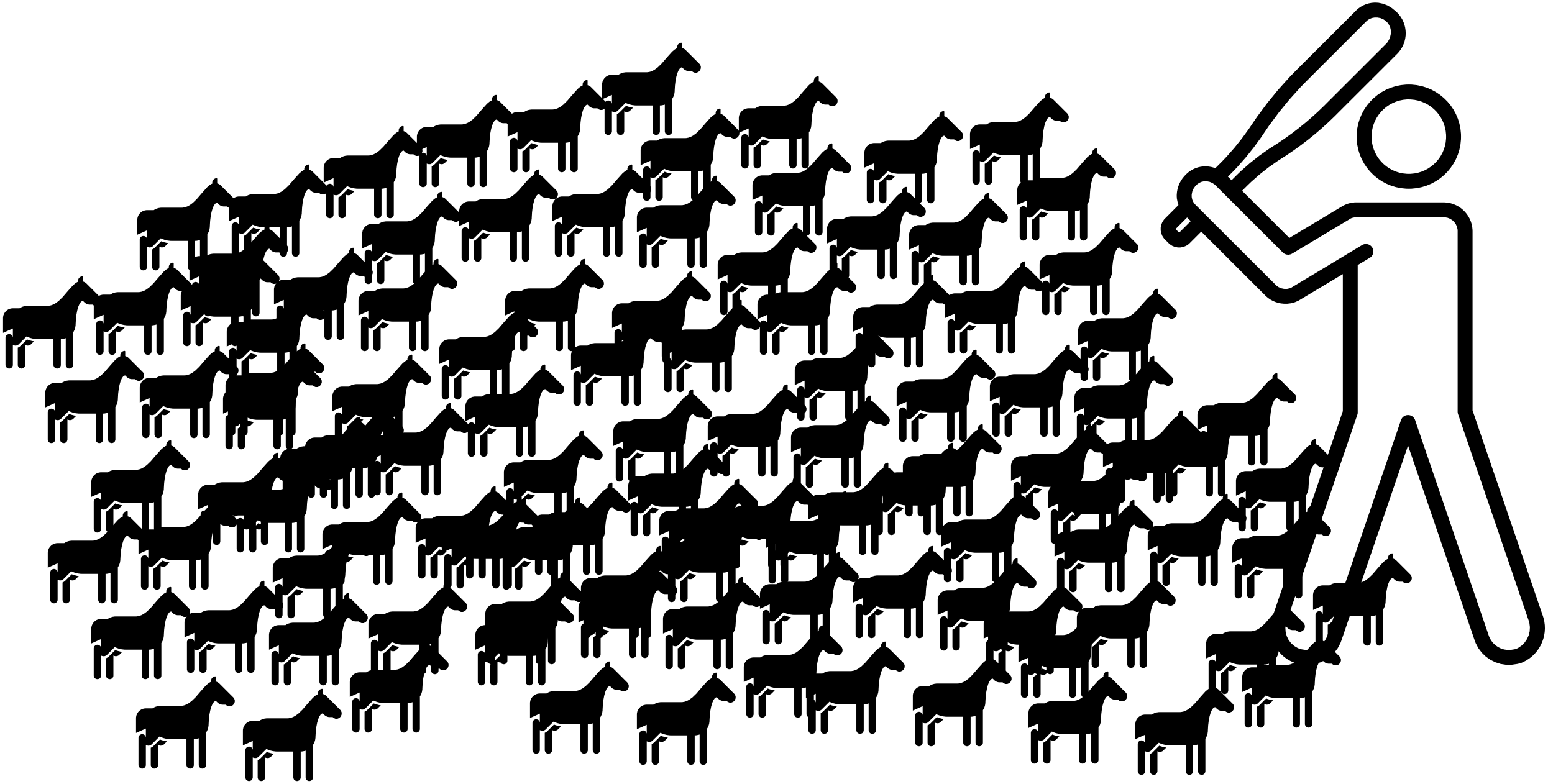
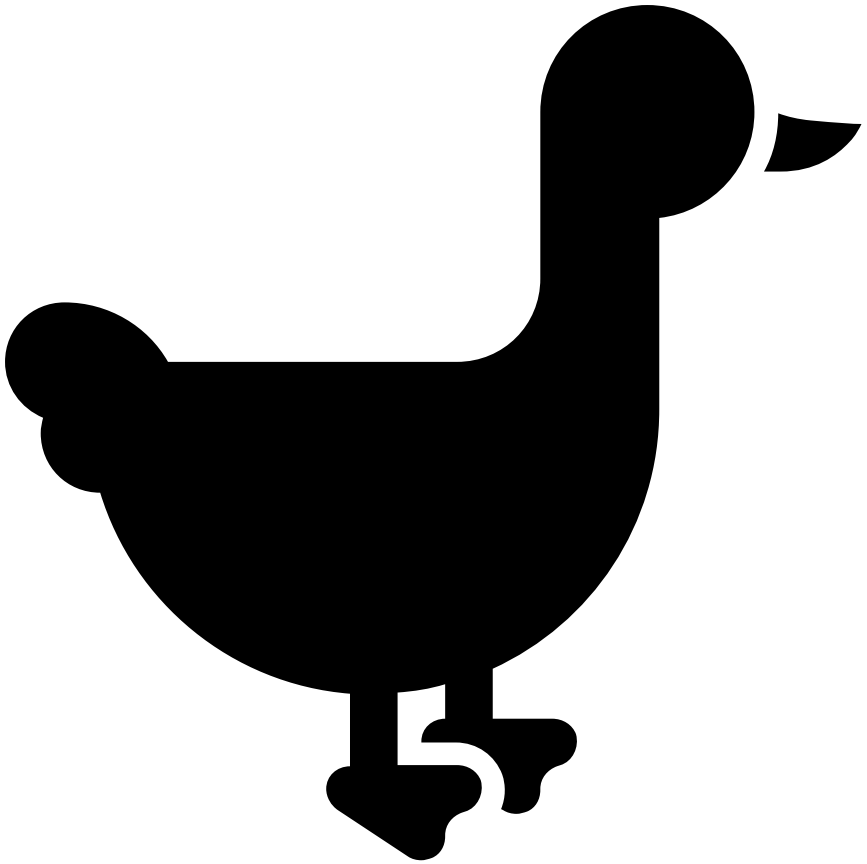
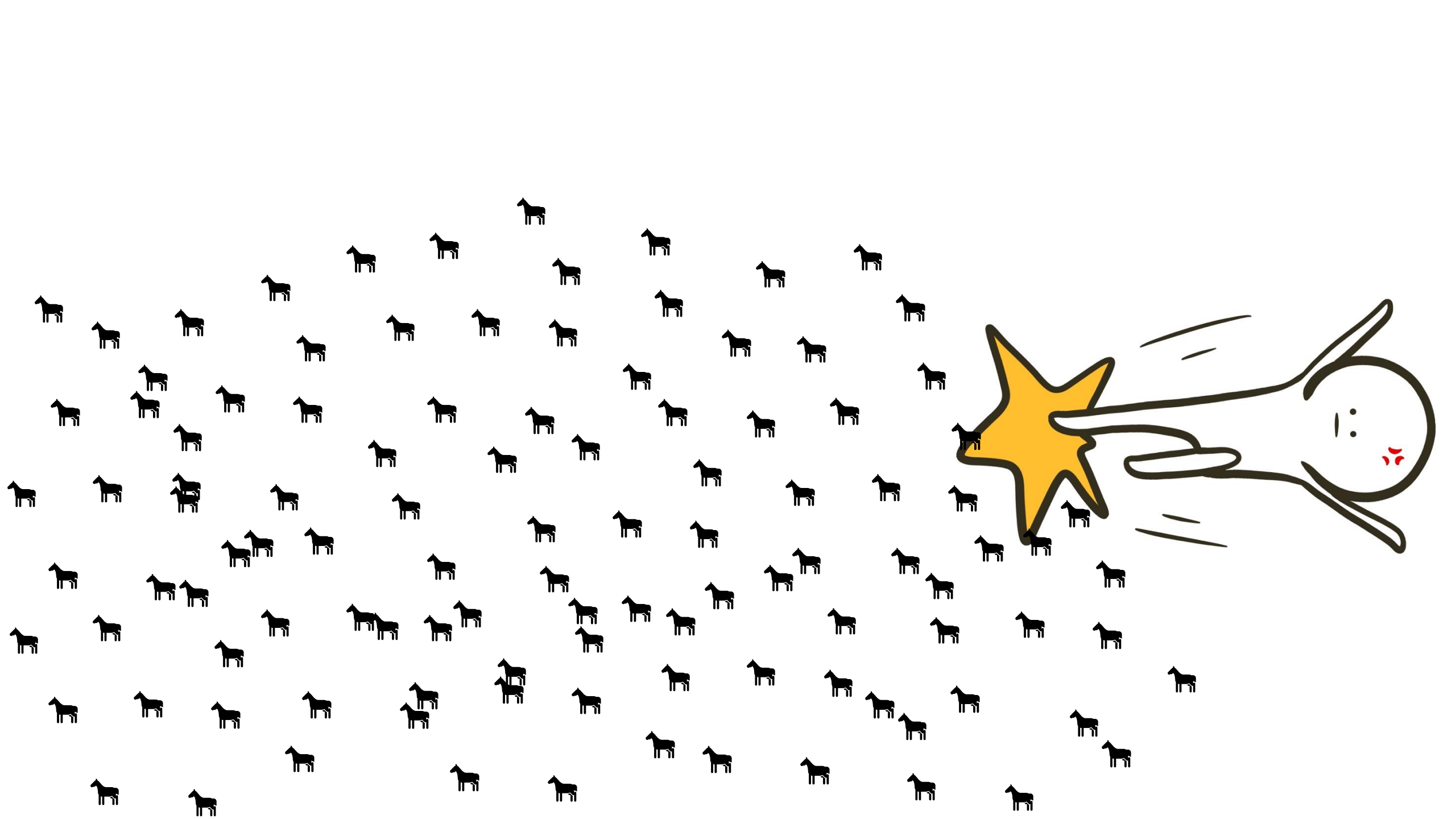
