Math 16A (Bernd Sturmfels), **Midterm Exam # 1**
Thursday, September 29, 8:10 a.m.–9:25 a.m.

Please start by writing your name, your student ID, your TA's name and the meeting time of your section on the cover of your blue book. **This exam is closed book.** Do not use any notes, calculators, cell phones etc. You must show all your all work to get credit. Write sentences if time permits. Each problem is worth 20 points, for a total of 100 points.

(1) Let $f(x) = x^2 + 4$ and $g(x) = \sqrt{x} - 1$.
Determine the following four functions:
   (a) $f(x)g(x)$
   (b) $f(g(x))$
   (c) $g(x)f(x)$
   (d) $g(f(x))$.

(2) Find the equation of the tangent line to the curve of the function $g(x) = (x-1)^{10}$ at $x = 2$.

(3) A helicopter is rising at a rate of 32 feet per second. At a height of 128 feet the pilot drops a pair of binoculars. After t seconds, the binoculars have height $s(t) = -16t^2 + 32t + 128$ feet from the ground. How fast will they be falling when they hit the ground ?

(4) Draw the graph of a function which has the following four properties:
   (a) There is a local minimum at $x = 0$.
   (b) There is an inflection point at $x = 1$.
   (c) For $x \geq 1$, the function is concave down.
   (d) The graph has an asymptote for $x \to \infty$.

(5) Let $f(x)$ be a function and define a new function by $g(x) = 5 \cdot \sqrt{f(x)}$. Suppose $f(1) = 4$ and $f'(1) = 3$. Determine $g(1)$ and $g'(1)$.