# 3.6 Test your bathtub thinking skills: quiz #1

How good are you at anticipating how stocks accumulate, dissipate and change over time? This is a key systems thinking skill because stocks are at the heart of causality and are key drivers of complexity. By anticipating how stocks evolve, we can answer some systems questions such as how quickly will a limit or a tipping point be reached, or how long can the stock buffer us from outside shocks or how soon will a situation recover?

Answering these questions requires "bathtub thinking", no doubt the trickiest of our ten systems thinking skills. In this unit you will pass the first of two tests to see how well you intuitively understand accumulations. Each of the tests has already been tested on large groups of students and practitioners. I'll give you the answer, a short explanation and I'll let you know how the others that previously sat the test went after each test. Ok, let's get started.

The first test involves interpreting a chart using our understanding of how things accumulate. This graph shows the number of people entering and leaving a department store over a 30 minute period. You should answer two questions:

1. During which minute were the most people in the store?
2. During which minute were the fewest people in the store?

Now, pause the video and answer these two questions.

Here are the correct answers. I'll explain why.

To answer the first question you need to consider the number of people in the store as a stock. The stock accumulates the difference between the people entering and the people leaving the store. Drawing a stock and flow diagram may be useful. Let's add some numbers. During the first minute fourteen people entered the store and ten people left. The difference of four people accumulates in the stock of people in the store. People accumulated in this way for as long as the inflow of people entering was greater than the outflow of people leaving. This happened until the $13^{th}$ minute. Beyond that point there was a net flow of people leaving the store. The answer to question one is "minute 13". Only 42% of students from the prestigious MIT who sat this test answered this question correctly and 17% said that it can't be calculated.

To answer the second question we need to compare the areas between the two curves before and after the thirteenth minute. Why is that? Well, the area between the inflow and outflow curves represents the net accumulation into the stock or the dissipation of the stock. The area is simply the difference between the inflows and outflows over a period of time. For each of the first thirteen minutes, more people entered the store than left it. The area between the curves over this period represents the number of people being added to the stock. After the $13^{th}$ minute, the trend flips. The leaving curve is greater than the entering curve from the $14^{th}$ to the $30^{th}$ minute and this negative net flow drains the stock. We can see that the amount of draining is greater than the amount of accumulation which means that there are fewer people in the store at the end of minute 30 than there were at any other time. Here, only 30% of MIT students answered this question correctly and 28% said that it can't be determined. So, how did you go?