adamjee maths

A-LEVEL MATHS / EDEXCEL / FREE RESOURCES

Correlation and regression

Question paper

4 questions

Exam questions and marking instructions remain credited to their board.

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2. Amar is studying the flight of a bird from its nest.

He measures the bird's height above the ground, h metres, at time t seconds for 10 values of t
Amar finds the equation of the regression line for the data to be $h = 38.6 - 1.28t$

(a) Interpret the gradient of this line.

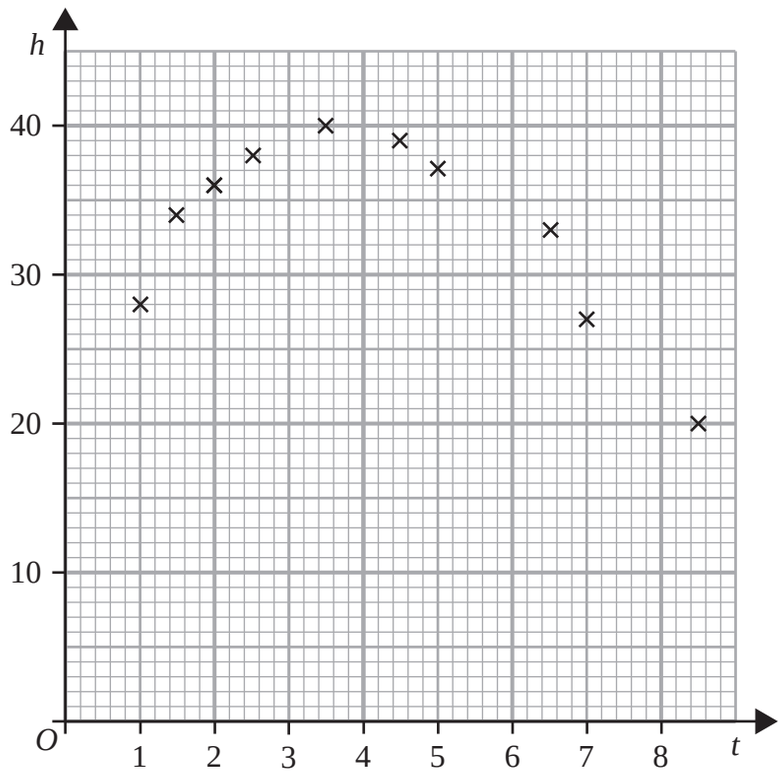
(1)

The product moment correlation coefficient between h and t is -0.510

(b) Test whether or not there is evidence of a negative correlation between the height above the ground and the time during the flight.
You should
- state your hypotheses clearly
- use a 5% level of significance
- state the critical value used

(3)

Jane draws the following scatter diagram for Amar's data.



(c) With reference to the scatter diagram, state, giving a reason, whether or not the regression line $h = 38.6 - 1.28t$ is an appropriate model for these data.

(1)

Jane suggests an improved model using the variable $u = (t - k)^2$ where k is a constant.

She obtains the equation $h = 38.1 - 0.78u$

(d) Choose a suitable value for k to write Jane's improved model for h in terms of t only.

(1)

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Question 2 continued

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Question 2 continued

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Question 2 continued

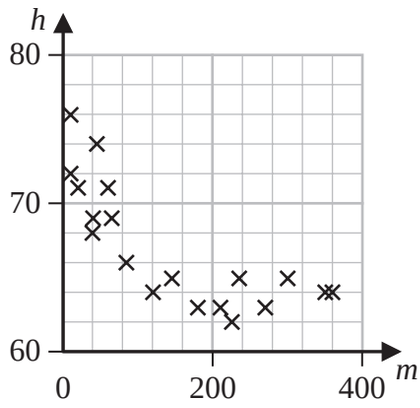
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6. Anna is investigating the relationship between exercise and resting heart rate. She takes a random sample of 19 people in her year at school and records for each person

- their resting heart rate, h beats per minute
- the number of minutes, m, spent exercising each week

Her results are shown on the scatter diagram.



(a) Interpret the nature of the relationship between h and m

(1)

Anna codes the data using the formulae

$$x = \log_{10} m$$
$$y = \log_{10} h$$

The product moment correlation coefficient between x and y is -0.897

(b) Test whether or not there is significant evidence of a negative correlation between x and y
You should

- state your hypotheses clearly
- use a 5% level of significance
- state the critical value used

(3)

The equation of the line of best fit of y on x is

$$y = -0.05x + 1.92$$

(c) Use the equation of the line of best fit of y on x to find a model for h on m in the form

$$h = am^k$$

where a and k are constants to be found.

