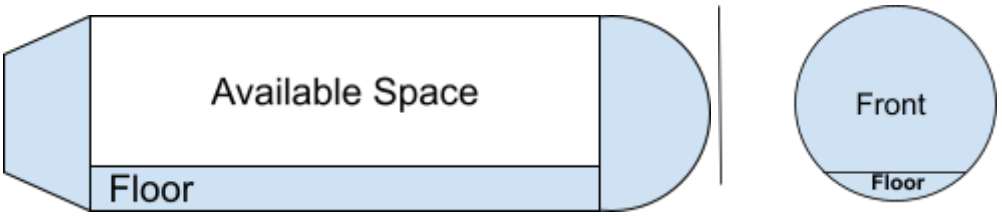
How many tennis balls fit into a Boeing 787 Dreamliner?

To start to solving the problem I will do do some assumptions below to simplify and avoid unnecessary complexities and focus of the main problem about the volumetric

- Assuming the airplane is empty it means there is any seat there and no equipaments.
- Assuming the Boeing 787 Dreamliner has cylindrical format and dimensions of 1.5 m radios and 63 m of length.
- Assuming the the tennis ball has 30 mm

Calculating the volume of airplane:



The total available volume:

Circle area multiplied by the length of the airplane is the total volume but we need to remove the floor space for calculation. Let' s calculate the floor area using sector formula and then remove it from the circle area:

$$A\,floor \;=\; A\,sector \;-\; A\,triangle$$

$$A\,floor \;=\; \pi R^2\,\frac{90°}{360°} \;-\; \frac{bh}{2} \;=\; \pi R^2\,\frac{1}{4} \;-\; \frac{R^2}{2} = R^2 * \left(\frac{2\pi - 4}{8}\right)$$

Calculate the available area:

$$A\,available \;=\; A\;circle \;-\; A\,floor$$

$$A\,available \;=\; \pi R^2 \;-\left[R^2 * \left(\frac{2\pi - 4}{8}\right)\right]$$

Finally we have the available volume:

$$V available \;=\; A\,available \;*\; L$$

The quantity of tennis balls that fit in a volume is the total space divided by the unit of 1 ball occupied in the space. Using the sphere volume formula to calculate the volume of tennis ball:

$$Vsphere = \frac{4}{3}\pi r^3$$

$$Q_{total} = \frac{V\ available}{V\ tennis\ ball}$$

$$Q_{total} = \frac{\left[\pi R^2 - \left[R^2 * \left(\frac{2\pi - 4}{8}\right)\right]\right] * L}{\frac{4}{3}\pi r^3} = \frac{3R^2\left[\pi - \pi * \left(\frac{2\pi - 4}{8}\right)\right] * l}{4\pi r^3}$$

$$Qtotal = \frac{3 * 1.5^2 * (2.23) * 63}{4 * \pi * (3 * 10^{-3})^3} = \frac{951.09}{3.39 * 10^{-7}} = 2.803 * 10^6\ tennis\ ball$$

Considering the Boing will be fully occupied without any empty space. Total tennis ball that fits into Boeing is $2.803 * 10^6$ tennis balls