

Solutions

2.1 $r = \frac{-54}{\sqrt{40 \times 90}} = \frac{-54}{60} = -0.9$: a strong negative linear correlation (as x rises, y falls fairly consistently).

2.2 $S_{xy} = 522 - \frac{60 \times 84}{10} = 18$; $S_{xx} = 410 - \frac{60^2}{10} = 50$; $b = \frac{18}{50} = 0.36$; $\bar{x} = 6$, $\bar{y} = 8.4$; $a = 8.4 - 0.36(6) = 6.24$: $y = 6.24 + 0.36x$.

2.3 $x = 20$ lies outside the observed range 4–12: extrapolation assumes the linear pattern continues, with no evidence to support it.

3.1 (a) $S_{ww} = 10036.45 - \frac{339.25^2}{12} = 10036.45 - 9590.88 = 445.57 \checkmark$. (b) $S_{td} = \frac{S_{tw}}{11.5} = \frac{-91.55}{11.5} = -7.96$; $S_{dd} = \frac{S_{ww}}{11.5^2} = \frac{445.57}{132.25} = 3.37$. (c) $r = \frac{-91.55}{\sqrt{26.43 \times 445.57}} = -0.844$ (coded or uncoded give the same r). (d) As average daily temperature increases, daily gas consumption decreases (a strong negative linear relationship). (e) $b = \frac{-91.55}{26.43} = -3.4638$; $a = \frac{339.25}{12} - (-3.4638)\frac{9.1}{12} = 28.271 + 2.627 = 30.897$: $w = 30.9 - 3.46t \checkmark$. (f) $d = \frac{w}{11.5}$: at $t = 2$, $w = 30.9 - 6.92 = 23.98$, so $d = 2.09 \text{ m}^3$; the gradient for d is $\frac{-3.46}{11.5} = -0.301$: each extra degree of average temperature cuts consumption by about 0.3 m^3 .

Local review guidance: S statistics from the summary data with the n division; coding reversed by the right power of the factor; interpretations in context with units, and predictions flagged as within range only. This is authored classroom guidance.