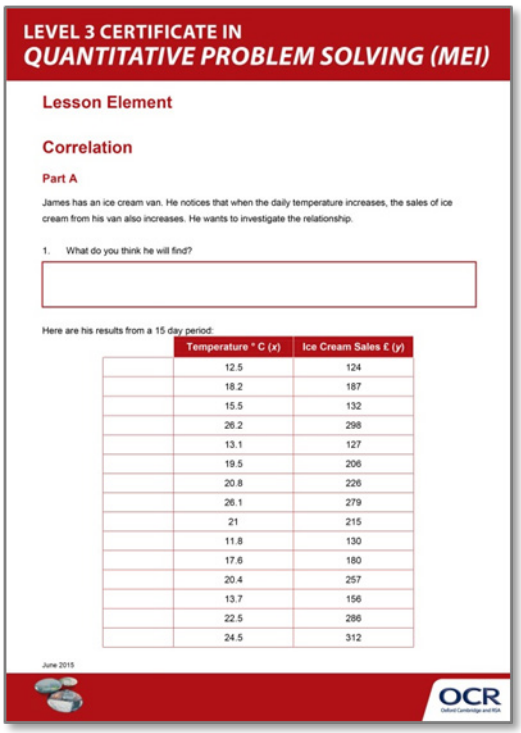
LEVEL 3 CERTIFICATE IN
QUANTITATIVE PROBLEM SOLVING (MEI)

Lesson Element

Product moment correlation

Instructions and answers for teachers

These instructions should accompany the OCR resource "Product moment correlation' activity *which supports OCR Level 3 Certificate in Quantitative Problem Solving (MEI).*


LEVEL 3 CERTIFICATE IN
QUANTITATIVE PROBLEM SOLVING (MEI)

Lesson Element

Correlation

Part A

James has an ice cream van. He notices that when the daily temperature increases, the sales of ice cream from his van also increases. He wants to investigate the relationship.

1. What do you think he will find?

Here are his results from a 15 day period:

	Temperature ° C (x)	Ice Cream Sales £ (y)
	12.5	124
	18.2	187
	15.5	132
	26.2	298
	13.1	127
	19.5	206
	20.8	226
	26.1	279
	21	215
	11.8	130
	17.6	180
	20.4	257
	13.7	156
	22.5	286
	24.5	312

June 2015

OCR

This activity offers an opportunity for maths skills development.

Associated materials:

'Product moment correlation' Lesson Element learner activity sheet

December 2015

OCR
Oxford Cambridge and RSA

The expectation is that students will have some understanding of the product moment correlation coefficient prior to completing this task.

Assumed Knowledge:

Students will need to be able to:

- Use suitable technology to find Pearson's product moment correlation coefficient and to interpret the correlation coefficient.
- Calculate, both from simple raw data and from summarized data, the product moment correlation coefficient for a set of bivariate data.
- Interpret the value of a product moment correlation coefficient in relation to the appearance of a scatter diagram, with particular reference to values close to −1, 0 and 1.
- Understand the difference between an independent (or controlled) variable and a dependent variable.

Possible Misconceptions:

Assuming correlation implies causation.

Activity:

The activity is designed to be completed after students have undertaken some work on the correlation coefficient. Depending on the ability of the group, the students could work in pairs or individually.

Students are expected to calculate the correlation coefficient using either a spreadsheet or calculator, having drawn the scatter diagram and concluded that there is strong positive correlation. There is an opportunity for repeated calculation after some alterations to the data set and this should stimulate students to think of other factors that can impact on data collection.

Students should be encouraged to interpret their results at each stage to reinforce their understanding of the concepts. They should explain to their peers what they have done and check each other's work.

There is scope for a serious discussion into correlation and causation; an excellent resource for further discussion would be http://www.tylervigen.com/ where various unrelated data sets are shown to have positive correlations.

Product moment correlation activity

Part A

James has an ice cream van. He notices that when the daily temperature increases, the sales of ice cream from his van also increases. He wants to investigate the relationship.

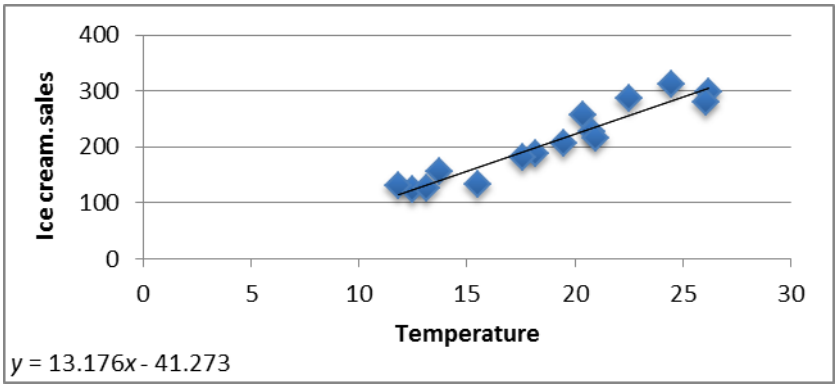
1. What do you think he will find?

Ice cream sales go up in hot weather.

