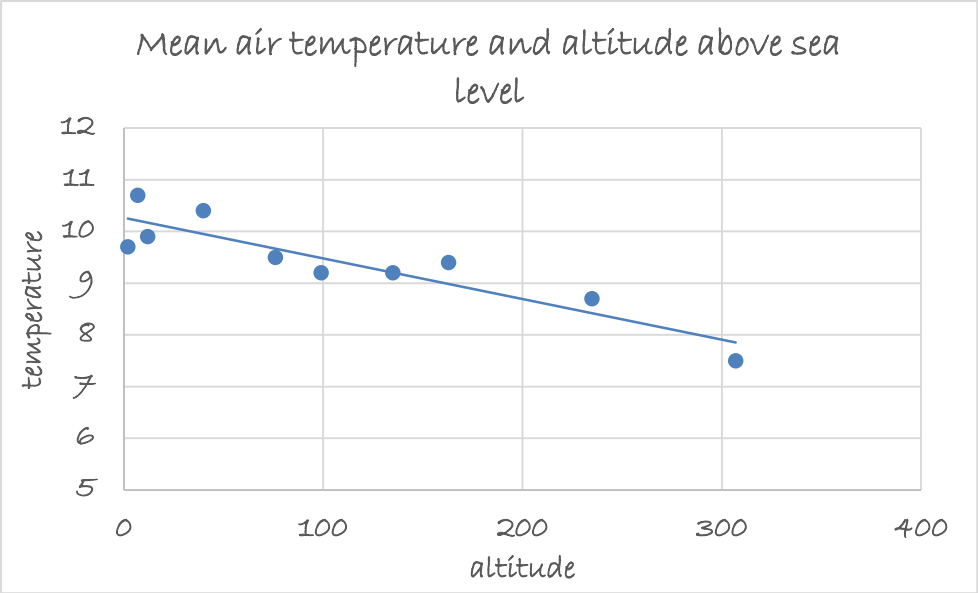
Section 2: Testing for correlation

Exercise level 3 solutions

1. (i)



(ii) $\bar{x} = \frac{\sum x}{10} = 107.6$ $\bar{y} = \frac{\sum y}{10} = 9.42$

(iii) $r = -0.9051$ from calculator.

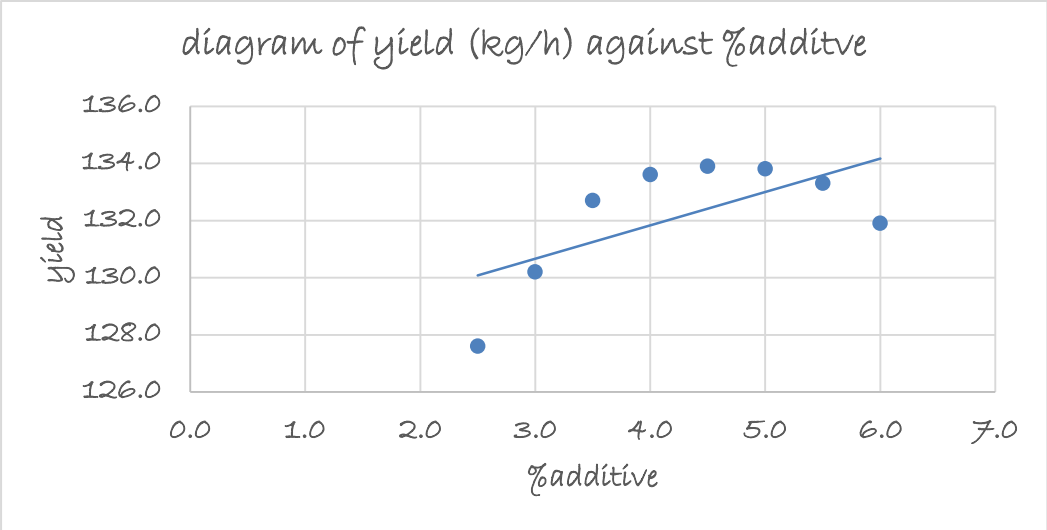
(iv) From graph, intercept on y axis is about 10.3.
Gradient is about -2.4/300 = -0.008
So approximate equation is $y = 10.3 - 0.008x$

(v) $x = 200$, y estimate is about 8.69 to 8.7 °C
$x = 450$ is outside the range of the readings and so requires further data before any estimation is attempted.

