

# The Furniture Challenge Problem

*Seventh and Eighth Grade Math*



**Developed by:**

The teachers, students, and mentors in the  
Gaming Research Integration for Learning Laboratory® (GRILL®) Summer 2015

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## 1. THE FURNITURE PROBLEM

Problem 1:

Primary Resource: Thinking Mathematically (Mason, Burton, and Stacey)

Adapted by: Emilly Collins and Chris Vanderhorst

Problem 2:

Created by Emilly Collins

### 1.1. INTRODUCTION

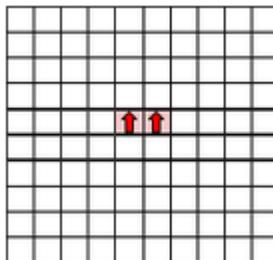
Nearly every year, 14.9% of people will change residences. In the US this equates to 47.51 million people moving each year or 3.96 million people moving every month. The majority of the time people will bring all of their needed furniture with them and re-arrange it all to fit into their new home. This creates difficulty as some do not know what furniture they will place in each room or where they will place it.

The Timmermans are rearranging their living room. Some limitations are making the moves difficult. They are not sure if some of the moves are even possible. It is your job to find out if the moves are possible or not and then make your argument to the Timmermans.

### 1.2. PROBLEM

#### 1.2.1. ARMCHAIR

A very heavy armchair needs to be moved, but the only possible movement is to rotate it



through 90 degree rotations about any of its corners. Can it be moved so that it is exactly beside its starting position and facing the same way?

Figure 1: This is an example of a model that illustrates the before and after of the chair.

### 1.2.2. COUCH

A very heavy couch needs to be moved in the smallest amount of moves possible. Can you get the couch from the start position to the finish position using only flips, slides, and rotations?

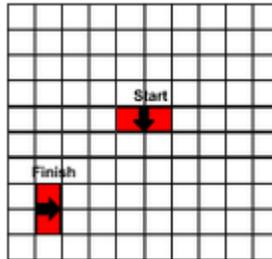


Figure 2: This is an example of a model that illustrates the start and finish for the couch.

### 1.3. PARAMETERS

- Problem 1
  - Use a model.
  - Record the possible moves to try to find a pattern.
  - Explain what points can a fixed corner of the chair reach.
  - Make a conjecture and explain it.
- Problem 2
  - Use a model.
  - Record the possible moves.
  - Explain in details how you made your moves including points or rotations, slides, and rotations. Include distances.
  - Make a conjecture and explain it.

### 1.4. PROJECT WRITE-UP

- Problem 1
  - The model used with possible moves and patterns.
  - An explanation of what points a fixed corner of a chair can reach.
  - An explained conjecture with evidence.
- Problem 2
  - The model used with possible moves and patterns in details.
  - An explained conjecture with evidence.

## 1.5. RUBRIC

Category	Components	Points Earned	Comments
<i>Final Write-Ups</i>	<ul style="list-style-type: none"> <li>- All components listed under “Final Write Up” sections from each problem are addressed with details</li> <li>- Answers are clear and concise with evidence for each problem</li> </ul>	/25	
<i>Model</i>	<ul style="list-style-type: none"> <li>- Both models are represented</li> <li>- Both models include the moves and the detailed description of the moves</li> </ul>	/15	
<i>Grammar and Mechanics</i>	<ul style="list-style-type: none"> <li>- Correct grammar and mechanics</li> <li>- Units are used properly and appropriately</li> <li>- Layout is simple and easy to follow</li> </ul>	/10	
<i>Total</i>		/50	