Ball A of mass *m* is moving along x-axis with kinetic energy of *K* and momentum *p*. It undergoes elastic collision with a stationary ball B of mass *m*, after the collision the ball A moves along negative x-axis with kinetic energy *K/9*. Find the momentum of B.

Solution: Kinetic energy of the ball A before the collision was $K = \frac{m \cdot v_0^2}{2}$, where v_0 is the speed of the ball before the collision. After the collision it became equal to $K' = \frac{m \cdot v_A^{\,2}}{2}$, where v_A is the speed of the ball after the collision. From the initial conditions we see, that $K' = \frac{K}{9}, \frac{K}{K'} = 9, \left(\frac{v_0}{v_A}\right)^2 = 9, v_A = \frac{1}{3} v_0$.

The momentum of the ball A before the collision was $p_{A0} = m \cdot v_0 = p$, and after the collision it became equal to $p_A = -m \cdot v_A = -m \cdot \frac{1}{3} \cdot v_0 = -\frac{1}{3} p_{A0}$ (minus sign means, that after the collision ball changed the direction of the movement to opposite). According to the law of conservation of the momentum, total momentum of balls A and B before the collision should be equal to total momentum after the collision: $p_{A0} + p_{B0} = p_A + p_B$. Ball B didn't moved before the collision, it means that $p_{B0} = 0$.

Then, momentum of the ball B after the collision is: $p_B = p_{A0} - p_A = p_{A0} - \left(-\frac{1}{3} p_{A0}\right) = \frac{4}{3} p_{A0} = \frac{4}{3} p$.

Answer: $\frac{4}{3} p$.