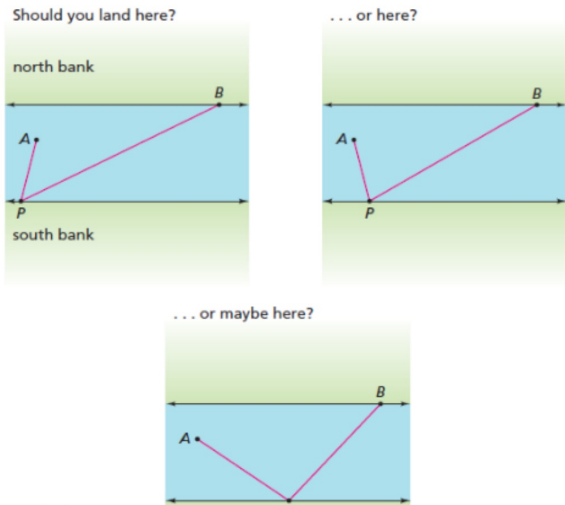


**Launch:**

Imagine that you are motorboating on a river and you need fuel. First you must drop a passenger off on one river bank. Then you must refuel at a station on the other river bank.

Below are some pictures of the situation. The boat is at *A*. After you drop the passenger off at *P*, you will refuel at *B*. You can choose the location for *P* anywhere along the south bank. Because you are low on fuel, you want to minimize the length of the path you travel.

p.631



## 8.2 Finding the Shortest Path

Objective: Choose points that result in the minimum length for a path

**Minds in Action** episode 37

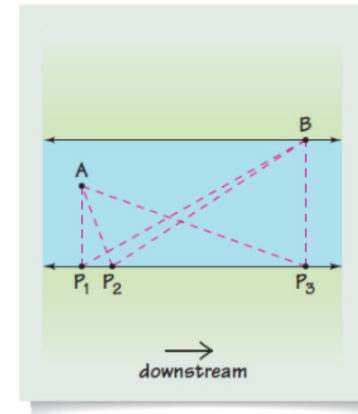
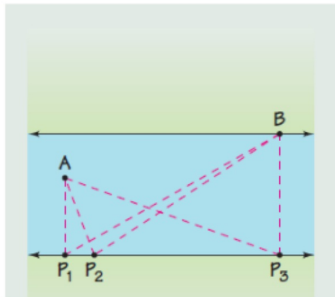
Tony and Sasha think about the refueling problem.

**Sasha** If you are traveling downstream, there's no way that you'd go back upstream from *A* to drop off the passenger before refueling.

**Tony** And you'd never go farther downstream than the fuel station at *B*.

**Sasha** So the best solution has to be somewhere downstream from *A* and upstream from *B*.

**Tony** Let's try some different places for *P*. We can measure to see what happens to the total distance traveled as we move *P* from left to right.



**Sasha** The path through *P*<sub>1</sub> directly below *A* is about 63 mm. The path through *P*<sub>3</sub> directly below *B* is about 68 mm. The path through *P*<sub>2</sub> measures 59 mm. The best path has to be somewhere between *P*<sub>1</sub> and *P*<sub>3</sub>.

## For You To Do:

Trace the river lines and points A and B on p.632

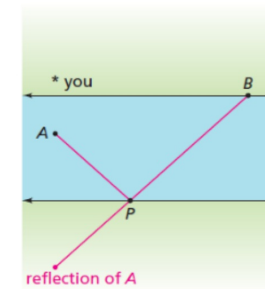
1. Try some different places for point P and use a ruler to measure the total distance in mm.
2. What is the shortest distance you can get?
3. Do you notice anything about the location of point P?

## Developing Habits of Mind

p.633

**Visualize.** Here is another way to think about the refueling problem. When you look into a mirror, an object's reflection appears to be the same distance from the mirror as the real object. However, the reflection appears to be on the opposite side of the mirror from the real object. This makes the image and the real object symmetric with respect to the mirror.

Picture a mirror along the south bank of the river. You are standing on the north bank looking across the river.

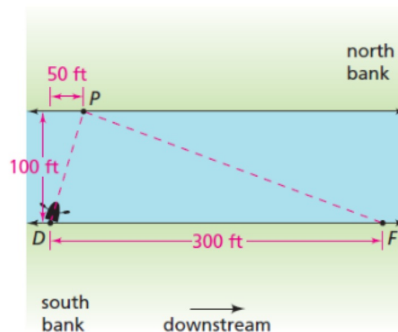


You can make the path from the *reflection of A* to B as short as possible by connecting the two points with a line segment. The point where this path crosses the south bank is also the point that minimizes the trip from A to P to B.

## On Your Own page 634 #1&4

Use the figure below for Exercises 1–3.

You are in a rowboat, docked on the south bank of a river at D. You have to drop off a passenger on the north bank and then return the boat at F.



1. Find the total distance you have to row if the drop-off point P is 50 feet downstream from D. Assume that you can row in a straight line in spite of the river's current.  
If P were  $x$  feet downstream, what would be the length of the path?

## On Your Own

4. **Write About It** Returning from picking berries near a campground, you find your tent on fire. Luckily, the river is nearby. You must quickly empty your berry bucket and figure out at which point P you should fill your bucket with water to minimize the distance you travel. Write about methods you could use to find the shortest path from where you are, to the river, and then to the tent.

