2 + 9)(x^2 - 4)$

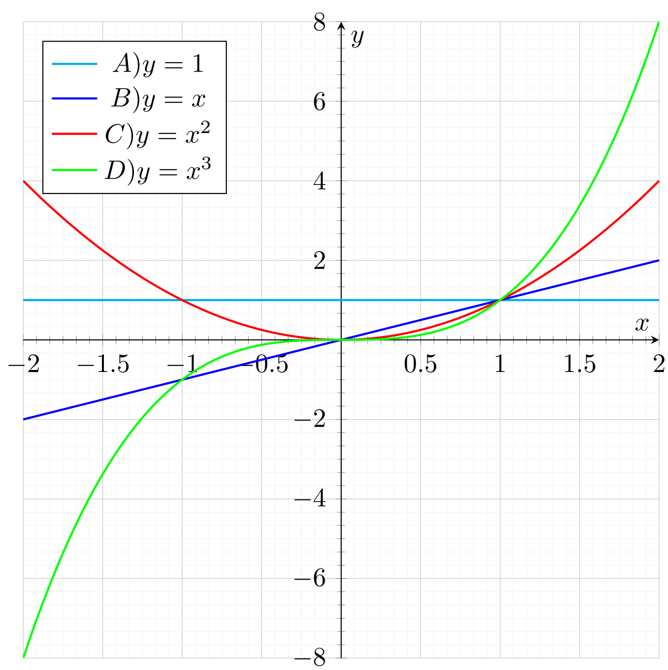
Pr 6. Match each of the following polynomials with the graph of its parent function:

(a) $f(x) = 1 - x^3 + 13x$

(b) $g(x) = 2028$

(c) $h(x) = 32x - 2027$

(d) $k(x) = 3x^2 - 2x + 1$



Section 5.2 Part b: Quadratic Functions

- General form of a Quadratic Function - $f(x) = ax^2 + bx + c$ where a, b, and c are real numbers with $a \neq 0$
  - Vertex $\left(-\frac{b}{2a}, f\left(-\frac{b}{2a}\right)\right)$
  - Axis of Symmetry $x = -\frac{b}{2a}$
  - Domain and Range
- Quadratic Formula - used to solve equations of the form $ax^2 + bx + c = 0$ - $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
- Recall: Profit = Revenue - Cost

Pr 1. Determine the vertex, axis of symmetry, domain, range, x-intercept(s), y-intercept, maximum value and minimum value for each quadratic function, if they exist.

(a) $f(x) = 2x^2 + 6x$

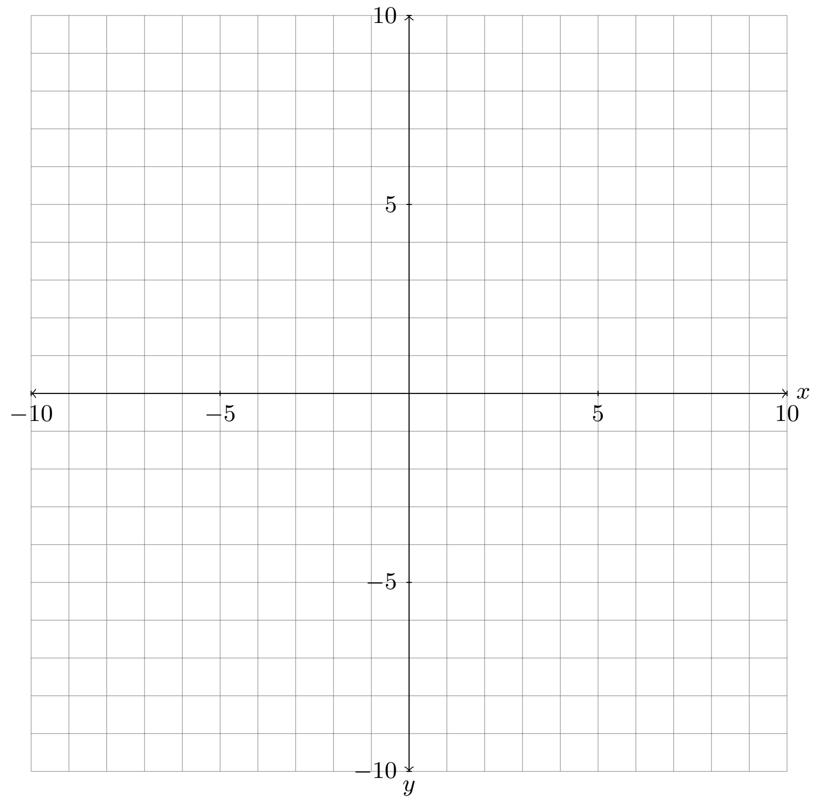
(b) $g(x) = 3x^2 - 6x + 3$

(c) $h(x) = 36 - 49x^2$

(d) $j(x) = \frac{1}{5}x^2 + \frac{49}{500}x - \frac{31}{100}$

Pr 2. Graph the quadratic function with the following properties

i. As $x \to -\infty$, $h(x) \to \infty$ and as $x \to \infty$, $h(x) \to \infty$
ii. $h(x)$ has a single real zero of -3.
iii. There is a minimum value of 0.
iv. The graph has a y-intercept of $(0, 9)$.



Pr 3. The cost to produce bottled mineral water is given by $C(x) = 18x + 7500$, where x is the number of thousands of bottles produced. The profit from the sale of these bottles is given by the function $P(x) = -x^2 + 300x - 7500$.

(a) What is the revenue function, $R(x)$, in dollars, where x is the number of bottles of mineral water made and sold.

(b) How many bottles must be sold to maximize the revenue?

(c) What is the maximum revenue?

Pr 4. The fixed cost of manufacturing collectible bobble head figurines is \$350, while the production cost is \$30. If we sell figurines at \$350, then none are demanded, while 300 are demanded if we give the figurines away for free.

(a) Determine the company's profit function $P(x)$, in dollars, as a function of x, the number of figurings made and sold.

(b) How many figurines must be sold in order to maximize profit?

(c) At what price per figurine will the maximum profit be achieved?

(d) How many bobble-heads need to be sold in order to break-even?