where t is the two-tailed Student's t value for 95% confidence and $v = 16$, obtained from Appendix A, Table A.4.

The prediction interval for x values is calculated from

$$s_{\hat{x}} = \frac{s_{y/x}}{b}\sqrt{\frac{1}{N} + \frac{1}{n} + \frac{(\bar{y}_0 - \bar{y})^2}{b^2 \sum_{i=1}^{n} (x_i - \bar{x})^2}}$$

$\overline{y} = 53.505$. If $y_0 = \overline{y}$, the predicted value is

$$\hat{x} = \frac{53.505 - 0.9426}{0.7509} = 70\,\text{mg}\,\text{L}^{-1}.$$

The prediction interval is

$$s_{\hat{x}} = \frac{1.201}{0.7509}\sqrt{\frac{1}{1} + \frac{1}{18} + \frac{(53.505 - 53.505)^2}{0.7509^2 \times 57000}} = 1.64\,\text{mg}\,\text{L}^{-1}$$

If $y_0 = 120$, the predicted value is

$$\hat{x} = \frac{120 - 0.9426}{0.7509} = 158.6\,\text{mg}\,\text{L}^{-1}$$

The prediction interval is

$$s_{\hat{x}} = \frac{1.201}{0.7509}\sqrt{\frac{1}{1} + \frac{1}{18} + \frac{(120 - 53.505)^2}{0.7509^2 \times 57000}} = 1.75\,\text{mg}\,\text{L}^{-1}$$

The 95% confidence interval is calculated by multiplying the prediction interval by the appropriate Student's t value (two-tailed, 95% confidence, $v = 16$, obtained from Appendix A, Table A.4).

If $y_0 = \overline{y} = 53.505$, the confidence interval for $\hat{x}$ is $70.0 \pm 2.120 \times 1.64 = 70.0 \pm 3.48\,\text{mg}\,\text{L}^{-1}$.
If $y_0 = 120$, the confidence interval for $\hat{x}$ is $158.6 \pm 2.120 \times 1.75 = 158.6 \pm 3.71\,\text{mg}\,\text{L}^{-1}$.

Question 15

1. There are sufficient concentration levels and sufficient replication at each level. However, the spacing of the concentrations of the standard solutions it not ideal. The concentrations should be approximately evenly spaced across the range of interest.
2. The regression statistics are consistent with a linear relationship. However, a visual examination indicates that data up to $x = 0.8\,\text{mg}\,\text{L}^{-1}$ would fit a steeper line. The fitted line is pulled down by the excessive leverage of the data at $x = 1.6\,\text{mg}\,\text{L}^{-1}$. This effect is also clear from the plot of the residual values. The leverage is exaggerated by the uneven spacing of