1. (a) $(f+g)(x) = \left(x^3+1\right) + \left(\dfrac{x}{x-6}\right)$, $(f-g)(x) = \left(x^3+1\right) - \left(\dfrac{x}{x-6}\right)$,
$(f\cdot g)(x) = \left(x^3+1\right)\left(\dfrac{x}{x-6}\right)$, $(f/g)(x) = \left(x^3+1\right)\Big/\left(\dfrac{x}{x-6}\right)$

   (b) $(f\circ g)(x) = \left(\dfrac{x}{x-6}\right)^3 + 1$, $(g\circ f)(x) = \dfrac{x^3+1}{x^3-5}$

   (c) The domain of $f\circ g$ is $(-\infty,6)\cup(6,\infty)$; or all x such that $x\neq 6$.
   The domain of $g\circ f$ is $(-\infty,\sqrt[3]{5})\cup(\sqrt[3]{5},\infty)$; or all x such that $x\neq\sqrt[3]{5}$.

2. (a) The domain of h is all real numbers, $\mathbb{R}$.

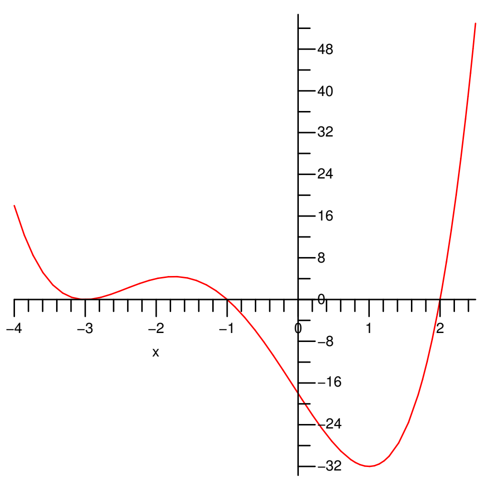
   (b) The degree of $h(x)$ is 4, the leading coefficient is 1, and the constant term is -18.
   The end behavior of $h(x)$ is like x^4.

   (c) The possible rational zeros of $h(x)$ are $\pm1,\pm2,\pm3,\pm6,\pm9,\pm18$.

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

   (e) The zeros of $h(x)$ are $x=-1$ (multiplicity 1), $x=2$ (multiplicity 1), and $x=-3$ (multiplicity 2).

   (f) The graph $y=h(x)$ is given by:



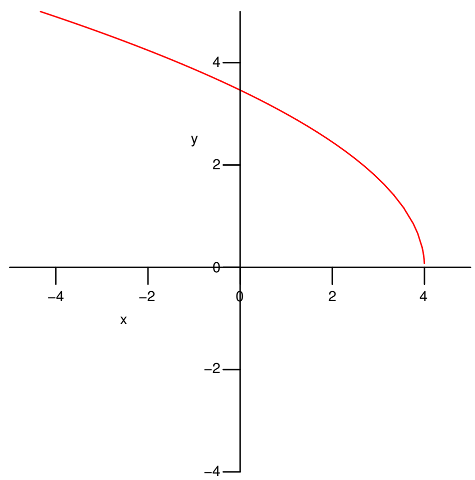
3. (a) $(h+g)(1) = (-32) + \left(-\frac{1}{5}\right)$,
$(h\cdot g)(1) = (-32)\left(-\frac{1}{5}\right)$,
$(h\circ g)(1) = h\left(-\frac{1}{5}\right) = \left(-\frac{1}{5}\right)^4 + 5\left(-\frac{1}{5}\right)^3 + \left(-\frac{1}{5}\right)^2 - 21\left(-\frac{1}{5}\right) - 18 = -\frac{8624}{625}$,
$(g\circ h)(1) = g(-32) = \frac{32}{38}$.

   (b) The domain of the function $(x-6)\cdot g(x)$ is $\{x : x\neq 6\}$.

4. (a) $(f\circ k)(x) = f\left(\sqrt{12-3x}\right) = \left(\sqrt{12-3x}\right)^2 = 12-3x$.

   (b) The domain of $f\circ k$ is $(-\infty,4] = \{x : x\leq 4\}$.

