NAME: _____ **Panther ID:** _____

Worksheet 6 - MAC 2312, Fall 2013

1. Compute

(a) $\int \frac{x^3+2x^2+1}{x^4+x^2}\,dx$

(b) $\int_0^1 \frac{x^3-4x-10}{x^2-x-6}\,dx$

2. If a thin rod of length L (measured in cm) has constant density δ (measured in g/cm), then the mass of the rod (in g) is computed by $m = \delta \cdot L$. Next you are asked to derive a formula for the mass of a rod with variable density. Suppose that the rod is placed on the x-axis between the points $x = a$ and $x = b$, and suppose the variable density at the point x in the rod is given by $\delta(x)$, for $x \in [a, b]$. Derive the formula for the total mass by dividing the rod in small pieces, etc.

3. A charged rod of length L is placed along the x-axis with the left side at the origin. It can be shown that the electric field produced by the rod at a point in the plane $P(a, b)$ has horizontal, respectively, vertical components given by

$$E_x(P) = \int_{L-a}^{-a} \frac{\lambda x}{4\pi\epsilon_0(x^2+b^2)^{3/2}}\,dx \qquad E_y(P) = \int_{L-a}^{-a} \frac{\lambda b}{4\pi\epsilon_0(x^2+b^2)^{3/2}}\,dx\,,$$

where λ is the charge density per unit length on the rod and ϵ_0 is the free space permittivity. (A picture will be shown on the board.) Evaluate the two integrals to determine simple formulas for the components of the electric field $E_x(P), E_y(P)$.
Hint: For one integral you need a trig substitution. The other can be done faster. Note also that λ and ϵ_0 are constants.