**Activity 2.6.3 – Crossing Lake James**

Transportation problems provide great opportunities for mathematical modeling. One interesting scenario emerges when a person wants to minimize their travel time when traveling using two different modes of transportation.



Lisa is traveling across Lake James to meet a friend. To reduce her travel time, rather than biking around the lake, she decides to cross the lake by boat and then ride her bike on the road. So, beginning at point A, she will boat to point P, and then ride her bike to point C. The perpendicular distance from point A to the beginning of the road (point B) is 6 miles. Her average speed by boat is 6 miles per hour; her average speed by bike is 12 miles per hour. The total travel time is the time it takes Lisa to boat from point A to point P and then ride from point P to point C.

1. Create an expression for the amount of time it takes for Lisa to travel from point A to point P.
2. How far from point B should Lisa boat to if she only wants to travel by boat for 2 hours?
3. Create an expression for the amount of time it takes for Lisa to travel from point P to point C.
4. Create a function for Lisa’s total travel time in terms of *x*.
5. What would Lisa’s total travel time be if *x* = 0? What happened in this situation?
6. What would Lisa’s total travel time be if *x* = 20? What happened in this situation?
7. Find the value of *x* that would lead to a total travel time of 3 hours?
8. Use the graph of the total travel time function to find the value of *x* that minimizes the total travel time? Explain how you arrived at your answer.

**Crossing Jewell Park**

Jeff needs to get to the store as quickly as possible to buy some items before the store closes. He decides to walk through Jewell Park and then walk on the street. The perpendicular distance from his house to the street is 1 mile, and the store is located 2 miles down the street. Jeff can walk through the park at a speed of 1.5 miles per hour and can walk along the street at a speed of 2.5 miles per hour.



1. Create a function for Jeff’s total travel time in terms of *x*.
2. What would Jeff’s total travel time be if *x* = 1?
3. Find the value of *x* that would lead to a total travel time of 1.4 hours?

1. Use the graph of the total travel time function to find the value of *x* that minimizes the total travel time? Explain how you arrived at your answer.
2. Create a new problem situation similar to Lisa crossing Lake James and Jeff crossing Jewell Park that involves two modes of transportation with different speeds. Construct a model for the total travel time and find an optimal solution to your problem.