1. (a) $\hat{\alpha} = 121.26$, $\hat{\beta} = -15.9383$: estimated straight line regression, $\hat{\eta}(x) = 121.3 - 15.94x$.

(b) regression sum of squares $= \hat{\beta}^2 \sum (x - \bar{x})^2 = 6204.65$:

<table>
<thead>
<tr>
<th></th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>regression</td>
<td>1</td>
<td>6204.65</td>
<td>6204.65</td>
<td>104.51</td>
</tr>
<tr>
<td>residual</td>
<td>98</td>
<td>5818.25</td>
<td>59.37</td>
<td></td>
</tr>
<tr>
<td>total</td>
<td>99</td>
<td>12022.90</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(c) $s^2 = 59.37$ (residual MS)

(d) $\hat{\beta} \pm 0.975(t_{98}) \sqrt{s^2/k} = -15.9383 \pm 1.96 \times \sqrt{59.37/24} = (-19.03, -12.85)$.

(e) $\hat{\mu}(4.56) = 48.58$; $c = \frac{1}{100} + \left(\frac{4.56 - 4.5417}{24.4250}\right)^2 = 0.010014$; $se(\hat{\mu}(4.56)) = \sqrt{59.37}$;
95% CI: $48.58 \pm 1.96 \times \sqrt{0.010014 \times 59.37} = (47.05, 50.11)$;
95% PI: $48.58 \pm 1.96 \times \sqrt{1.010014 \times 59.37} = (33.21, 63.95)$.

2. Most of the required answers are easily obtained from MINITAB:

MTB > regr y 1 x;
SUBC> noconst;
SUBC> predict 1.

The regression equation is $y = 0.796 x$

Predictor Coef SE Coef T P
Noconstant
x 0.795678 0.008594 92.59 0.000
S = 0.818457

Analysis of Variance
<table>
<thead>
<tr>
<th>Source</th>
<th>DF</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>1</td>
<td>5742.25</td>
<td>5742.25</td>
<td>8572.15</td>
<td>0.000</td>
</tr>
<tr>
<td>Residual Error</td>
<td>19</td>
<td>12.73</td>
<td>0.67</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>20</td>
<td>5754.98</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Predicted Values for New Observations

<table>
<thead>
<tr>
<th>x</th>
<th>Fit</th>
<th>SE Fit</th>
<th>95% CI</th>
<th>95% PI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.796</td>
<td>0.009</td>
<td>(0.778, 0.814)</td>
<td>(-0.917, 2.509)</td>
</tr>
</tbody>
</table>

Thus $\hat{\beta} = 0.796$; and a 95% confidence interval for $\beta$ is $0.778, 0.814$.

Also, $\sigma = s = 0.818$.

To obtain a 95% CI for $\sigma$, we use $19S^2/\sigma^2 \approx \chi^2_{19}$. This gives $(0.62, 1.20)$.

3. (a) $r = -0.695$; using MINITAB or EXCEL.

(b) An approximate 95% confidence interval can be obtained for $\rho$ by using the approximate result

$$\text{arctanh} R \approx N\left(\text{arctanh} \rho, \frac{1}{n-3}\right).$$

$$\text{arctanh}(-0.695) = -0.8580 \pm 1.96 \sqrt{\frac{1}{24}} = (-1.276, -0.440);$$ and then transforming back gives

$$\text{tanh}(-1.276), \text{tanh}(-0.440) = (-0.856, -0.481).$$

(c) $r' = -0.675$. On MINITAB this is most easily done by ranking the $x$s and the $y$s (separately) and then computing the correlation between the ranks:

MTB > rank x rx
MTB > rank y ry
MTB > corr rx ry

Pearson correlation of rx and ry = -0.675
4. (Problem 7.5)

5. This analysis is readily achieved using MINITAB:

\[
\text{MTB > print c1 c2 c3}
\]

\[
\begin{array}{rrrr}
\text{Row} & \text{x} & \text{y} & \text{n} \\
1 & 1 & 36.6 & 16 \\
2 & 2 & 40.9 & 14 \\
3 & 3 & 40.3 & 12 \\
4 & 4 & 53.1 & 10 \\
5 & 5 & 62.0 & 8 \\
6 & 6 & 56.1 & 6 \\
\end{array}
\]

\[
\text{MTB > regr c2 1 c1; SUBC> weights c3. }
\]

Weighted analysis using weights in n

The regression equation is \( y = 30.5 + 5.06 \times \)

\[
\begin{array}{rrr}
\text{Predictor} & \text{Coef} & \text{SE Coef} \\
\text{Constant} & 30.511 & 3.773 \\
x & 5.060 & 1.115 \\
\end{array}
\]

\[
S = 14.70 \quad \text{R-Sq} = 83.7\% \quad \text{R-Sq(adj)} = 79.7\%
\]

Analysis of Variance

\[
\begin{array}{rrrrrr}
\text{Source} & \text{DF} & \text{SS} & \text{MS} & \text{F} & \text{P} \\
\text{Regression} & 1 & 4452.9 & 4452.9 & 20.59 & 0.011 \\
\text{Residual Error} & 4 & 864.9 & 216.2 \\
\text{Total} & 5 & 5317.8 \\
\end{array}
\]

Thus \( \hat{\alpha} = 30.51, \hat{\beta} = 5.06 \) and \( \hat{\sigma}^2 = 216.2. \)

6. (Problem 7.9)

7. (Problem 7.9)