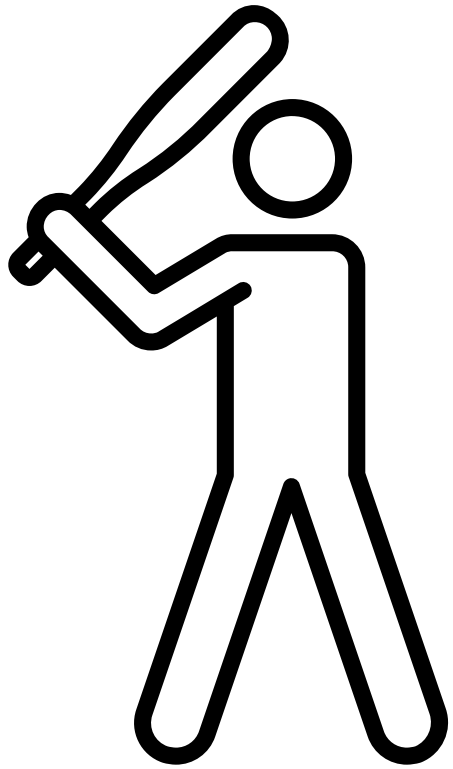
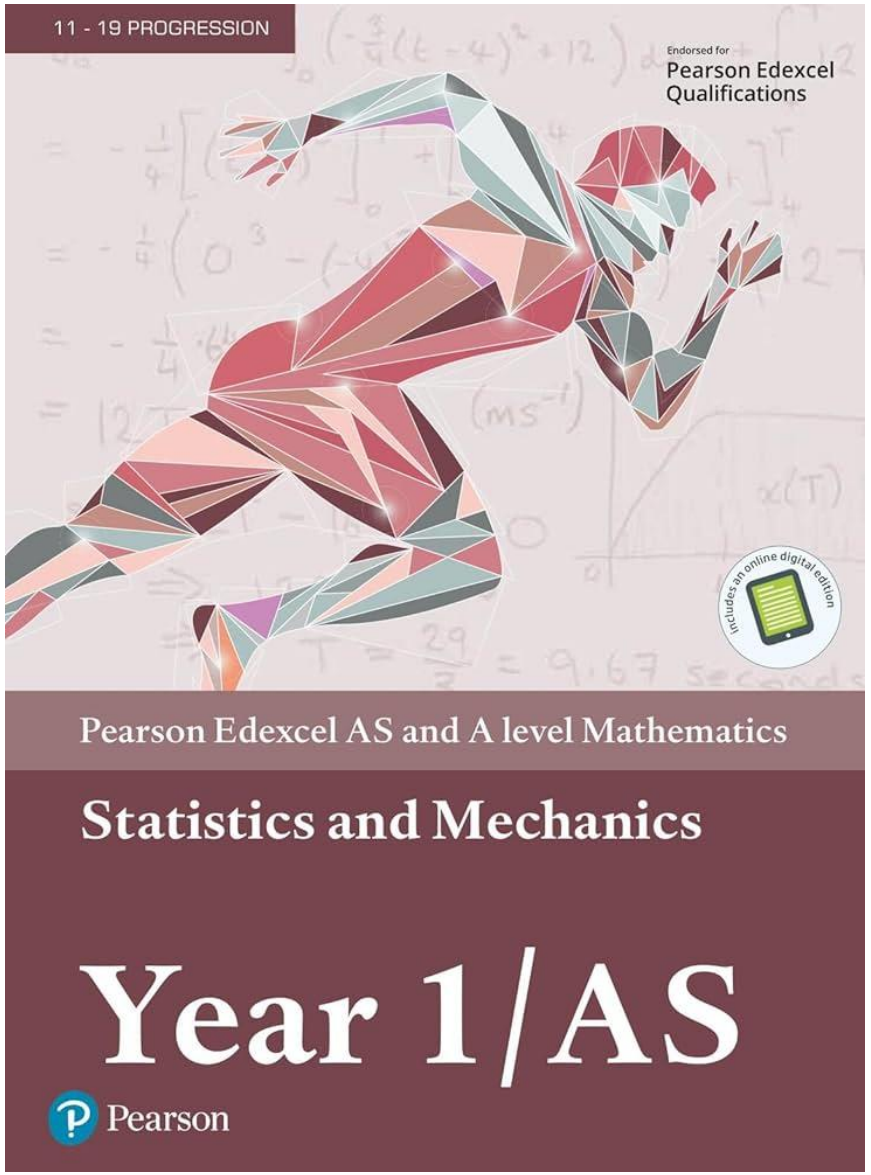
But... maths??







