

# Rocket Carts

You can *be* a rocket!

## WHAT TO DO

Sit on the cart with your legs crossed along with one or more of the heavy rubber balls. Make sure your legs are on the cart and not touching the ground, then throw the ball as hard as you can and see what happens.

## WHAT'S HAPPENING?

Perhaps you always assumed that to make a cart (or a skateboard) move you needed to push on some fixed object like the ground or a wall, but Sir Isaac Newton's Third Law of Motion actually tells us that if you push on something it always pushes back on you (*for every action there is an equal and opposite reaction*)- and it doesn't matter what you push. When you throw the ball you are really applying a force or pushing it to make it move, thus it pushes back on you with an equal and opposite force, causing you (and the cart you're sitting on) to move backwards. The forces on both you and the ball are exactly equal, but because the ball has much less mass than you (and the cart), the ball gets a much greater acceleration and so it moves a lot faster. But you also move, just much more slowly. This is actually Newton's Second Law of Motion ( $\text{force} = \text{mass} \times \text{acceleration}$ ). To throw the ball faster you need to use more force, so you and the ball both move faster. And to throw a larger ball (which has a greater mass) you must push it a lot harder, so it pushes back on you a lot harder as well and you'll move even faster. Now you know how to go fast enough to win the race- good luck!