A proton beam that carries a total current of 4.3 mA has a 5.0 mm diameter. The current density in the proton beam increases linearly with distance from the center. This is expressed mathematically as follows $J = J_e(r/R)$, where R is the radius of the beam and J_e is the current density at the edge. How many protons are delivered each second by this proton beam?

The total current in the beam is 4.3 mA = $4.3*10^{-3}$ A.
The charge flowing through the cross section of the beam per second will be $4.3*10^{-3}$ C.

Hence the number of protons delivered per second will be given by the ratio of the charge crossing per second to the charge of one proton, which is

$$\frac{4.3*10^{-3}\ \mathrm{C}}{1.6*10^{-19}C} = 2.69*10^{16}$$

Hence $2.69*10^{16}$ protons are delivered per second.

(Don't get confused with the current density, the number of proton per second depends on the current only.)