Monopoly – Part 1

Student Activity

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. While the word monopoly means 'exclusive possession or control', a quick internet search of the word most frequently references the game than the definition. When playing the game, most people have their favourite property set to collect; without doubt, the most popular property set is the blue pair adjacent to Go. At $350 and $400 they are the most expensive on the board, but do these properties represent value for money? If you're going to be a property tycoon, then it is worth doing your homework first. This investigation looks at different ways to explore which properties on the Monopoly board represent the best value for money.

Equipment

- Monopoly Board
- TI-Nspire Calculator

Instructions

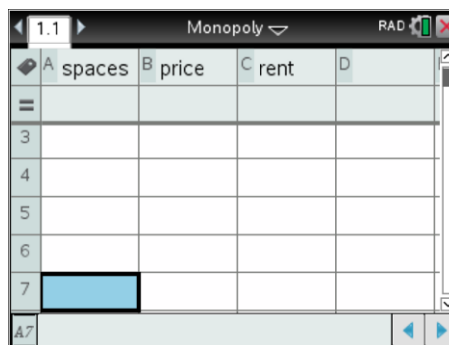Start a new TI-Nspire document and insert a spreadsheet.

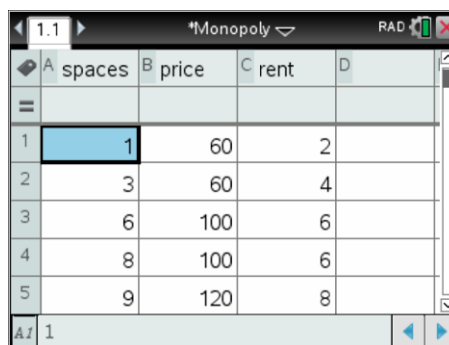Create the following list names:

- Spaces
- Price
- Rent

Save the file as: "Monopoly"

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 on the third and so on.

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

Question: 1.

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

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

Data for the first side of the board is shown opposite, the axis have been adjusted using the Window Zoom option so as to include the origin.
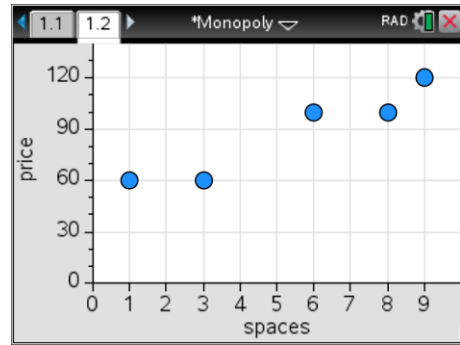
> By default the graph zooms in on the data being displayed. For this data, zero will not be displayed on the *price* or *space* axes. Use the Window - Zoom option to adjust x-min and y-min to include zero. Including the zero on both axes helps identify the relative location of the data points and therefore understand the relationship.

Imagine a straight line passing as close as possible to all the data points. (It is not possible for a single straight line to pass through all the points).

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.

A line representing the first couple of data points has been shown opposite, the equation itself has been hidden.
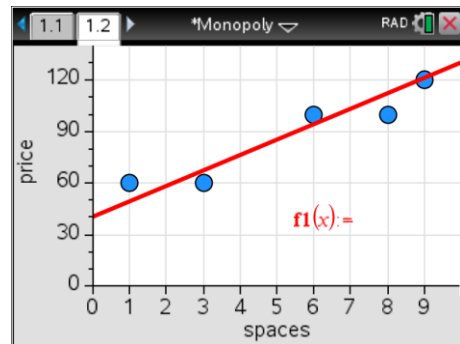
Question: 2.

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 the original equation?)

> By default the plotted function is recorded in f1(x). This function can be called upon in any application within this problem. For example in the calculator page 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) in the table. [Difference = Estimate - Actual]

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

Author: P. Fox

TEXAS INSTRUMENTS

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, compare it with 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.

Investigate the relationship between property price and rental return.

(i)   Determine an equation of best fit for the data and comment on how accurately your equation models the data.

(ii)   If a property lies below the line of best fit, what does it suggest about either its price or rental return.

(iii) As properties occur in groups, which property group represents the best value for money? Justify your answer.

(iv)   If the railroad sites were changed to 'properties' determine the following:

a.   Individual property price for each railroad, based on its location.

b.   Rental return for each property, based on its price.

Author: P. Fox