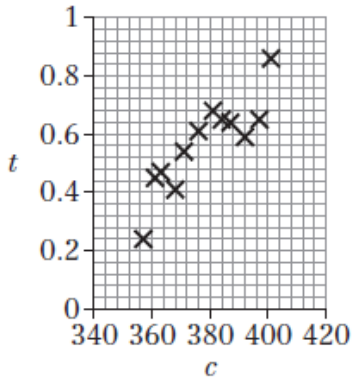
Correlation, Mixed Exercise 4

1 The data shows that the number of serious road accidents in a week strongly correlates with the number of fast food restaurants. However, it does not show whether the relationship is causal. Both variables could correlate with a third variable, e.g. the number of roads coming into a town.

2 a



b There is strong positive correlation.

c As mean CO_2 concentration in the atmosphere increased, mean temperatures also increased.

3 a There is strong positive correlation.

b If the number of items increases by 1, the time taken increases by approximately 2.64 minutes.

4 The answer is likely to be unreliable as it involves extrapolation. 3500 is well outside the limits of the data set used.

The economist used the regression line of y on x. Estimating energy consumption (x) from Gross National Product (y) would need the regression line of x on y.

5 a $15.2 + 2 \times 11.4 = 38$

As $50 > 38$, $t = 50$ °C is an outlier.

b The outlier should be omitted, as it is very unlikely that the average temperature was 50 °C in a climate where people need to buy gloves, and so this data point is likely an anomaly.

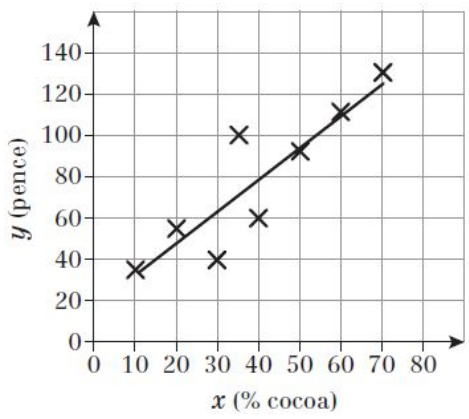
c If the temperature increases by approximately 1 °C, the number of pairs of gloves sold each month decreases by 5.2.

6 a 44 cm is the length of the spring with no mass attached. If a mass of 1 g is attached, the spring will increase in length by approximately 0.2 cm.

b i $m = 150$ is outside the range of the data (extrapolation) so is less likely to be accurate.

ii This particular regression equation should only be used to predict a value of s given m. To predict a value of m given s, you should use the regression equation of m on s.

7 **a** and **b**

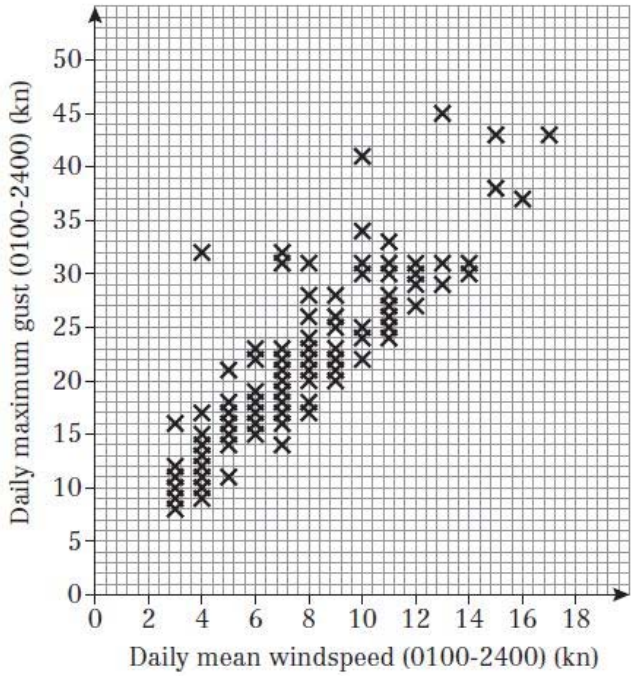


c Brand D is overpriced, since it's price is much more than you would expect (the data point is far above the regression line)..

d The regression equation should be used to predict a value for y given x, i.e. the price given the percentage of cocoa solids. So the student's method is a valid one.

Large data set

1 **a**



b There is moderate positive correlation

c The relationship is causal, as the maximum gust is related to the mean windspeed. A higher mean windspeed is likely to result in a higher maximum gust.

d **i** $g = 4.97 + 2.15 \times 0.5$
$= 6.045$

d ii $g = 4.97 + 2.15 \times 5$
$= 15.72$ kn

iii $g = 4.97 + 2.15 \times 12$
$= 30.77$ kn

iv $g = 4.97 + 2.15 \times 40$
$= 90.97$ kn

e Parts **ii** and **iii** are within the range of the data (interpolation), so are more likely to be accurate.
Parts **i** and **iv** are outside the range of the data (extrapolation), so are less likely to be accurate.

f Using the 'SLOPE' and 'INTERCEPT' function in a spreadsheet:

$w = 0.05 + 0.35\,g$

$w = 0.05 + 0.35 \times 30$
$= 10.55$ kn

2 a Using the 'SLOPE' and 'INTERCEPT' function in a spreadsheet:

$s = 14.6 - 1.7c$ (values taken to 2 d.p.)

The missing total sunshine data values are approximately:

2.7, 7.8, 6.1, 11.2, 2.7. 7.8, 11.2, 14.6, 9.5, 6.1. 2.7, 4.4, 7.8, 2.7, 4.4, 4.4, 1.0

b The relationship is likely to be causal: greater cloud cover is likely to result in less sunshine.