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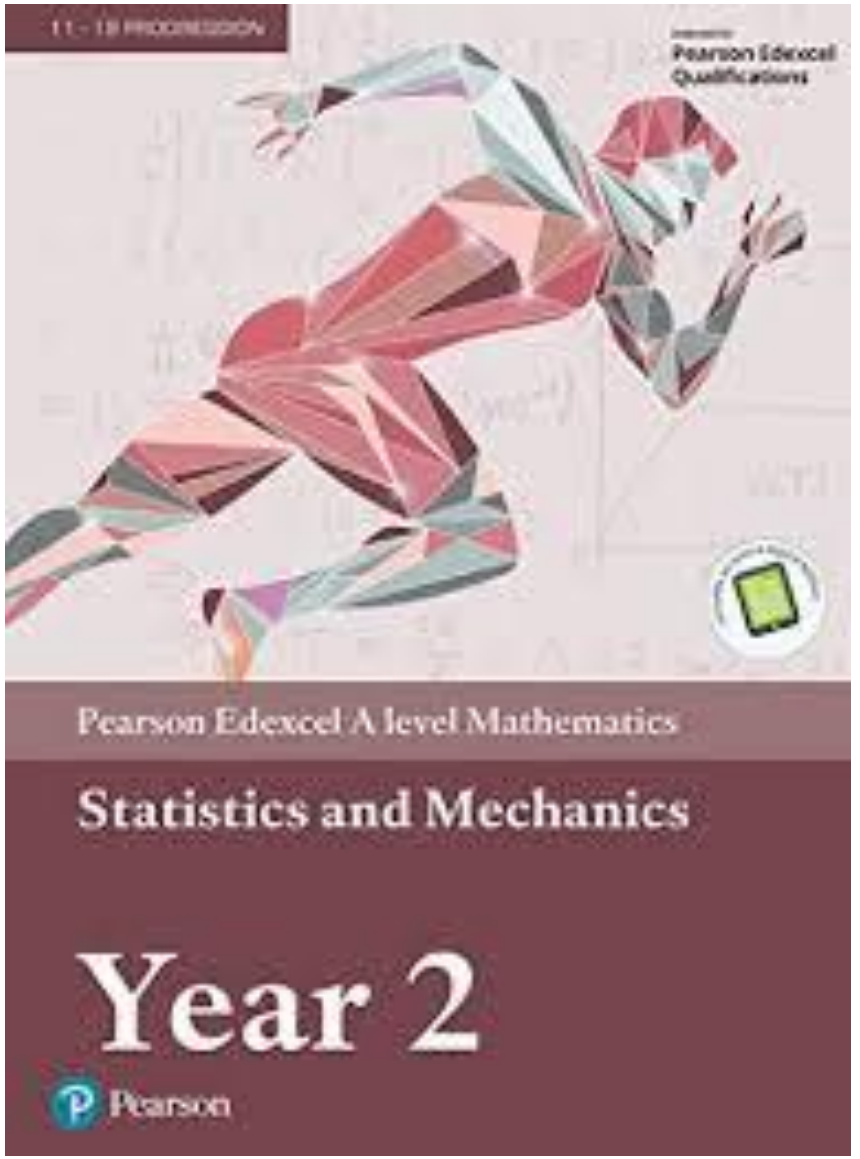
