1. (3 pts each) Circle true or false. No explanation necessary.

   (a) If $0 < f(x) < g(x)$ for all x, then $\int_1^4 \frac{g(x)}{f(x)} > 3$.

   True $\displaystyle\int_1^4 \frac{g(x)}{f(x)}\,dx > \int_1^4 \frac{f(x)}{f(x)}\,dx = \int_1^4 1\,dx = x|_1^4 = 4 - 1 = 3.$

   (b) $\int_\pi^\pi \frac{\sin^2(x^5)-\cos(42x)}{x^2+x+1} > 2$.

   False The integral is from π to π, so it's 0.

   (c) $\int_1^\infty \frac{1}{x^{71}}\,dx$ converges.

   True $\displaystyle\int_1^\infty \frac{1}{x^{71}}\,dx = \lim_{b\to\infty}\int_1^b x^{-71}\,dx = \lim_{b\to\infty} -\frac{1}{70}x^{-70}\Big|_1^b = \lim_{b\to\infty} -\frac{1}{70b^{70}} + \frac{1}{70} = \frac{1}{70}.$

   (d) If $g(x) + 2$ is an antiderivative of $f(x)$, then $g(x)$ is also an antiderivative of $f(x)$.

   True $g(x) + 2$ and $g(x)$ have the same derivative.

2. (6 pts) State the construction theorem for antiderivatives.

   If $f(x)$ is continuous on the closed interval $[a, b]$, then the function $F(x) = \int_a^x f(t)\,dt$ is an antiderivative of $f(x)$ for $a \le x \le b$.