2. (i) $r = 0.6503$

(ii) H_0: $\rho = 0$
H_1: $\rho > 0$
So 1-tail test.
At 5% significance level with $n = 8$, Critical value = 0.6215
Test correlation coefficient, $r = 0.6503 > c.v.$
So significant result. Reject H_0
There is sufficient evidence to suggest there is a positive correlation between % additive and yield.

(iii)



(iv) $\bar{x} = \frac{\sum x}{8} = 4.25 \qquad \bar{y} = \frac{\sum y}{8} = 132.125$

(v) Several points to make:
Is data random? X is a controlled variable as % additive increased.
Correlation and causation? There may be significant correlation in the range of the data recorded. But no inference of causation should be drawn from this and no inference about correlation outside the range of the data.
Linear? A curve would seem to fit the data better than a straight line, with the greatest yield at $x \approx 4.5$. Increases in additive beyond this do not appear effective.

3. (i) $Q = aW^b$

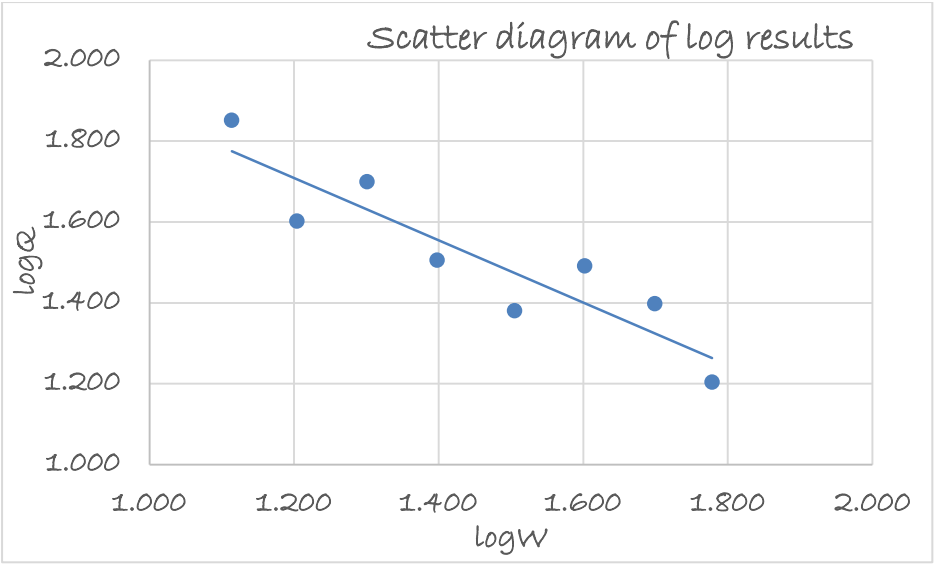
$\log_{10} Q = \log_{10} a + \log_{10}(W^b)$

$\log_{10} Q = \log_{10} a + b\log_{10} W$

(ii)

$\log_{10}W$	1.114	1.204	1.301	1.398	1.505	1.602	1.699	1.778
$\log_{10}Q$	1.851	1.602	1.699	1.505	1.380	1.491	1.398	1.204

Edexcel A level Maths Hypothesis testing 2 Exercise solutions



(iii) Mean of $\log_{10}W$ is $\bar{x} = \frac{\sum x}{8} = 1.4052$, mean of $\log_{10}Q$ is $\bar{y} = \frac{\sum y}{8} = 1.5164$

Gradient = -0.75 to – 0.8. (-0.77)

$\log_{10} Q - 1.5164 = -0.77(\log_{10} W - 1.4052)$

$\log_{10} Q = 2.63 - 0.77 \log_{10} W$

(iv) $\log_{10} a = 2.63 \quad \Rightarrow a \approx 430$

$b \approx -0.77$

(Considerable variation in drawn lines gives a wide range for a and b)

4. $r = 0.2347$ (from calculator/spreadsheet)

H_0: $\rho = 0$

H_1: $\rho > 0$

So 1-tail test.

From tables, for 5% significance level with $n = 8$, critical value = 0.6215

Test correlation coefficient, $r = 0.2347 <$ c.v.

So result is not significant. Accept H_0

There is insufficient evidence to suggest there is a positive correlation between the masses of heart and liver in mice.