Bivariate Data and Correlation: exam practice

10 questions · 33 marks · worked solutions and markschemes

Name _____ Date _____ Score / 33

- Answer every question before you look at the solutions. They start after the last question, with the marks for each line: M for method, A for accuracy, R for reasoning.
- Online, with more practice: ibmathrevision.com/hlaa/bivariate-data-and-correlation-exam-practice

1. **2 marks · Paper 1 style · no calculator**

The regression line of y on x is $y = 3.2x - 4$ and $\bar{x} = 5$.

Find $\bar{y}$. **[2]**

2. **3 marks · Paper 2 style · calculator**

Eight pairs of values (x, y) are shown.

x	1	2	3	4	5	6	7	8
y	9	7	8	5	6	3	4	2

Find r and interpret it. **[3]**

3. **3 marks · Paper 1 style · no calculator**

Match each value of r to a description: $r_1 = -0.95$, $r_2 = 0.12$, $r_3 = 0.68$.

Describe each correlation. **[3]**

4. **3 marks · Paper 1 style · no calculator**

A study finds $r = 0.92$ between the number of ice creams sold and the number of sunburn cases at a beach.

(a) Describe the correlation. **[1]**

(b) State, with a reason, whether ice cream sales cause sunburn. **[2]**

5. **3 marks · Paper 2 style · calculator**

The number of hours, x, six students revised and their test scores, y, are shown.

x	2	4	5	7	8	10
y	15	22	24	31	33	41

(a) Find Pearson's product-moment correlation coefficient r. **[2]**

(b) Describe the correlation. **[1]**

6. **3 marks · Paper 1 style · no calculator**

For a set of bivariate data, $\bar{x} = 6$, $\bar{y} = 20$ and the regression line of y on x has gradient 2.5.

(a) Find the equation of the regression line. **[2]**

(b) Explain why the line should not be used to predict y when $x = 40$, given that the x values lie between 2 and 10. **[1]**

7. **3 marks · Paper 2 style · calculator**

The heights h cm and masses m kg of six adults are shown.

h	150	158	163	170	176	182
m	52	57	60	66	70	75

(a) Find the regression line of m on h. **[2]**

(b) Interpret the gradient in context. **[1]**

8. **4 marks · Paper 2 style · calculator**

The outside temperature, $x\,^{\circ}\mathrm{C}$, and the daily sales of hot drinks, y, at a kiosk are recorded on seven days.

x	12	15	18	22	25	30	34
y	48	44	41	35	31	26	20

(a) Find the equation of the regression line of y on x. **[2]**

(b) Use your equation to estimate the sales when the temperature is $20\,^{\circ}\mathrm{C}$. **[2]**

9. **4 marks · Paper 2 style · calculator**

The age x (years) and value y (thousands of euros) of seven used cars are shown.

x	3	5	6	8	9	11	12
y	42	39	35	30	29	24	21

(a) Find the equation of the regression line of y on x. **[2]**

(b) Estimate the value of a 7-year-old car. **[2]**

10. **5 marks · Paper 2 style · calculator**

A spring is stretched by masses x g and its extension y mm is recorded.

x	10	20	30	40	50
y	3.1	5.0	7.2	8.9	11.1

(a) Find r. **[2]**

(b) Find the regression line of y on x and estimate the extension for 32 g. **[3]**

Answers and worked solutions

Question 1 — 2 marks

Answer: 12

$(\bar{x}, \bar{y})$ lies on the line **M1**

$\bar{y} = 12$ **A1**

Question 2 — 3 marks

Answer: $r = -0.929$, strong negative

GDC **(M1)**

$r = -0.929$ **A1**

strong negative linear correlation **A1**

Question 3 — 3 marks

Answer: strong negative; very weak; moderate positive

r_1: strong negative **A1**

r_2: very weak / no linear correlation **A1**

r_3: moderate positive **A1**

Question 4 — 3 marks

Answer: (a) strong positive; (b) no: both depend on sunny weather

(a)

strong positive **A1**

(b)

no **A1**

correlation does not show causation; both rise with sunny weather **R1**

Question 5 — 3 marks

Answer: (a) $r = 0.997$; (b) strong positive

(a)

GDC **(M1)**

$r = 0.997$ **A1**

(b)

strong positive **A1**

Question 6 — 3 marks

Answer: (a) $y = 2.5x + 5$

(a)

line passes through $(\bar{x}, \bar{y})$ **M1**

$y = 2.5x + 5$ **A1**

(b)

$x = 40$ is far outside the data range (extrapolation) **R1**

Question 7 — 3 marks

Answer: (a) $m = 0.723h - 57.1$

(a)

GDC **(M1)**

$m = 0.723h - 57.1$ **A1**

(b)

each extra cm of height adds about 0.723 kg **A1**

Question 8 — 4 marks

Answer: (a) $y = -1.26x + 63.1$; (b) 37.9

(a)

GDC **(M1)**

$y = -1.26x + 63.1$ **A1**

(b)

$-1.26(20) + 63.1$ **M1**

37.9, about 38 drinks **A1**

Question 9 — 4 marks

Answer: (a) $y = -2.35x + 49.6$; (b) 33.1 thousand euros

(a)

GDC **(M1)**

$y = -2.35x + 49.6$ **A1**

(b)

$-2.35(7) + 49.6$ **M1**

33.1 thousand euros **A1**

Question 10 — 5 marks

Answer: (a) $r = 0.999$; (b) 7.46 mm, from $y = 0.199x + 1.09$

(a)

GDC **(M1)**

$r = 0.999$ **A1**

(b)

$y = 0.199x + 1.09$ **A1**

$0.199(32) + 1.09$ **M1**

7.46 mm **A1**

Every solution is also on ibmathrevision.com/hlaa/bivariate-data-and-correlation-exam-practice
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