(5)

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Question 6 continued

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Question 6 continued

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Question 6 continued

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Question 6 continued

(Total for Question 6 is 9 marks)

TOTAL FOR STATISTICS IS 50 MARKS

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2. Marc took a random sample of 16 students from a school and for each student recorded

- the number of letters, x, in their last name
- the number of letters, y, in their first name

His results are shown in the scatter diagram on the next page.

(a) Describe the correlation between x and y.

(1)

Marc suggests that parents with long last names tend to give their children shorter first names.

(b) Using the scatter diagram comment on Marc's suggestion, giving a reason for your answer.

(1)

The results from Marc's random sample of 16 observations are given in the table below.

x	3	6	8	7	5	3	11	3	4	5	4	9	7	10	6	6
y	7	7	4	4	6	8	5	5	8	4	7	4	5	5	6	3

(c) Use your calculator to find the product moment correlation coefficient between x and y for these data.

(1)

(d) Test whether or not there is evidence of a negative correlation between the number of letters in the last name and the number of letters in the first name.

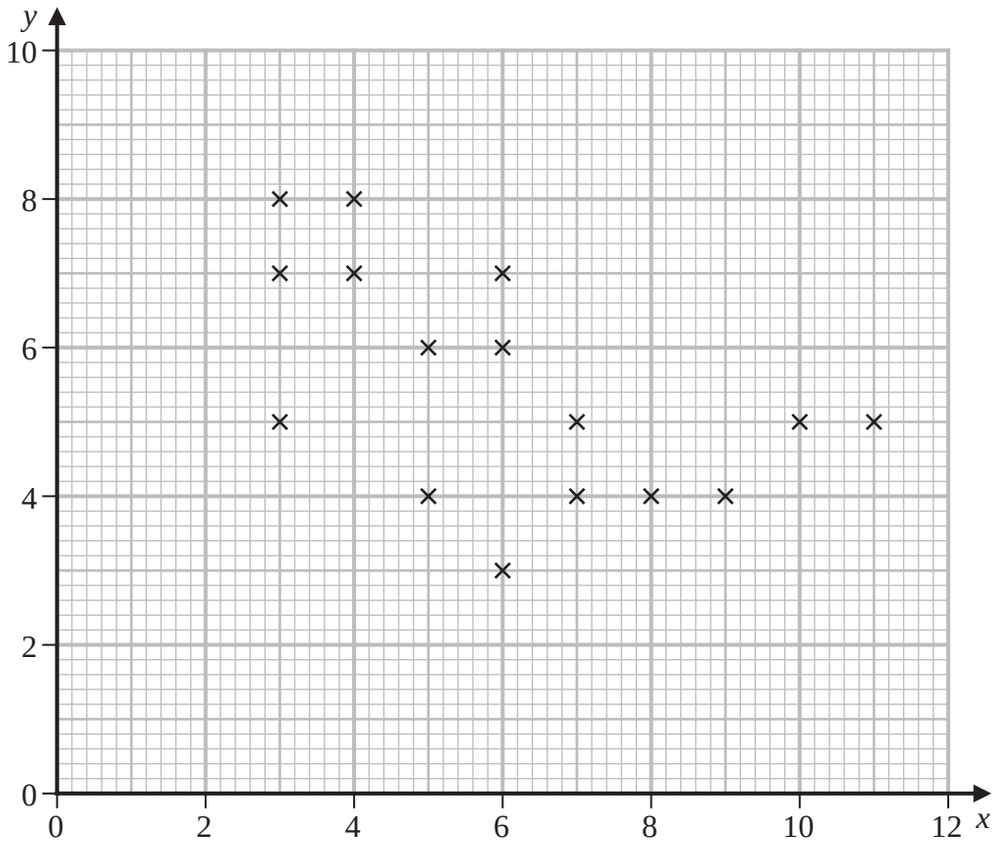
You should

- state your hypotheses clearly
- use a 5% level of significance

(3)

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Question 2 continued.



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2. Tessa owns a small clothes shop in a seaside town. She records the weekly sales figures, £w, and the average weekly temperature, t °C, for 8 weeks during the summer.
The product moment correlation coefficient for these data is −0.915

(a) Stating your hypotheses clearly and using a 5% level of significance, test whether or not the correlation between sales figures and average weekly temperature is negative.

(3)

(b) Suggest a possible reason for this correlation.

(1)

Tessa suggests that a linear regression model could be used to model these data.

(c) State, giving a reason, whether or not the correlation coefficient is consistent with Tessa's suggestion.

(1)

(d) State, giving a reason, which variable would be the explanatory variable.

(1)

Tessa calculated the linear regression equation as $w = 10\,755 - 171t$

(e) Give an interpretation of the gradient of this regression equation.

(1)

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