Solutions

Marking: **K** knowledge, **App** use of the case or data, **An** analysis (a chain of reasons: cause, then effect), **Ev** evaluation (a judgement with a reason). In calculations, **M1** is for the method and **A1** for the answer; **B1** is an independent mark.

Each answer shows the steps, then the **result**.

2.1

$17.4 + 4.83 \times 2.5 = \mathbf{29.5}$ minutes

each extra km adds about 4.8 minutes

2.2

$\hat{y} = 31.89$; residual $31.0 - 31.89 = \mathbf{-0.89}$

the delivery was about 0.9 minutes faster than the line predicts

2.3

$r^2 = \mathbf{0.64}$

64% of the variation in sales goes with advertising; 36% is left unexplained

2.4

$\bar{x} = 3$, $\bar{y} = 27$

$S_{xy} = 14 + 3 + 0 + 4 + 12 = 33$; $S_{xx} = 10$

$b = \mathbf{3.3}$; $a = 27 - 9.9 = \mathbf{17.1}$

3.1

(a) $b = \dfrac{100}{33.33} = \mathbf{3.0}$; $a = 41 - 3.0 \times 5.67 = \mathbf{24.0}$

(b) $24 + 21 = \mathbf{45}$, i.e. £45,000

(c) $24 + 60 = \mathbf{84}$; extrapolation: spend far outside 2 to 9, where the line has no support (customers stop responding)

3.2

(a) $\mathbf{0.72}$

(b) the link is correlation, not cause; rain (or cold weather) raises both umbrella and hot-drink sales; giving away umbrellas does not make it rain

(c) an experiment: give umbrellas away on random days and compare coffee sales

3.3

(a) $4.83 \times 0.25 = £\mathbf{1.21}$ per km; $17.4 \times 0.25 = £\mathbf{4.35}$ per order

(b) cost $31.89 \times 0.25 = £\mathbf{7.97}$; fee $2 + 3.6 = £\mathbf{5.60}$, a loss of £2.37

(c) **4**: the per-km part about matches cost, but the fixed part £2 is far below £4.35, so every order loses about £2.35 (App); the line fits well inside 1 to 3.75 km ($r^2 = 0.98$), but longer orders are extrapolation (An); traffic at peak hours is not in the model (K); judgement, e.g. raise the base fee to about £4.50 and cap delivery at 4 km until data exist (Ev). **2–3**: costs compared, limits not used. **1**: one relevant point.

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