#1 Karl rode for an hour each day for eleven days. He recorded the number of kilometres he rode and the temperature on that day.

<table>
<thead>
<tr>
<th>Temperature $T$ ($^\circ$C)</th>
<th>32.9</th>
<th>33.9</th>
<th>35.2</th>
<th>37.1</th>
<th>38.9</th>
<th>30.3</th>
<th>32.5</th>
<th>31.7</th>
<th>35.7</th>
<th>36.3</th>
<th>34.7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance $d$ (km)</td>
<td>26.5</td>
<td>26.7</td>
<td>24.4</td>
<td>19.8</td>
<td>18.5</td>
<td>32.6</td>
<td>28.7</td>
<td>29.4</td>
<td>23.8</td>
<td>21.2</td>
<td>29.7</td>
</tr>
</tbody>
</table>

Karl believes that the relationship between $T$ and $d$ can be modelled by a linear regression equation so he created a scatter plot of his data. It is shown below.

(a) Write down the independent variable

(b) Karl describes the correlation as strong. Circle the value below which best represents the correlation coefficient.

| 0.928 | 0.355 | 0   | -0.355 | -0.928 |

(c) Karl’s model is $d = -1.64T + 82.3$. Use the model to predict the decrease to kilometres rode for any increase of 2 degrees in temperature.

\[-1.64 \times 2 = \boxed{-3.28}\]

(d) If the model is correct for any temperature, how far would it predict Karl could ride in $0^\circ$ C.

\[T = 0\]
\[d = -1.64(0) + 82.3\]
\[d = 82.3 \text{ km}\]
Sara heated an unknown liquid until it boiled. She then recorded the temperature \((y \, ^\circ C)\) as the liquid cooled, \(x\) minutes after it boiled.

<table>
<thead>
<tr>
<th>Time ((x , \text{min}))</th>
<th>0</th>
<th>4</th>
<th>8</th>
<th>12</th>
<th>16</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature ((y , ^\circ C))</td>
<td>105.2</td>
<td>89.3</td>
<td>77.6</td>
<td>62.3</td>
<td>55.1</td>
<td>41.7</td>
</tr>
</tbody>
</table>

(a) The relationship between the variables is modelled by the regression equation \(y = ax + b\).

(i) Write down the value of \(a\) and of \(b\).

\[
\begin{align*}
  a &= -3.11 \\
  b &= 103
\end{align*}
\]

(ii) Write down the boiling point of the unknown liquid

\(105.2 \, ^\circ C\)

(b) Write down the correlation coefficient.

\(r = -0.996\)  
\(\text{ (3 sig figs)}\)

(c) State two words that describe the correlation coefficient between the variables

\(\text{Strong} \quad \text{Negative}\)

(d) Estimate the temperature of the liquid after 6 minutes.

\[
\begin{align*}
  x &= 6 \\
  y &= -3.11 \times 6 + 102.9666 \\
      &\approx \boxed{84.3 \, ^\circ C}
\end{align*}
\]

(e) Estimate how long it will take for the liquid to reach room temperature of \(18^\circ C\)

\[
\begin{align*}
  y &= 18 \\
  18 &= -3.11 \times + 102.9666 \\
      &\text{Subtract 102.9666 from both sides} \\
     -84.9666 &= -3.11 \times x \\
     \div & -3.11 \quad \div & -3.11 \\
      27.3 \, \text{minutes} &= x
\end{align*}
\]