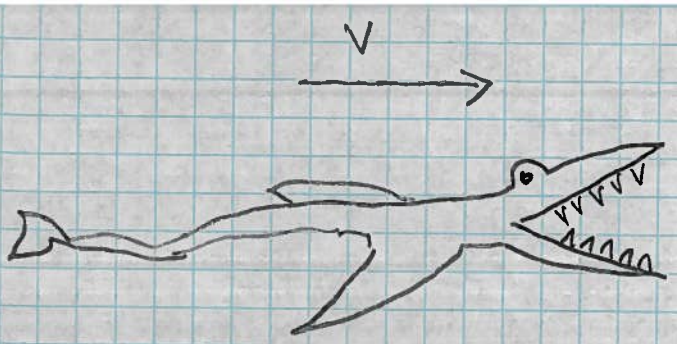
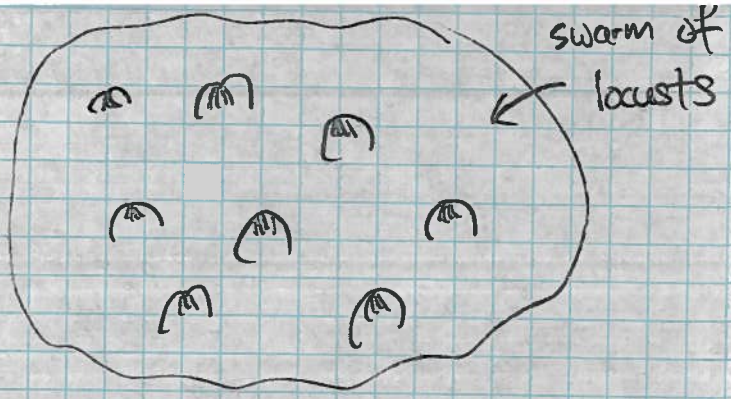




Pterodactyl coasts at $v = 10\ ^m/_s$ toward swarm of motionless locusts. Pterodactyl's mass in $M = 3$ kg, while swarm has density $\rho = 0.08\ ^{kg}/_{m^3}$. Pterodactyl opens circular mouth so $D = 0.18$ m. Thus, area of mouth is

$$\text{Area } A = \pi\left(\frac{D}{2}\right)^2 = 0.0254\ m^2$$

Pterodactyl swallows locusts so that its mass increases. After a short time, its speed has slowed to $v' = 0.8\,v = 8\ ^m/_s$.

Use cons of momentum to find new mass of pterodactyl

$$Mv + m(0) = (M+m)v'$$

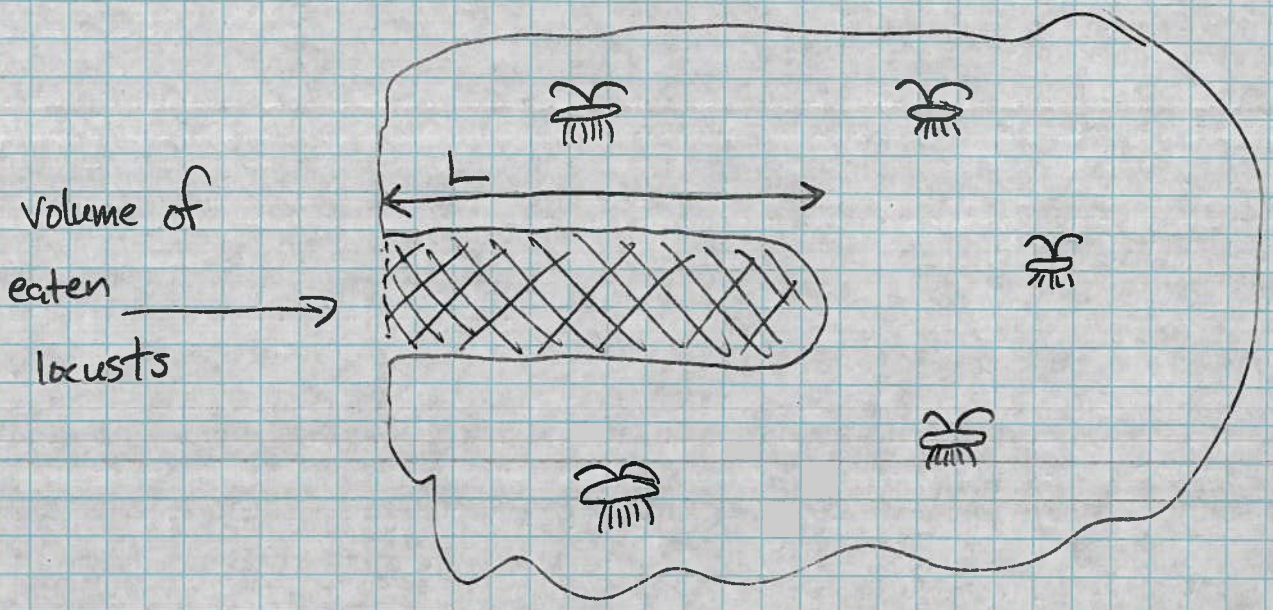
(m: mass of swallowed insects)

$$\rightarrow \quad M+m = M\left(\frac{v}{v'}\right)$$

$$= (3\text{ kg})\left(\frac{10\ ^m/_s}{8\ ^m/_s}\right) = 3.75\text{ kg}$$

$$\rightarrow \quad m = 0.75\text{ kg of swallowed locusts}$$

How far has pterodactyl flown into swarm?



$$\text{Volume} = (\text{area of mouth})\,(\text{length of travel into swarm})$$
$$= A \cdot L$$

Mass of swallowed insects is

$$m = \rho A L = 0.75\ \text{kg}$$

$$\Rightarrow L = \frac{0.75\ \text{kg}}{A \cdot \rho} = \frac{0.75\ \text{kg}}{(0.0254\ \text{m}^2)\left(0.08\ \frac{\text{kg}}{\text{m}^3}\right)}$$

$$\boxed{L = 369\ \text{m}}$$

That's a long way to go for a meal.