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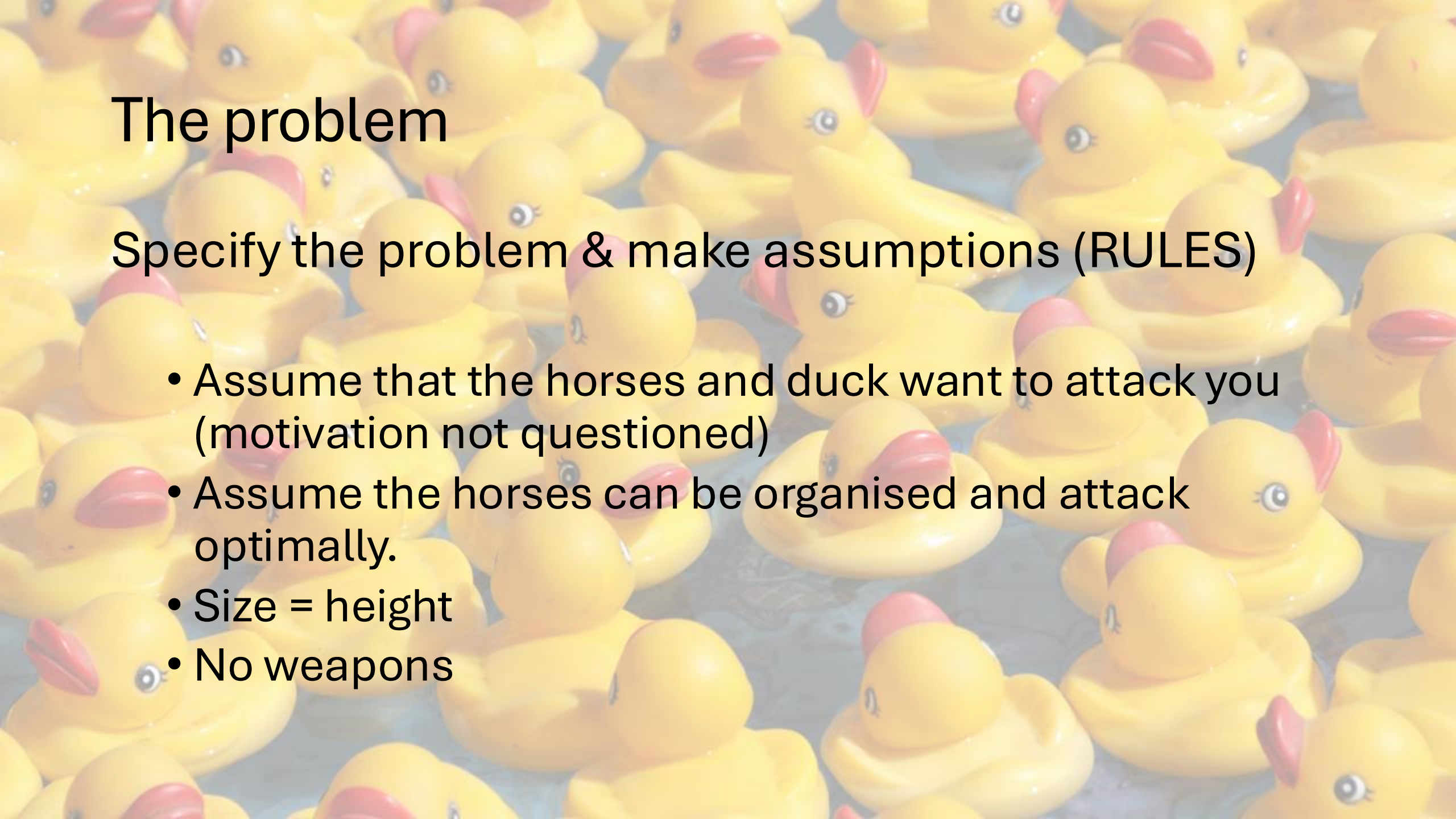
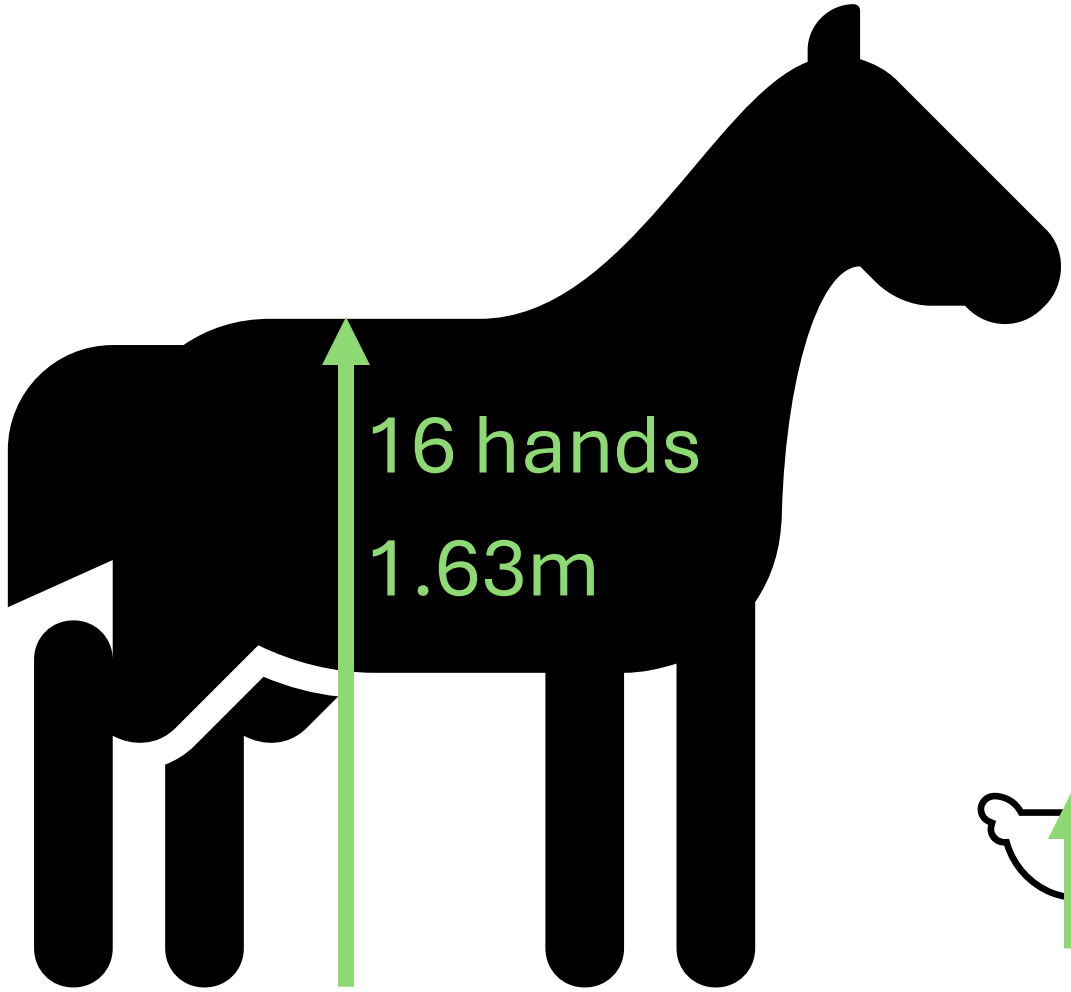


