

Monopoly - Part 1

Student Investigation

7 8 9 10 11 12



TI-Nspire™



Activity



Student



90 min

Introduction

Monopoly™ is one of the most popular board games in the world. The game is so successful it has become an eponym for the definition: “exclusive possession or control”, evident via a simple internet search on the word *monopoly*. Most people have their favourite property set to collect; most commonly the blue property set adjacent to GO. At \$350 and \$400 they are the most expensive on the board. Are these properties really the best?

If you're going to be a property tycoon, you should do your research before investing. First. This three-part investigation looks at different ways to explore which properties on the Monopoly board represent the best value for money and arm you with mathematically based strategies before you roll the dice in your next game.



Equipment

- Monopoly board game
- TI-Nspire Calculator

Instructions

Start a new TI-Nspire document and insert a spreadsheet.

Create the following list names:

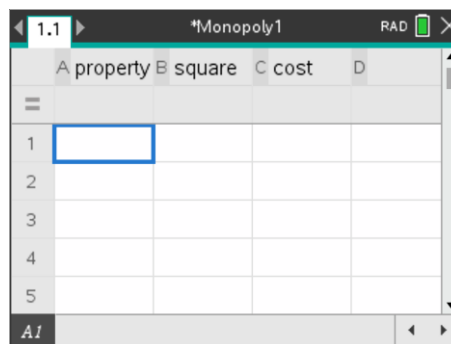
- Property
- Square
- Cost

Save the file as: Monopoly1

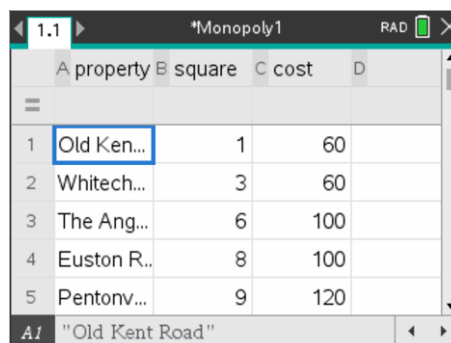
In this investigation ONLY property prices will be recorded, utilities and railroads will not be included. The “GO” square represents 0, so the first property appears on the first space, the second property is on the third and so on.

Record the name, location (square) and cost for all the available properties on the board. The first side of the board has been completed in the spreadsheet shown opposite.

Note: Property names may vary depending on the game version.



	A property	B square	C cost	D
1				
2				
3				
4				
5				



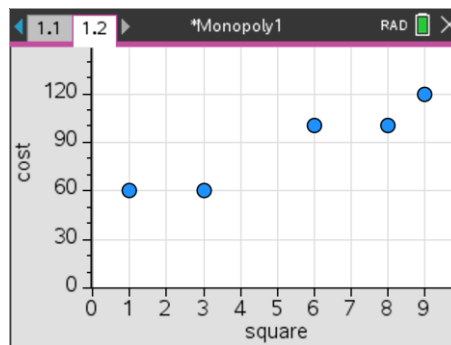
	A property	B square	C cost	D
1	Old Ken...	1	60	
2	Whitech...	3	60	
3	The Ang...	6	100	
4	Euston R...	8	100	
5	Pentonv...	9	120	

Question: 1.

Describe the general trend for property prices as a player progresses around the board.

Insert a Data & Statistics application and produce a scatter plot with **square** on the independent (horizontal) axis and **cost** on the dependent (vertical) axis.

Data for the first side of the board is shown opposite.



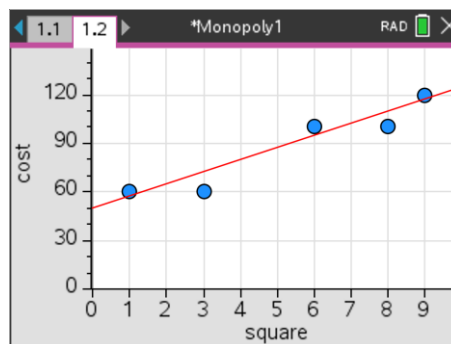
By default the graph zooms in on the data being displayed. For this data, zero will not be displayed on the *square* or *cost* axes. Use the Window - Zoom option to adjust x-min and y-min to include zero. Including the zero on both axes helps identify the relative location of the data points and therefore understand the relationship.

It is not possible for a single straight line to pass through all the data points, however you can imagine a straight line passing as close as possible to data points, this is referred to as a “line of best fit”.

Determine, by approximation only, the equation to a line that would best represent or fit the data. This equation can be changed manually by experimentation.

To graph your equation press: **Menu > Analyse > Plot Function**

A line representing the first couple of data points has been shown opposite; the equation itself has been hidden.



Question: 2.

Explain how you determined your original equation, the subsequent adjustments you made and record your final equation.

ie: What estimates were made to help determine the gradient and y intercept of your equation(s)?



By default the plotted function is recorded in f1(x). This function can be called upon in any application within this problem. Example in the calculator application type: f1(11) to estimate the value of the first property on the second side of the board.

Question: 3.

Reproduce the table below for **all sides** of the Monopoly board. Record the actual and estimated property values (estimated from your rule). [Difference = cost - estimate]

Spaces	1	3	6	8	9	11	13	14
Actual	60	60	100	100	110	140	140	160
Estimate								
Difference								

Question: 4.

Calculate and record the 'mean' difference. Explain why this calculation is not a true representation of the accuracy of your line.

Question: 5.

Square all the differences, compute the *mean* of the squared values and then *square-root* the result.

- (i) Record this new computed value.
- (ii) Explain the effect that 'squaring' has on the differences.
- (iii) Explain why the 'square-root' step is included.

**Question: 6.**

Return to the Statistics application. From the **Analyse** menu, select **Residuals** followed by **Show Residual Plot**. Move the cursor over the data points on this plot. What does this plot represent?



Click on a point in the residual plot to see the corresponding point in the scatter plot.

Question: 7.

From the **Analyse** menu select **Regression** followed by **Linear Regression**. Explain what this line does and compare it to your line including specific reference to the 'residuals'.

Question: 8.

Does the relationship between the property price and distance from 'GO' provide any information about which property represents the best value?

Question: 9.

Explain why the property prices (and perceived value) might increase as a player progresses around the board.