Here are his results from a 15 day period:

Temperature ° C (x)	Ice Cream Sales £ (y)
12.5	124
18.2	187
15.5	132
26.2	298
13.1	127
19.5	206
20.8	226
26.1	279
21	215
11.8	130
17.6	180
20.4	257
13.7	156
22.5	286
24.5	312

2. Plot a scatter diagram of temperature (x-axis) against ice cream sales (y-axis) and draw a line of best fit.



What can you say about the correlation between temperature and ice cream sales?

It is a (strong) positive correlation.

3. Find the correlation coefficient (r) using the CORREL or PEARSON functions in a spreadsheet or a suitable calculator.

***r* = 0.953520299**

4. What does the correlation coefficient tell you about these data sets?

The *r* value is close to 1, so it is a (strong) positive correlation.

5. Is this what you predicted would happen? Why?

It is assumed that in warmer weather more people want to eat ice cream.

6. James takes the temperature today, and it is 20°C. Use your line of best fit to make a prediction for his ice cream sales.

Evidence of using the line of best fit to interpolate ice cream sales at 20°C; which is ≈ £225.

7. There is a heat wave predicted for the summer and James plans to use the line of best fit to predict sales. How reliable would these predictions be?

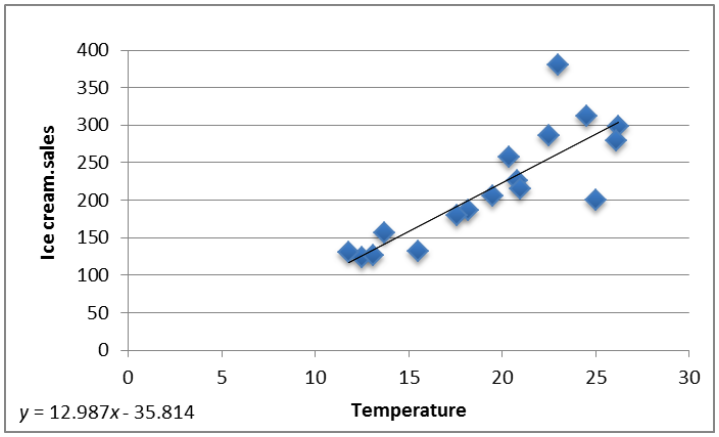
Reliability would be lost if the predicted temperatures exceed the observed data range. Extrapolation or estimating beyond the extremes of the data already collected is subject to uncertainty.

Part B

1. If we added the following two days of values to the data set, would you still use the same line of best fit to model the relationship? Why?

Temperature ° C (*x*)	Ice Cream Sales £ (*y*)
23	380
25	200

Yes. The general trend of the data is still the same; these values could just be outliers or errors.



2. Can you think of any reason as to why these values are different?

It could be a weekend day or a bank holiday/special event, so sales are higher because more people are enjoying their leisure time, even though the temperature is not as high.
Low sales despite a high temperature could be due to other weather factors e.g. it could be hot but humid or raining, or just that nobody wanted ice cream that day.
Sales are not purely dependent on temperature.

3. What happens to the correlation coefficient (*r*) if we include these 2 values?

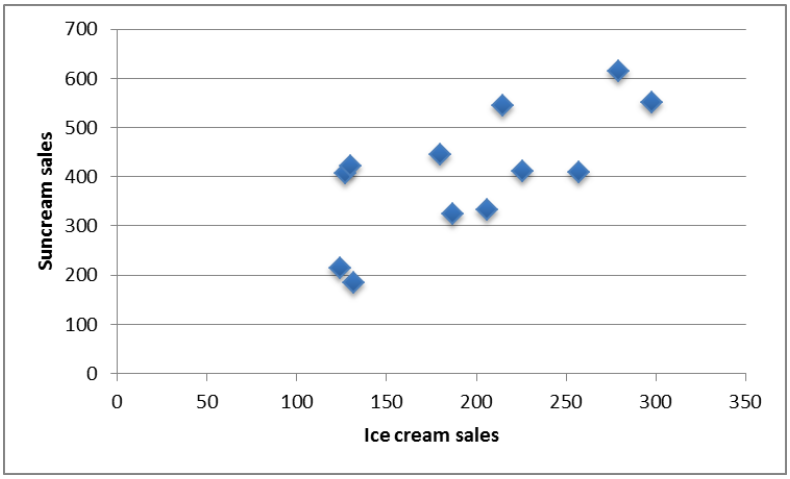
***r* = 0.835264792, which indicates that the positive correlation is not as strong as before.**

4. If you repeat the initial calculation of the correlation coefficient but with the variables switched around (ice cream sales becomes *x*), what happens to the *r* value?

The *r* value stays the same.

Part C

James notices that there seems to be a link between the days he sells most ice cream and the increased sales of sun cream at his friend Martha's shop. He therefore concludes that there is a positive correlation between sales of ice cream and sales of sun cream. He creates a scatter diagram to prove his theory and this is shown below. He concludes that ice cream makes people want sun cream.



1. What can *you* conclude from this scatter diagram?

The scatter graph shows that there is a positive correlation.

2. How can you explain to James why his conclusion is wrong?

James linked 2 data sets that both have a positive correlation to the same thing (temperature) so it seems that there is a link mathematically but not logically; James ice cream sales do not affect Martha's sales. Correlation does not imply causation.

December 2015