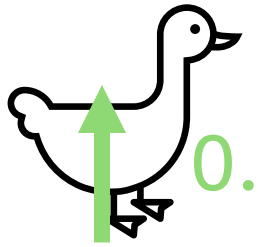
The problem

Specify the problem & make assumptions (RULES)

- Assume that the horses and duck want to attack you (motivation not questioned)
- Assume the horses can be organised and attack optimally.
- Size = height
- No weapons

What size are duck-sized horses?



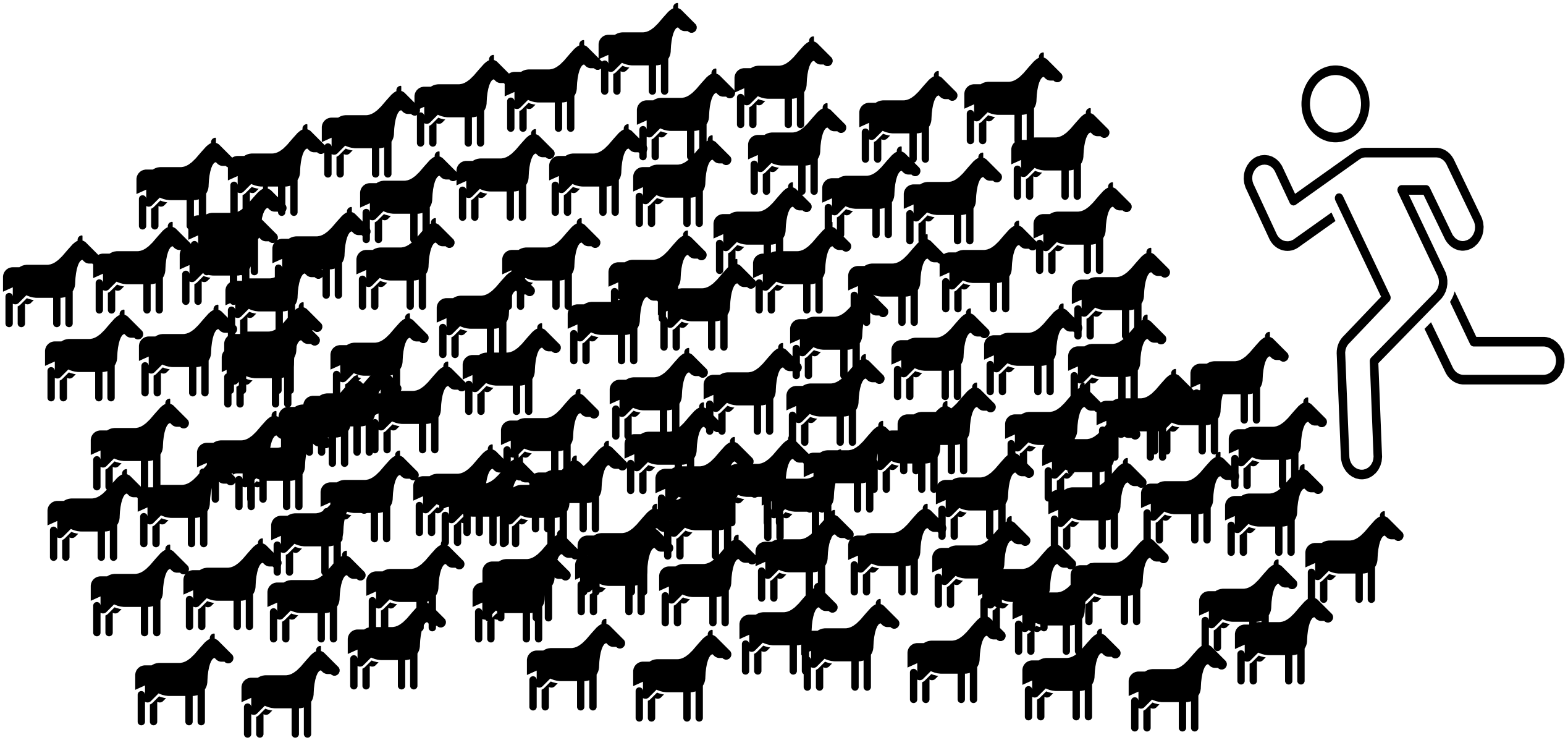


$$\frac{1.63}{0.35} = 4.66$$

$$\frac{550}{4.66^3} = 5.4\text{kg}$$

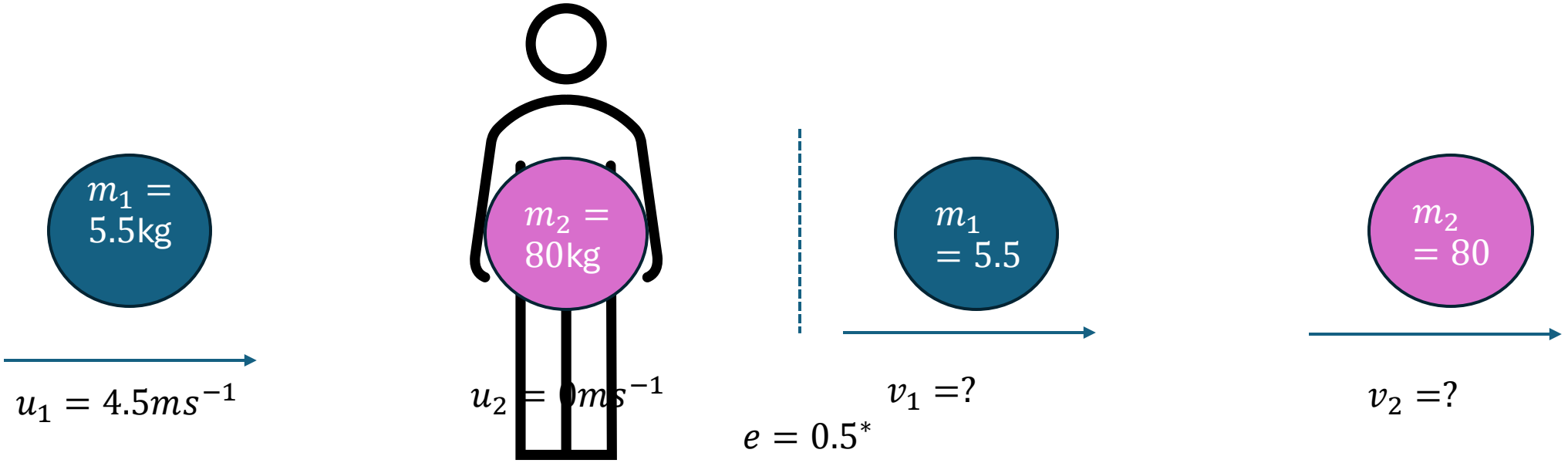
Mass ≈ 550kg

100 5. 5kg 35cm tall horses.



