The force between the two masses, M and m is

$$\mathbf{F} = \frac{-GMm}{r^2}\hat{\mathbf{r}}$$

where r is the distance between the two masses. Now consider the mass M as a concentrated mass $1\,g$ and the mass $m = \rho\, ds$ as a uniform distributed mass with density ρ per unit length. If the distributed mass ($\rho\, ds$) locates along $s = -1$ to $s = 1$.

(a.) The concentrated mass locates at (x, y), find the total force between the concentrated mass and the distributed mass.

(b.) The concentrated mass locates at $(x, y) = (3, 4)$, find the total force between the concentrated mass and the distributed mass.

(c.) Assume that the point locates at $(x, y) = (0, \epsilon)$, find the forces at (x, y) for three cases, $\epsilon = 0^-, 0, 0^+$.

(d.) Please determine the equivalent locations of the lumped mass for all the cases.

(e.) Give comments by using the Hadamard pricipal value.

f. Plot F_x versus (x, y) and F_y versus (x, y).

(Hint: Kellog book, pp.4-6)