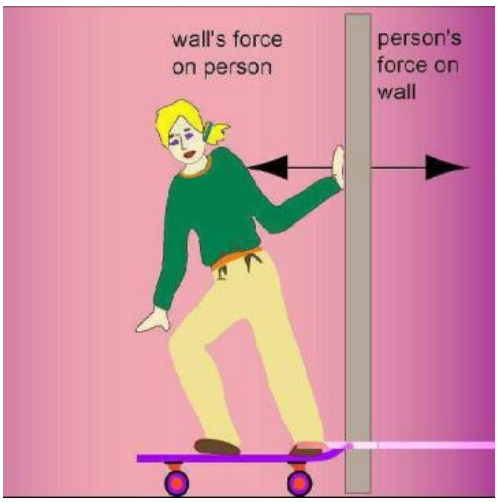
Newton's 3rd Law

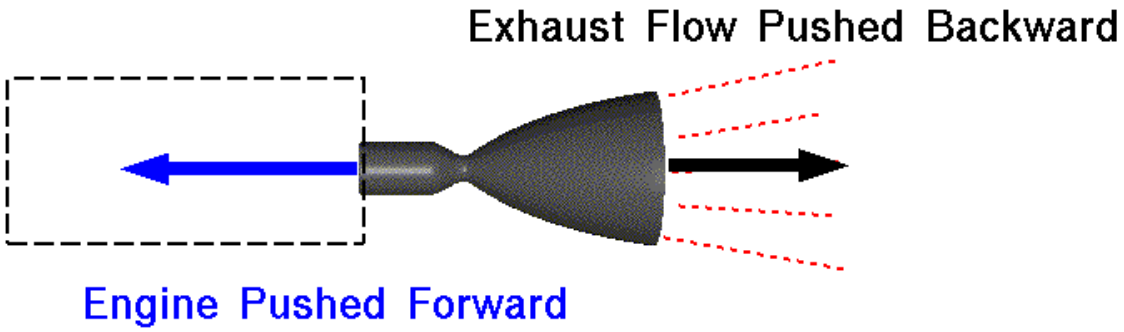
Forces only exist in pairs called action-reaction pairs.

Ex 1: A person pushes against the wall.

There is a force on the person AND a force on the wall.
Only forces acting on the person cause her to accelerate.



Ex 2: A rocket accelerates in space.



Action force:

Reaction force:

Ex 3: A swimmer

Action force:

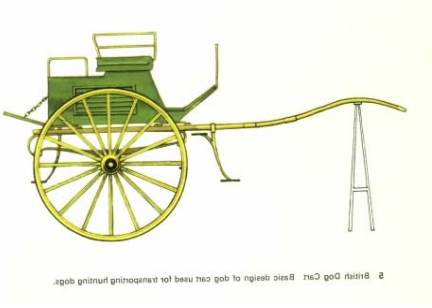
Reaction force:

Ex 4: A Horse is pulling a cart, and explains that since the cart pulls back on him with the same force with which he pulls on the cart, he will never be able to move. Why is the horse wrong?

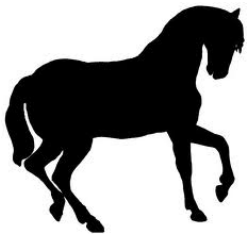

HORSE-SENSE
GIDDIUP! PULL THE CART SO WE CAN GET GOING.
FOR ME TO PULL THE CART WOULD BE A FUTILE EFFORT.
YOU SEE, IF I PULL ON THE CART, THE CART WILL PULL BACK ON ME. BY NEWTON'S 3rd LAW, THE FORCES ARE EQUAL AND OPPOSITE- SO THEY'LL CANCEL OUT. A ZERO NET FORCE WON'T GET US MOVING.
PHYSICS
PHYSICS
PHYSICS
$a_{CART} = \frac{F_{CART}}{m_{CART}}$
I DON'T CARE ABOUT THE FORCE EXERTED ON YOU. I'M INTERESTED IN THE FORCE YOU EXERT ON THE CART! YOU PULL THE CART AND I GUARANTEE IT WILL MOVE!
BUT HOW CAN I MOVE FORWARD WHEN THE CART PULLS BACKWARD ON ME?
PHYSICS
PHYSICS
PHYSICS
JUST PUSH BACKWARD ON THE GROUND. BY NEWTON'S 3rd LAW, THE GROUND WILL PUSH FORWARD EQUALLY ON YOU --- THEN I'LL SIMPLY FOLLOW ALONG!
THAT GROUND IS DOING A VERY GOOD JOB!
PHYSICS, GRUMBLE PHYSICS

Draw separate FBD

Cart



Horse



the cart.

Key Point: Action Reaction Pairs NEVER act on the same object, so they cannot cancel out.

Hwk: Read p. 142 - 144
p. 154 #53-54

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