Mass

Velocity



Conservation of momentum:

$$5.5 \times 4.5 + 0 = 5.5v_1 + 80v_2$$

Newton's experimental law:

$$e = \frac{v_2 - v_1}{-4.5}$$

$$v_1 = -1.8ms^{-1}$$
$$v_2 = -0.4ms^{-1}$$

*References: Lorna Edelsten, Janet E. Jeffrey, Leanne V. Burginx and Richard M. Aspden, *Viscoelastic deformation of articular cartilage during impact loading, 2010*

H.C. DORGE,1 T. BULL ANDERSEN,2 H. SéRENSEN 2 and E.B. SIMONSEN 2, Biomechanical differences in soccer kicking with the preferred and the non-preferred leg, 2001*

$F = m\frac{dv}{dt}$, $\frac{dv}{dt}$ assume constant acceleration

$$\mu = 0.7^*$$

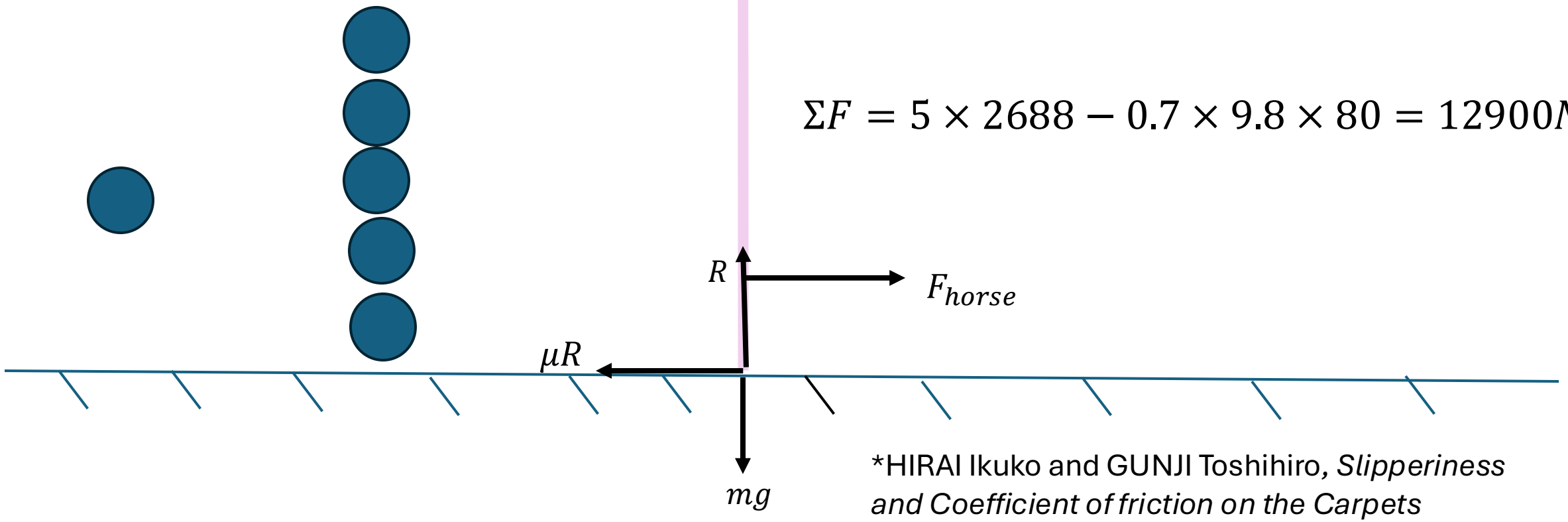
$$s = \frac{1}{2}(u+v)t.\ t = 0.009s$$

$$R = 9.8 \times 80$$

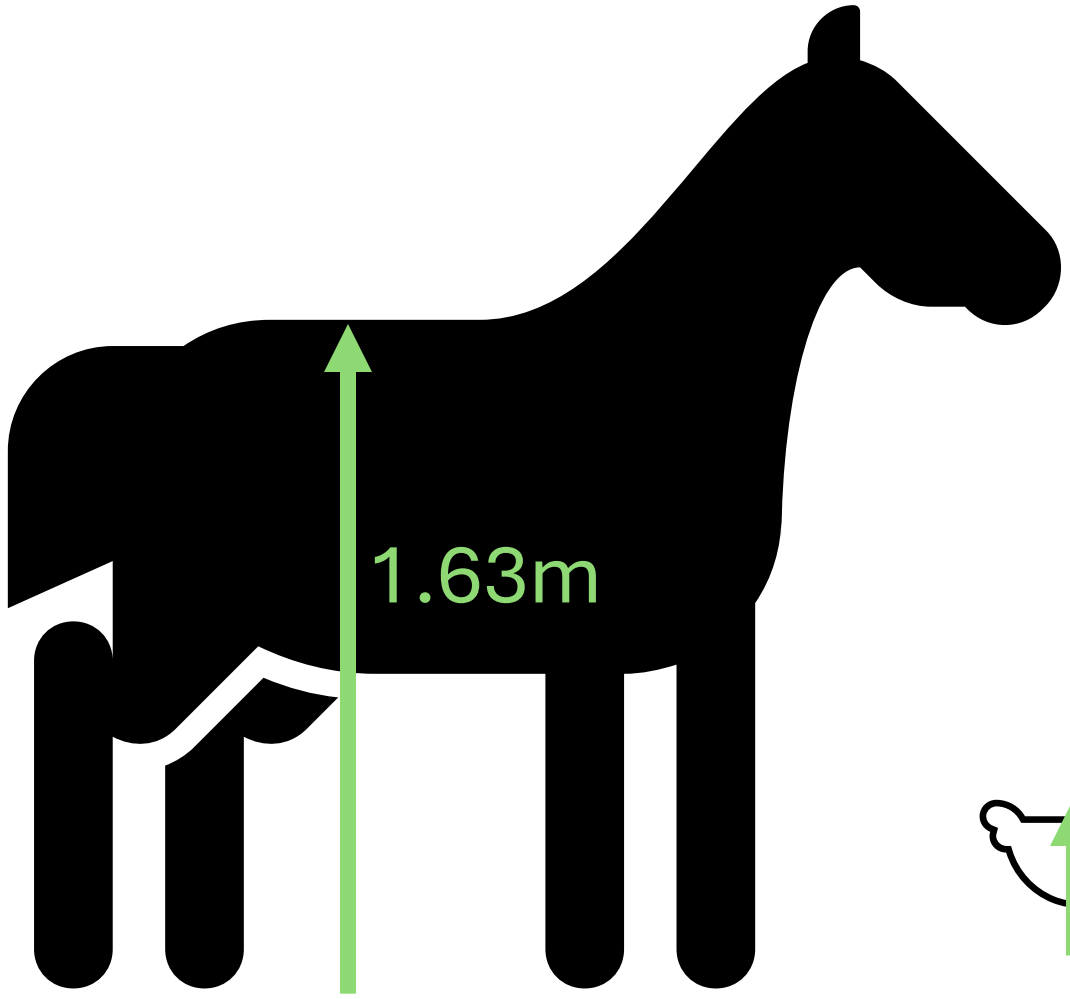
$$F_{horse} = \frac{5.5 \times 4.5}{0.009} = 2688N$$

