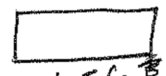
Rushing The Field

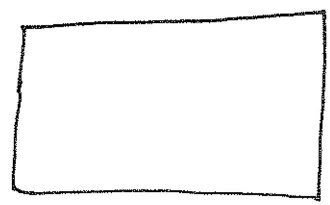
Looking down on a person, they are something like a rectangle:

with long side ~ 1–2 ft ~ 1.5 ft

And back to front, maybe 1 ft.



A ~~foot~~ football field is also a rectangle:



The area of the football field over the typical area of a person will be the number of folks who fit on the field!

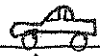
$$\text{Area} = \text{length} \times \text{width}$$

$$A_{field} = 300\,ft \times 150\,ft = 45000\,ft^2$$

$$A_{person} = 1.5\,ft \times 1\,ft = 1.5\,ft^2$$

$$\frac{A_{field}}{A_{person}} = \frac{45000\,ft^2}{1.5\,ft^2} = \boxed{30000}$$

Around 30,000 people could cram onto a football field!



Volume of a car

Estimation requires approximate numbers. We can say a car is more or less a rectangular prism:

with height h, width w, length l.

Volume of this shape is $l \times w \times h = V$.

Height of a car? I'm about 5ft tall and can just see over it. So

$$h \sim 5\text{ft}.$$

Width: I can just about lay down in a car across the back seat.

$$w \sim 5\text{ft}.$$

Length: Seems around twice as long as I am tall, or maybe a bit longer.

$$l = 10 - 13\text{ ft} \sim 10\text{ft}.$$

$$\text{Volume} = h \times w \times l = 5\text{ft} \times 5\text{ft} \times 10\text{ft}$$

$$\boxed{\simeq 250\text{ft}^3}$$

If asked for an order of magnitude calculation,

$$250 = 2.50 \times 10^2$$

$$\rightarrow \boxed{\sim 10^2\text{ ft}^3}$$

Dimensional Analysis

(1.) $\frac{\Delta x \, v}{a}$

Δx → displacement, so meters.
v → velocity, so m/s
a → acceleration, so m/s^2

$\Delta x \to [m]$
$v \to [m/s]$
$a \to [m/s^2]$

$$\frac{m \times \frac{m}{s}}{\frac{m}{s^2}} = m \times \frac{m}{s} \times \frac{s^2}{m}$$

$= [m \cdot s]$

(2.) $v \, t$ → time, so seconds.
v → velocity, so m/s

$\frac{m}{s} \cdot s \to [m]$ velocity times time is a distance! that makes sense!

(3.) $v = v_0 + at$

- v: velocity $[m/s]$
- v_0: velocity $[m/s]$
- a: acceleration $[m/s^2]$
- t: time $[s]$

$$\left[\frac{m}{s}\right] = \left[\frac{m}{s}\right] + \left[\frac{m}{s^2} \cdot s\right]$$

$$\left[\frac{m}{s}\right] = \left[\frac{m}{s}\right] + \left[\frac{m}{s}\right]$$ → Can add/subtract parts of equation with same units.

Both sides are m/s!