Brigitte’s Boating Adventure

Brigitte is enjoying rowing her sturdy boat across Blue Lake on a sunny morning. Suddenly, the boat strikes a rock, making a small crack in the hull (the body of the boat).

Water begins to leak into the boat; 3 litres of water leaks in during each minute of time.

But Brigitte’s boat is equipped with a small pail and so she can alternate rowing the boat and bailing out the water to keep the boat afloat while she returns to the dock.

(a) If Brigitte does not bail any water out of the boat, how much water would there be in the boat after 1 minute? What about after 30 minutes?

(b) But of course, Brigitte does bail water out of the boat. Using her pail, she removes 1.4 litres during each minute. How many litres of water remain in the bottom of the boat after 1 minute? What about after 30 minutes?

(c) Over each of the next 30 minute periods, the amount that you found in part (b) is added to the water in the bottom of the boat. While alternately bailing and rowing, Brigitte keeps the boat moving toward shore at 2 km per hour.

Alas, despite her efforts, the boat sinks in shallow water just at the end of the dock, at which point it contains a total of 144 litres of water.

Can you use this information to figure out how far away from the end of the dock Brigitte was when the boat struck the rock? Complete the table on the right to help answer this question.

The elapsed time is the time since the boat hit the rock.

<table>
<thead>
<tr>
<th>Time (hr) Elapsed</th>
<th>Water (L) in Boat</th>
<th>Distance (km) Rowed</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td></td>
<td>1 km</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>2 km</td>
</tr>
</tbody>
</table>

Challenge:

Suppose that Brigitte’s boat had hit the rock 1 km further from the dock than you found in part (c) above. The boat still takes on the same amount of water each minute as before (3 litres) and the boat will still sink once it is holding 144 litres of water.

Brigitte bails faster this time and so she has less time to row. This results in the boat moving at only 1 km per hour. How many litres of water would Brigitte have to bail out of the boat during each minute in order to just reach the dock before the boat sinks?

Hints:
1. How many minutes will the boat now take to reach the dock?
2. How quickly will the boat need to fill to reach 144 litres of water by this time?

More info: Check out the CEMC at Home webpage on Tuesday, May 12 for a solution to Brigitte’s Boating Adventure.