A man and his seven-year-old child are facing each other on ice skates on ice (frictionless). With their hands, they push off against one another. How does the magnitude of the pushing force experienced by the child \((F_c)\) compare with that experienced by the father \((F_f)\).

1) \(F_c < F_f\), because \(F=ma\) and mass of father is greater than that of the child.

2) \(F_c = F_f\), because action equals reaction according to Newton's 3rd law.

3) \(F_c > F_f\), because the mass of father is greater than that of the child, the amount of force that the father can exert on the child is much greater than that of the child.

4) None of the above, to compare the force magnitudes we need to know the associated accelerations first.
Now that you know the forces experienced by the father and the child are equal. If the man and his seven-year-old child were initially standing in the middle of a 200m wide frozen lake. After pushing off against one another, they each start to move off towards opposite edges of the lake. Who shall reach the edge of the lake first? Ignoring all forms of friction.

1) The child will reach the edge first. As the forces experienced by the father and the child are equal, the smaller mass child will have a larger acceleration, and therefore reach the edge first.

2) Both father and child reach the edge simultaneously. As the forces experienced by the father and the child are equal, the forces act to accelerate them equally, and therefore they'll both reach the edge at the same time.

3) The father will reach the edge first. As the forces experienced by the father and the child are equal, the larger mass father has larger kinetic energy and accelerates faster towards the edge.