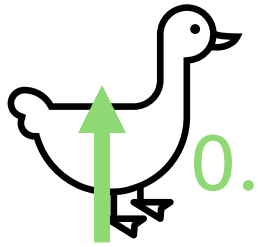
$$\Sigma F = 2688 - 0.7 \times 9.8 \times 80 = 2140N$$

$$\Sigma F = 5 \times 2688 - 0.7 \times 9.8 \times 80 = 12900N$$



*HIRAI Ikuko and GUNJI Toshihiro, *Slipperiness and Coefficient of friction on the Carpets*

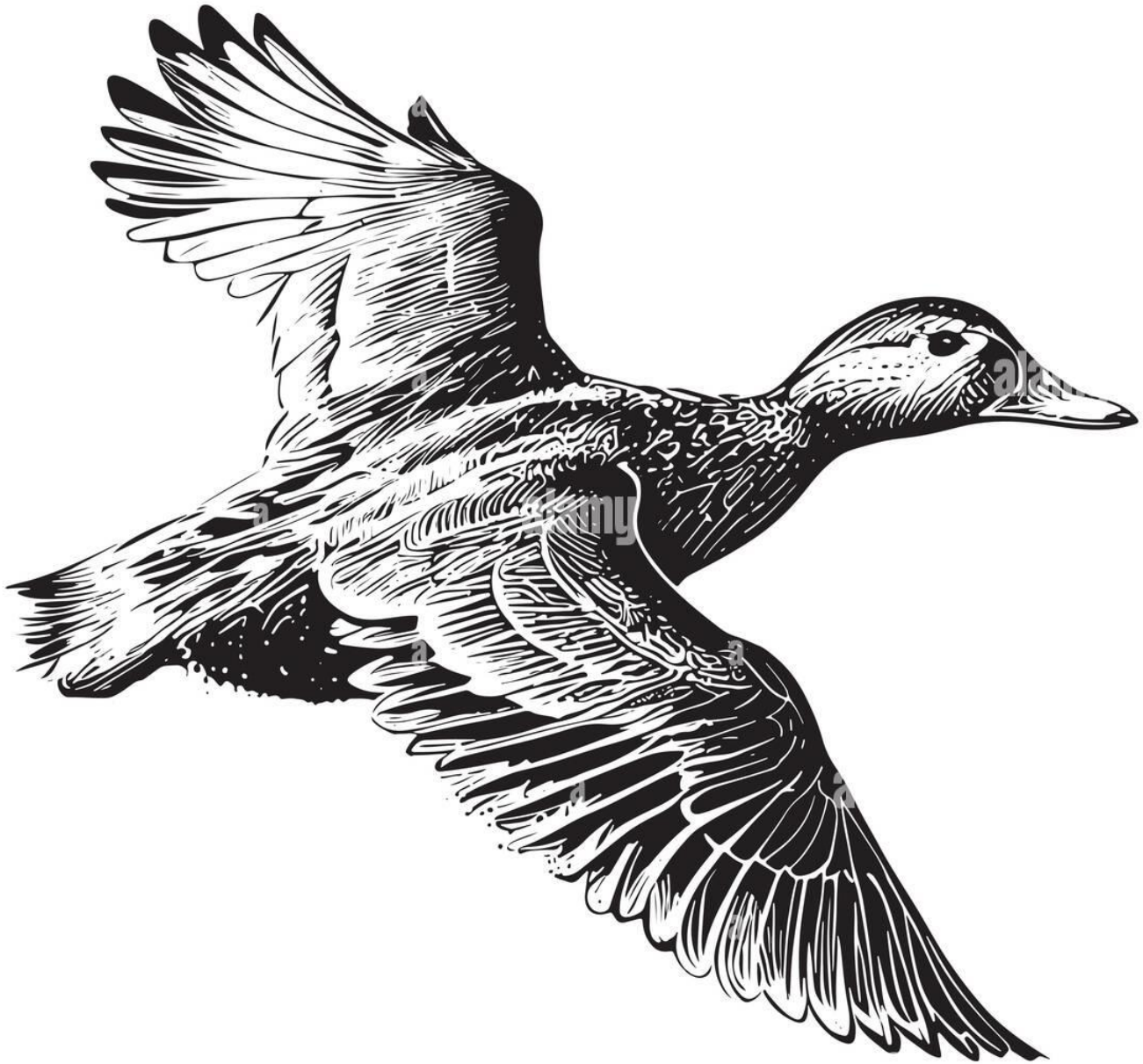




$$\frac{1.63}{0.35} = 4.66$$

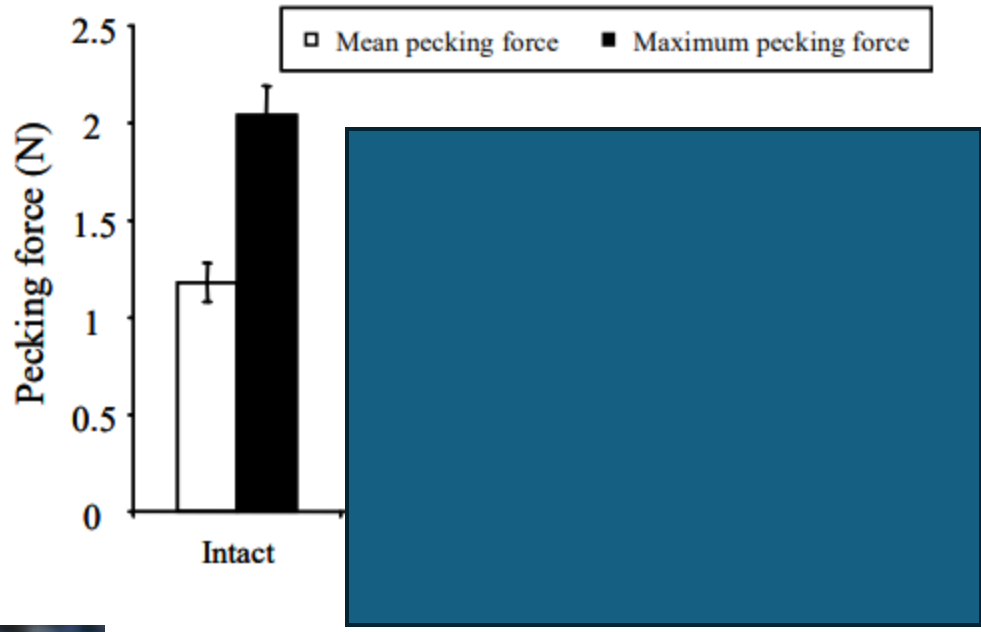
$$1.2 \times 4.66^3 = 121\text{kg}$$

Mass ≈ 1.2kg



Mallard = 70mph

$70 \times 4.66 = 326.2$mph

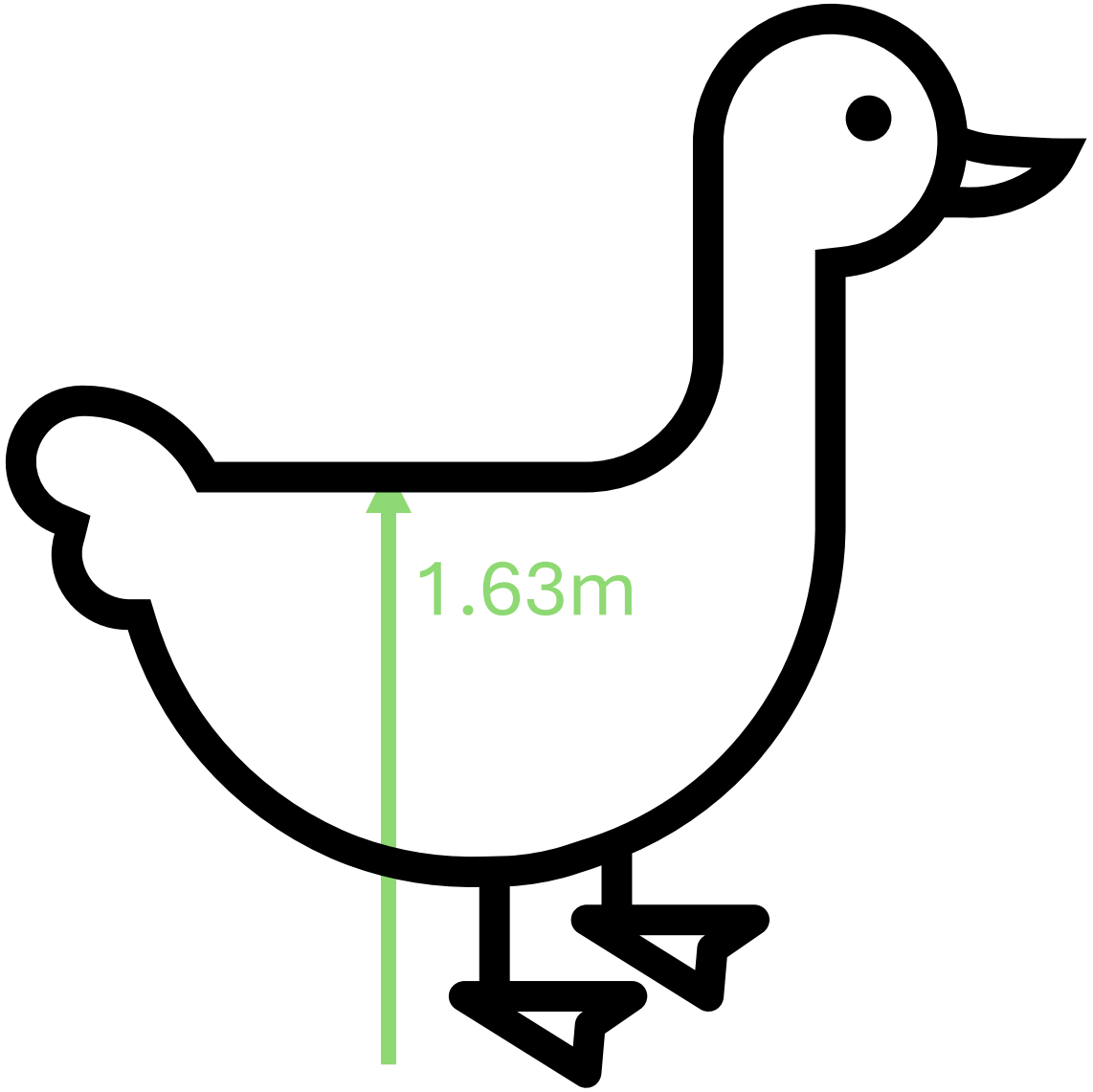


Rafael Freire*, Philip C. Glatz1 and Geoff Hinch, *Self-administration of an Analgesic Does Not Alleviate Pain in Beak Trimmed Chickens, 2008*

Force of peck:

$$2N \times 1.5 = 3N$$

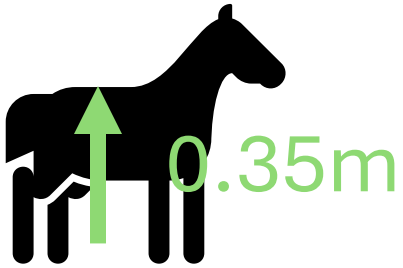
$$3 \times 4.66^3 = 303N$$



Number of pecks to 5 horses

$$\frac{12900}{303} = 42.5$$

Or 850 pecks to 100 horses.



Force of peck:

$2N \times 1.5 = 3$

$3 \times 4.66^3 = 303N$

$\Sigma F = 5 \times 2688 - 0.7 \times 9.8 \times 80 = 12900N$

Report:

Choose Duck.

Always choose duck.