Two people sitting on frictionless carts of negligible mass. Play catch with a 0.50 kg ball. Suppose Ted, whose mass is 100. kg, launches the ball toward the right at 20. m/s. Linda, whose mass is 50. kg catches the ball and throws it back at 20. m/s to Ted.

Determine the speed of Ted and Linda after Linda has thrown the ball back to Ted, but before Ted catches the ball.

Ted launch

$$p = 0 = p_{Ted} + p_{ball}$$

$$0 = (100.\,kg)\,v + 0.50\,kg\,(20.\,m/s)$$

$$\boxed{V_{Ted} = -1.0\,E\text{-}1\,m/s}$$

Linda Catch

$$p_0 = p$$

$$p_{ball} = p_{ball + Linda}$$

$$0.50\,kg\left(20.\,m/s\right) = p_{ball + Linda}$$

Linda Throw

$$p_0 = p$$

$$p_{ball + Linda} = p_{ball} + p_{Linda}$$

$$0.50\,kg\left(20.\,m/s\right) = 0.50\,kg\left(-20.\,m/s\right) + 50.\,kg\ V$$

$$\boxed{4.0E\text{-}1\,m/s = V}$$