 Interpolating and extrapolating

Student activity

Least squares regression line of best fit and interpolating and extrapolating

Activity 1

Regression analysis using a calculator

Part 1

Find the equation of the least squares line of best fit, and then find the line to a scatterplot.

For this activity, you will need the following files:

* data-file-1.xlsx
* how-to-guide-calculator-regression-analysis.docx

Steps:

1. For data sets 1, 2 and 3, find the equation of the line of best fit using a calculator. (Refer to the how-to guide)
2. Record your equation in the table below.
3. Construct a scatterplot of the data set.
4. Fit the least squares line of best fit by plotting the $y$ intercept and using the gradient to plot two more points.

| Data set | Equation of the line of best fit |
| --- | --- |
| 1 |       |
| 2 |       |
| 3 |       |

Part 2 – interpolating and extrapolating

Using the line of best fit

Estimate the missing values in the table below by interpolating or extrapolating using the line of best fit. State if this is an example of interpolating or extrapolating.

| Data set | Variable 1 | Variable 2 | Interpolating or extrapolating? |
| --- | --- | --- | --- |
| 1 | 25 |       |       |
| 1 | 42 |       |       |
| 1 |       | 30 |       |
| 2 | 45 |       |       |
| 2 |       | 22 |       |
| 3 | 27 |       |       |
| 3 |       | 65 |       |

Using the equation of the least squares regression line

Recalculate the missing values by substituting the known value into the equation of the least squares line of best fit. Show your working out.

| Data set | Variable 1 | Variable 2 |
| --- | --- | --- |
| 1 | 25 |       |
| 1 | 42 |       |
| 1 |       | 30 |
| 2 | 45 |       |
| 2 |       | 22 |
| 3 | 27 |       |
| 3 |       | 65 |

Activity 2

Regression analysis using digital technology (Excel, Geogebra or Desmos)

Part 1

Find the equation of the least squares line of best fit and then fit the line to a scatterplot.

For this activity, you will need the following files:

* Data-file-1.xls
* how-to-guide-Desmos-regression-analysis.docx
* how-to-guide-MS-Excel-regression-analysis.docx

Steps:

1. For data sets 7, 8 and 9, construct a scatterplot using technology.
2. Add a least squares regression line.
3. Record your equation in the table below.

| Data set | Equation of the line of best fit |
| --- | --- |
| 7 |       |
| 8 |       |
| 9 |       |

Part 2 – interpolating and extrapolating

Using the line of best fit

Estimate the missing values in the table below by interpolating or extrapolating using the line of best fit. State if this is an example of interpolating or extrapolating.

| Data set | Variable 1 | Variable 2 | Interpolating or extrapolating? |
| --- | --- | --- | --- |
| 7 | 95 |       |       |
| 7 |       | 23 |       |
| 8 | 2 |       |       |
| 8 |       | 23 |       |
| 9 | 30 |       |       |
| 9 |       | 30 |       |

Using the equation of the least squares regression line

Recalculate the missing values by substituting the known value into the equation of the least squares line of best fit. Show your working out.

| Data set | Variable 1 | Variable 2 |
| --- | --- | --- |
| 7 | 95 |       |
| 7 |       | 23 |
| 8 | 2 |       |
| 8 |       | 23 |
| 9 | 30 |       |
| 9 |       | 30 |

Activity 3

Practical questions

Choose your preferred method to construct a scatterplot with the least squares line of best fit graphed and its equation recorded.

You will need the following file open:

* Data-file-2.xls

Data Set 1 Engine Size and Fuel Use:

| Question | **Graphical method** | **Algebraic method** |
| --- | --- | --- |
| Equation of the line of best fit |  |  |
| Estimate the fuel use of a car with an engine size of 4L |  |  |
| Estimate the engine size of a car with an average fuel use of 8km/L |  |  |

Data Set 2 Goods Manufactured and Energy Costs:

| Question | **Graphical method** | **Algebraic method** |
| --- | --- | --- |
| Equation of the line of best fit |  |  |
| Estimate the monthly energy costs if 550 goods are manufactured |  |  |
| Estimate the number of goods manufactured if the monthly energy cost is $2000 |  |  |

Data Set 3 Height and Arm Span:

| Question | **Graphical method** | **Algebraic method** |
| --- | --- | --- |
| Equation of the line of best fit |  |  |
| Estimate the height of a person with an arm span of 160cm |  |  |
| Estimate the arm span of a person with a height of 180cm |  |  |

Data Set 4 GDP and CO2 Emissions:

| Question | **Graphical method** | **Algebraic method** |
| --- | --- | --- |
| Equation of the line of best fit |  |  |
| Estimate the tonnes per capita of CO2 emissions if a country has a GDP of $30,000 |  |  |
| Estimate the GDP of a country with CO2 emissions of 25 tonners per capita |  |  |

Activity 4

You will need the Desmos files saved during Part 2 of fitting-a-line-of-best-fit-by-eye-activity.docx

1. Record the equations of the lines of best fit fitted by eye.
2. Use the equation or scatterplot to answer each questions.

Data Set 1 Engine Size and Fuel Use:

| Question | **Graphical method** | **Algebraic method** |
| --- | --- | --- |
| Equation of the line of best fit (by eye) |  |  |
| Estimate the fuel use of a car with an engine size of 4L |  |  |
| Estimate the engine size of a car with an average fuel use of 8km/L |  |  |

Data Set 2 Goods Manufactured and Energy Costs:

| Question | **Graphical method** | **Algebraic method** |
| --- | --- | --- |
| Equation of the line of best fit (by eye) |  |  |
| Estimate the monthly energy costs if 550 goods are manufactured |  |  |
| Estimate the number of goods manufactured if the monthly energy cost is $2000 |  |  |

Data Set 3 Height and Arm Span:

| Question | **Graphical method** | **Algebraic method** |
| --- | --- | --- |
| Equation of the line of best fit (by eye) |  |  |
| Estimate the height of a person with an arm span of 160cm |  |  |
| Estimate the arm span of a person with a height of 180cm |  |  |

Data Set 4 GDP and CO2 Emissions:

| Question | Graphical method | **Algebraic method** |
| --- | --- | --- |
| Equation of the line of best fit (by eye) |  |  |
| Estimate the tonnes per capita of CO2 emissions if a country has a GDP of $30,000 |  |  |
| Estimate the GDP of a country with CO2 emissions of 25 tonners per capita |  |  |

Activity 5

1. Compare the estimate obtained using the least squares regression line (part 4) and the estimates obtained using the line of best fit by eye (part 5).
* Are there any discrepancies?
* Why might there be discrepancies?
* Which predictions are more accurate? Why.
1. Compare the estimate obtained between the graphical and algebraic methods. (Part 4 and Part 5)
* Are there any discrepancies?
* Why might there be discrepancies?
* Which predictions are more accurate? Why.
* What are the benefits of each method?