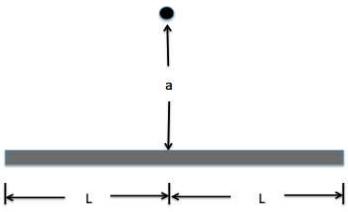
7. [9 points] If a particle of mass m is positioned at a perpendicular distance a from the center of a rod of length $2L$ and constant mass density δ as shown below



The force of gravitational attraction F between the rod and the particle is given by

$$F = Gm\delta a \int_{-L}^{L} \frac{1}{(a^2 + x^2)^{\frac{3}{2}}} dx.$$

a. [5 points] Does the force of gravitational attraction F approach infinity as the length of the rod goes to infinity? Justify your answer using the comparison test.

b. [4 points] Consider the integral

$$I = \int_{1}^{\infty} \frac{1}{(a^2 + x^2)^p} dx$$

i. Give a power function that if integrated over $[1, \infty)$ will have the same convergence or divergence behavior as I.

ii. For what values of p is I convergent or divergent?