1. Sketch the graph of $f(x) = -(x+3)^2 + 4$. Label intersections with the axes.

2. Let $f(x) = \dfrac{1}{x}$ and $g(x) = (x+3)^2$. Find, but do not simplify, $f \cdot g(x)$, $(f - g)(x)$, and $f \circ g(5)$.

3. Let $f(x) = |x| + 3$ and $g(x) = 2x$.
(a) Find the compositions $f(g(x))$ and $g(f(x))$.
(b) Graph both $f(g(x))$ and $g(f(x))$ by translating, reflecting, compressing, and stretching the graph of $|x|$.

4. Let $f(x) = x^2 + 5$, $g(x) = x - 2$, $h(x) = \sqrt{\frac{1}{3}x - 3}$.
(a) Find $f \circ g$.
(b) Graph $f \circ g$.
(c) Find $f \circ h$.
(d) Graph $f \circ h$.

5. Find the formula for $f^{-1}(x)$, and state the domain of the function f^{-1}:
$$f(x) = -\sqrt{5 + 4x}$$

.

6. Calculate $f^{-1}(x)$ for the following functions:

(a) $f(x) = x^3 + 1$ (b) $f(x) = \dfrac{1}{\sqrt{x+1}}$ (c) $f(x) = \begin{cases} x - 2 & x < 0 \\ x^2 & x \geq 0 \end{cases}$

7. An angry CSU fan throws an empty bottle onto the field during the CU - CSU football game. The bottle has an initial speed of $v = 8m/s$ and is thrown at an angle θ above the horizontal. Neglecting air resistance, the bottle will land a distance d down the field, where d is given by
$$d = \frac{v^2}{g} \sin 2\theta,$$
where v is the initial speed and g is acceleration due to gravity (use $g = 10\frac{m}{s^2}$). If the bottle lands $3.2m$ down the field, at what angle above the horizontal did the CSU fan throw the bottle? (There are two possible angles.)

8. Solve each equation for x:
(a) $2^{x-5} = 3$
(b) $\ln x + \ln(x - 1) = 1$ (HINT: First find the *domain of definition* of the problem.)
(c) $x^{\ln x} = (e^2)(x)$
(d) $e^x (2x + 1) = -x^2 e^x$
(e) $x^2 e^x + 10e^x = 7xe^x$

9. Evaluate the limits (if they exist):
(a) $\displaystyle \lim_{a \to 4} \frac{a^2 - 3a - 4}{4 - a}$
(b) $\displaystyle \lim_{x \to 2} \frac{x^2 - 2x - 1}{x^2 - 5x + 6}$
(c) $\displaystyle \lim_{x \to -1} \frac{|x - 1|}{x^2 - 1}$
(d) $\displaystyle \lim_{x \to 1} \frac{x^2 + 2x - 3}{x + 1}$
(e) $\displaystyle \lim_{x \to \infty} \frac{x^{1/3}}{x^{2/3}}$
(f) $\displaystyle \lim_{x \to +\infty} \sqrt{\frac{15x}{3x + 1} + 9}$