Linear model for scatter plots

Mana Maths

Te reo Māori terms

rārangi
line
Open in Te Aka

marara
scatter/dispersed
Open in Te Aka

tauira
model
Open in Te Aka

hononga
relationship
Open in Te Aka

Foundation

1. A scatter plot shows the relationship between hours studied and test score. A line of best fit is drawn. Use the line to predict the test score for 5 hours of study.

2. A scatter plot shows height vs shoe size. A line of best fit is drawn. Predict shoe size for a height of 160 cm.

3. A scatter plot shows temperature vs ice cream sales. A line of best fit is drawn. Predict ice cream sales when the temperature is 30°C.

4. A scatter plot shows age vs reaction time. A line of best fit is drawn. Predict reaction time for a 20-year-old.

5. A scatter plot shows distance from city centre vs rent. A line of best fit is drawn. Predict rent for a house 10 km from the city centre.

6. A scatter plot shows number of pages vs weight of a book. A line of best fit is drawn. Predict the weight of a book with 200 pages.

7. A scatter plot shows engine size vs fuel consumption. A line of best fit is drawn. Predict fuel consumption for a 2.0 L engine.

8. A scatter plot shows years of experience vs salary. A line of best fit is drawn. Predict salary for someone with 10 years of experience.

9. A scatter plot shows rainfall vs crop yield. A line of best fit is drawn. Predict crop yield for 500 mm of rainfall.

10. A scatter plot shows advertising spend vs sales. A line of best fit is drawn. Predict sales for $1000 spent on advertising.

11. A scatter plot shows speed vs stopping distance. A line of best fit is drawn. Predict stopping distance at 50 km/h.

12. A scatter plot shows number of rooms vs house price. A line of best fit is drawn. Predict house price for a house with 4 rooms.

Proficient

1. Given the line of best fit $y = 2.5x + 10$, predict y when $x = 6$.

2. Interpret the slope of the line $y = 0.8x + 5$ in the context of hours studied vs test score.

3. Given the line of best fit $y = -1.2x + 50$, predict x when $y = 20$.

4. A scatter plot shows a strong positive correlation. Which of the following correlation coefficients is most likely: 0.9, 0.2, -0.7?

5. Calculate the residual for the data point $(3, 15)$ if the line of best fit predicts $y = 14$.

6. The line of best fit passes through the points $(2, 5)$ and $(6, 13)$. Find its equation.

7. Using the equation from question 6, predict y when $x = 10$.

8. For the line of best fit $y = 3x + 4$, interpret the y-intercept in context.

9. Given a scatter plot with outliers, explain how removing an outlier would affect the line of best fit.

10. A line of best fit has equation $y = 0.5x + 20$. Predict y for $x = 30$ and comment on whether this extrapolation is reliable.

11. Compare two lines of best fit: one with slope 2.0 and one with slope 0.5. Which indicates a stronger relationship?

12. Given a residual plot that shows a random scatter, what does this suggest about the linear model?

Excellence

1. Using a linear model, predict the test score for a student who studies 8 hours. Discuss your confidence in this prediction considering variation at that point.

2. Compare predictions from two different lines of best fit derived from different samples of the same population. Explain why they might differ.

3. Explain why extrapolation beyond the range of data may be unreliable for a linear model.

4. Discuss the effect of outliers on the line of best fit and the correlation coefficient.

5. Given a residual plot that shows a curved pattern, comment on the appropriateness of a linear model.

6. Explain the difference between correlation and causation in the context of a study linking ice cream sales and drowning incidents.

7. Discuss sampling variation: if another sample of the same size is taken, how might the line of best fit differ?

8. Use the linear model to make a prediction and suggest a reasonable range (confidence interval) for that prediction.

9. Evaluate the limitations of a linear model for predicting house prices based on number of rooms.

10. Given a scenario where data collection was biased, suggest improvements to obtain a more reliable linear model.

11. Interpret a coefficient of determination $r^2 = 0.64$ in the context of a study on exercise and heart health.

12. Discuss the impact of a non-linear relationship (e.g., exponential) on the suitability of a linear model.