Newton's Third Law

This is a sketch of Jerod on his skateboard. He's on his way to Newton's Skate Park. When he pushes his foot against the ground, what happens next? He moves on his skateboard in the opposite direction. How does this happen?

Action and Reaction

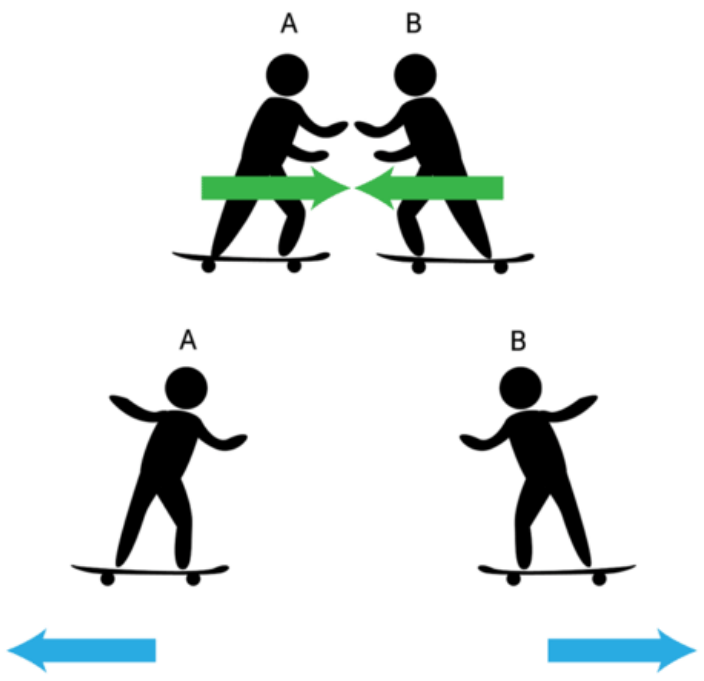
Newton's third law of motion explains how Jerod starts his skateboard moving. This law states that every action has an equal and opposite reaction. This means that forces always act in pairs. First an action occurs—Jerod pushes against the ground with his foot. Then a reaction occurs—Jerod moves forward on his skateboard. The reaction is always equal in strength to the action but in the opposite direction.

Q: If Jerod pushes against the ground with greater force, how will this affect his forward motion?

A: His action force will be greater, so the reaction force will be greater as well. Jerod will be pushed forward with more force, and this will make him go faster and farther.

Equal and Opposite Forces

The forces involved in actions and reactions can be represented with arrows. The way an arrow points shows the direction of the force, and the size of the arrow represents the strength of the force. Look at the skateboarders in the **Figure** below. In the top row, the arrows represent the forces with which the skateboarders push against each other. This is the action. In the bottom row, the arrows represent the forces with which the skateboarders move apart. This is the reaction. Compare the top and bottom arrows. They point in different directions, but they are the same size. This shows that the reaction forces are equal and opposite to the action forces.



Equal and Opposite but Not Balanced

Because action and reaction forces are equal and opposite, you might think they would cancel out, as balanced forces do. But you would be wrong. Balanced forces are equal and opposite forces that act on the same object. That's why they cancel out. Action-reaction forces are equal and opposite forces that act on different objects, so they don't cancel out. In fact, they often result in motion. Think about Jerod again. He applies force with his foot to the ground, whereas the ground applies force to Jerod and the skateboard, causing them to move forward.

Q: Actions and reactions occur all the time. Can you think of an example in your daily life?

A: Here's one example. If you lean on something like a wall or your locker, you are applying force to it. The wall or locker applies an equal and opposite force to you. If it didn't, you would go right through it or else it would tip over.