1. (7pts) Let $f(x) = \sqrt{x-2}$ and $g(x) = x^2 + 3$. Compute the following (simplify where possible):

a) $(f - g)(4) =$

b) $\dfrac{g}{f}(x) =$
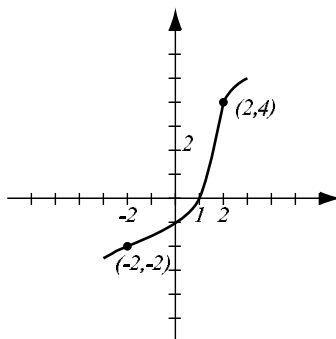
c) $(g \circ f)(x) =$

d) $(f \circ f)(x) =$

2. (2pts) Find functions f and g
so that $(f \circ g)(x) = \dfrac{3}{x^2 - 2x + 7}$.

3. (5pts) The function $f(x) = \dfrac{1}{x+5}$ is given.
a) Find the inverse of this function.
b) State the domain and range of f.

4. (4pts) The graph of f is shown at right. Sketch the graph of f^{-1} on the same coordinate system and indicate the special points on the graph of f^{-1}.

5. (10pts) Consider the polynomial $P(x) = 0.5x^3 - 3x^2 + 2x + 9$. Answer the following (decimal answers should have accuracy to two decimal places).
a) Find the x-intercepts of the graph and the y-intercept.
b) P behaves like what function for large $|x|$?
c) Find the turning points of P. Does P have the maximal possible number of turning points?
d) Sketch the graph of the function on paper. Make sure scale is marked and all features you found in a)-c) are indicated.

6. (4pts) Which of the following functions has an inverse? How do you know?
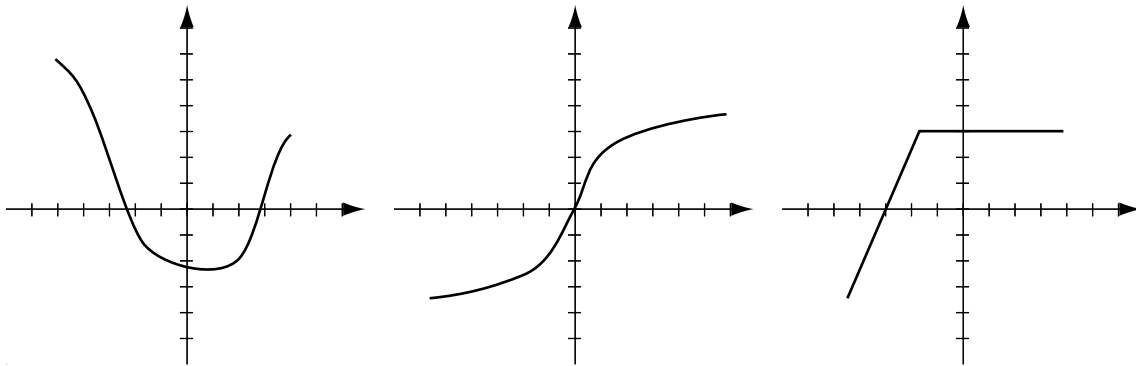
7. (10pts) Consider the rational function $f(x) = \dfrac{x^3 - 1}{x^2 - 4}$.

a) Find the domain of f and the vertical asymptotes of the graph.

b) Find the x-intercepts of the graph and the y-intercept.

c) f behaves like what function for large $|x|$? Find any horizontal or slanted asymptotes if the graph has them.

d) Sketch the graph of the function on paper. Make sure scale is marked and all features you found in a)-c) are indicated.

8. (3pts) Sketch the graphs of $y = \frac{1}{x}$ and $y = \frac{1}{x^3}$ in the same coordinate system. Your picture needs to accurately show the relative positions of those curves. Indicate all the points where the graphs intersect.

9. (2pts) On day x, a catering company serves $N(x)$ meals at price $P(x)$ per meal. Write the function that expresses the revenue of the catering company on day x.

10. (3pts) The volume of a hot-air balloon is given by $V(r) = \frac{4}{3}r^3$, where r is the radius of the balloon in meters. If the radius r is increasing with time t (in minutes) according to the formula $r(t) = 3t^2$, find the volume of the balloon V as a function of time t.

Bonus. (5pts) Find a polynomial whose graph is as shown. (Hint: what will give you the correct x-intercepts? The correct y-intercept?)