5. (a) The graph of k is seen below:



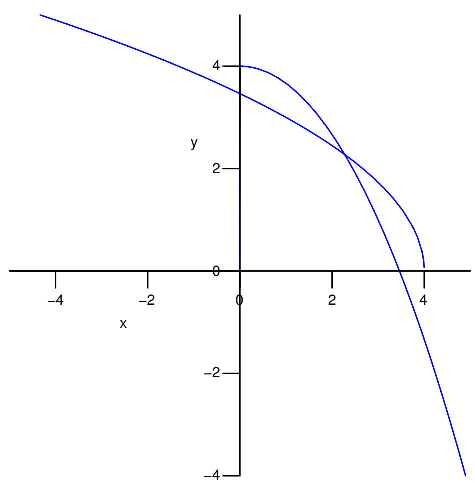
(b) The domain of k is $(-\infty, 4]$. The range of k is $[0, \infty)$?

(c) The function k is a one-to-one function. (It passes the horizontal line test.)

(d) $k^{-1}(x) = -\frac{x^2}{3} + 4$.

(e) The domain of k^{-1} is $[0, \infty)$, the range of k.

(f) The graph of k^{-1} is given by:



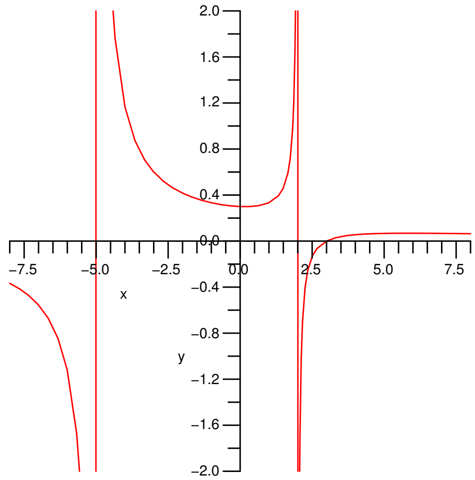
(g) The points (x_a, y_a) in part (a) are the reflection of the points (x_f, y_f) in part (f) through the line $y = x$. In other words, $(x_a, y_a) = (y_f, x_f)$.

6. (a) The domain of f is $\{x : x \neq -5, x \neq 2\}$.

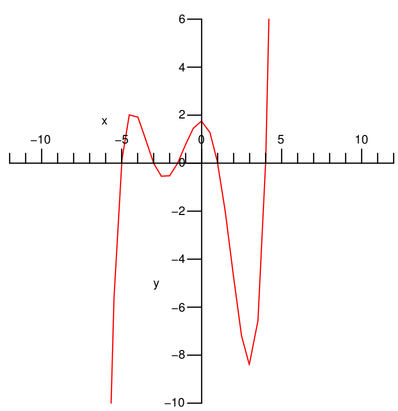
(b) The vertical asymptotes of f are $x = -5$ and $x = 2$.

(c) The horizontal asymptote of f is $y = 0$.

(d) The graph of f is given below:



7. (a) The domain of f is $\mathbb{R}$.
   (b) The range of f is $\mathbb{R}$.
   (c) The function f has no symmetry.
   (d) The function f is neither odd, nor even.
   (e) The function f does not have an inverse, because f is not a one-to-one function. (It fails the horizontal line test.)
   (f) The zeros of f are at $x = -10, x = -6, x = -3, x = 2, x = 8$.
   (g) The function f is a polynomial. (A rational function would have a vertical asymptote.)
   (h) The degree of $f(x)$ is 5 because it has 5 zeros.
   (i) Horizontal compression by a factor of 2. Note that the zeros of $i(x) = f(2x)$ are at $x = -5, x = -3, x = -3/2, x = 1, x = 4$. The values of the zeros are half that of the zeros of f:

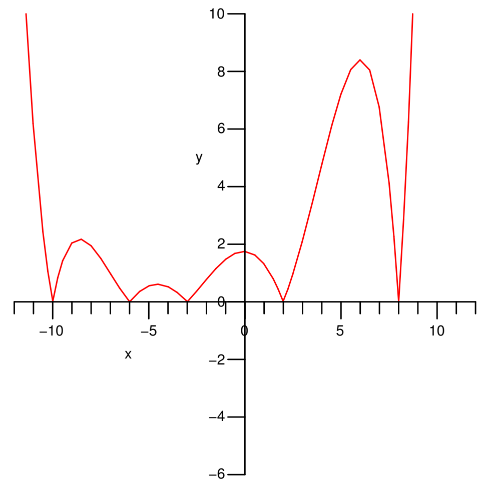


   (j) Shift left 2 units.

(k) Shift down 3 units.

(l) Vertical elongation by a factor of 3.

(m) When $f(x) \geq 0$, the graph is the same. Where $f(x) < 0$, the graph is reflected through the x-axis:



(n) Shift right 2 and up 4.

(o) Vertical elongation by a factor of 2. Then, after the elongation, shift down by 3.