1. Write the equation of a rational function whose graph has a horizontal asymptote at $x = 0$.

2. Write the equation of a rational function whose graph has vertical asymptotes at $y = -2$ and $y = 5$.

3. Write the equation of a rational function whose graph has an oblique asymptote at $y = 2x + 1$. 

4. Write the equation of a quadratic function whose graph has vertex \((1, 3)\) and passes through the point \((2, 0)\).

5. Write the equation of a quadratic function whose range is \([-2, \infty)\) and whose graph has x-intercepts \((1, 0)\) and \((-1, 0)\).
6. Three sides of a rectangle will be fenced with a total of 600 ft. of fencing (the other side is along a river). Express the area of the rectangle as a function of the length of the side parallel to the river.

7. The number of pairs sold of a particular pair of shoes can be expressed as a function of the cost of one pair as \( N(c) = 3000 - 10c \). Express the revenue, \( R \), earned by selling this shoe, as a function of \( c \). (Hint: Revenue = (cost per item)\*(number of items sold))

8. An “ice cream cone” shape is drawn as an equilateral triangle with a semicircle on one the sides of the triangle. Express the perimeter of the figure as a function of one of the sides of the square.
9. Suppose the yearly cost, in dollars, of owning a dog can be expressed as a function of the dog’s age in years as \( C(x) = 20x^2 - 200x + 1000 \). What age dog requires the lowest yearly cost?

10. The height of a basketball \( t \) seconds after a free throw shot is taken can be modeled by the function \( h(t) = -16t^2 + 40t + 5 \). Find the maximum height of the basketball.
11. Find the average rate of change of the function $g(x) = x^2 + 2x - 3$ on the interval $[1, 5]$.

12. Find the average rate of change of the function $h(x) = 7x - 5$ on the interval $[-1, 3]$.

13. Find the average rate of change of the function $f(x) = \frac{1}{x^2}$ on the interval $[\frac{1}{2}, 1]$. 
14. Consider the function \( h(x) = 3x^2 - 30x + 1 \).

a. Write the function in vertex form.
b. What are the coordinates of the vertex?
c. What is the equation of the axis of symmetry?
d. What are the coordinates of the x-intercepts, if any?
e. What are the coordinates of the y-intercept?

15. Let \( f(x) = 3x^2 - 30x + 1 \).

a. Write the function in vertex form.
b. What are the coordinates of the vertex?
c. What is the equation of the axis of symmetry?
d. What are the coordinates of the x-intercepts, if any?
e. What are the coordinates of the y-intercept?
16. \( f(x) = x + 1, \ g(x) = 3x - 5. \) For what values of \( x \) is \( g(x) \geq f(x) \)?

17. \( f(x) = -2x + 3, \ g(x) = \frac{1}{2}x - 2. \) Graph both functions on the axes provided. Use the graph to solve the inequality \( f(x) > g(x) \).
18. \( \text{Solve for } x: (x-3)(x+6)^2 < 0. \)

19. Solve for \( x \): \( x^3 + 2x^2 - 3x > 0 \)

20. Solve for \( x \): \( x^4 < 9x^2 \)
21. Graph the following polynomial. Be sure to label all intercepts and to consider the function’s end behavior and behavior near its x-intercepts.

\[(x + 3)^3(x - 2)^2(x + 1)\]

22. Graph the following polynomial. Be sure to label all intercepts and to consider the function’s end behavior and behavior near its x-intercepts.

\[(x - 1)(x + 2)^2(x - 3)^2\]
23. Consider the function \( g(x) = \frac{(x+1)^2(x-5)(x-3)^2}{(x-3)(x+2)} \).

a What are the equations of the vertical asymptotes?
b What are the coordinates of the \( x \)-intercepts, if any?
c What is the coordinate of the \( y \)-intercept, if any?
d Does the graph have any holes?
e Does the graph have a horizontal or oblique asymptote?
24. Sketch the graph of the function on the axes provided. Label all intercepts, asymptotes, holes, and any points where the graph crosses an asymptote.

\[
\frac{-2x^2 + 8}{x^2 + 2x - 15}
\]

25. Sketch the graph of the function on the axes provided. Label all intercepts, asymptotes, holes, and any points where the graph crosses an asymptote.

\[
\frac{5(x - 3)^2(x + 2)(x + 1)(x + 4)}{6(x - 2)^2(x + 1)}
\]
26. Sketch the graph of the function on the axes provided. Label all intercepts, asymptotes, holes, and any points where the graph crosses an asymptote.

\[
\frac{x^2 + 6x + 9}{x^3 - 36x}
\]
27. Graph $f(x) = \frac{3}{x^2} - 2$ using transformations.