

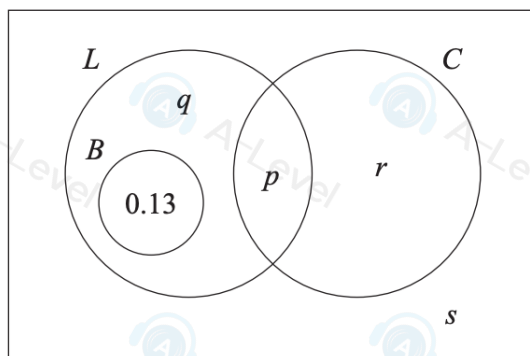
1. The Venn diagram shows the probability of a randomly selected student from a school being in the sets L , B and C , where

L represents the event that the student has instrumental music lessons

B represents the event that the student plays in the school band

C represents the event that the student sings in the school choir

p , q , r and s are probabilities.



- (a) Select a pair of mutually exclusive events from L , B and C .

(1)

Given that $P(L) = 0.4$, $P(B) = 0.13$, $P(C) = 0.3$ and the events L and C are independent,

- (b) find the value of p ,

(2)

- (c) find the value of q , the value of r and the value of s .

(3)

A student is selected at random from those who play in the school band or sing in the school choir.

- (d) Find the exact probability that this student has instrumental music lessons.

(3)

5. A discrete random variable Y has probability function

$$P(Y = y) = \begin{cases} k(3 - y) & y = 1, 2 \\ k(y^2 - 8) & y = 3, 4, 5 \\ k & y = 6 \\ 0 & \text{otherwise} \end{cases}$$

where k is a constant.

(a) Show that $k = \frac{1}{30}$

(2)

Find the exact value of

(b) $P(1 < Y \leq 4)$

(2)

(c) $E(Y)$

(2)

The random variable $X = 15 - 2Y$

(d) Calculate $P(Y \geq X)$

(3)

(e) Calculate $\text{Var}(X)$

(4)

2. Two students, Olive and Shan, collect data on the weight, w grams, and the tail length, t cm, of 15 mice.

Olive summarised the data as follows

$$S_{tt} = 5.3173 \quad \sum w^2 = 6089.12 \quad \sum tw = 2304.53 \quad \sum w = 297.8 \quad \sum t = 114.8$$

- (a) Calculate the value of S_{ww} and the value of S_{ww} (3)

- (b) Calculate the value of the product moment correlation coefficient between w and t (2)

- (c) Show that the equation of the regression line of w on t can be written as

$$w = -16.7 + 4.77t \quad (3)$$

- (d) Give an interpretation of the gradient of the regression line. (1)

- (e) Explain why it would not be appropriate to use the regression line in part (c) to estimate the weight of a mouse with a tail length of 2 cm. (2)

Shan decided to code the data using $x = t - 6$ and $y = \frac{w}{2} - 5$

- (f) Write down the value of the product moment correlation coefficient between x and y (1)

- (g) Write down an equation of the regression line of y on x .
You do not need to simplify your equation. (1)

3. A publisher collects information about the amount spent on advertising, £ x , and the sales, y books, for some of her publications. She collects information for a random sample of 8 textbooks and codes the data using $v = \frac{x + 50}{200}$ and $s = \frac{y}{1000}$ to give

v	0.60	8.10	4.30	0.40	1.60	6.40	2.50	5.10
s	1.84	6.73	5.95	1.30	2.45	7.46	4.82	6.25

[You may use: $\sum v = 29$ $\sum s = 36.8$ $\sum s^2 = 209.72$ $\sum vs = 177.311$ $S_{vv} = 55.275$]

- (a) Find S_{vs} and S_{ss}

(3)

- (b) Calculate the product moment correlation coefficient for these data.

(2)

The publisher believes that a linear regression model may be appropriate to describe these data.

- (c) State, giving a reason, whether or not your answer to part (b) supports the publisher's belief.

(1)

- (d) Find the equation of the regression line of s on v , giving your answer in the form $s = a + bv$

(4)

- (e) Hence find the equation of the regression line of y on x for the sample of textbooks, giving your answer in the form $y = c + dx$

(3)

The publisher calculated the regression line for a sample of novels and obtained the equation

$$y = 3100 + 1.2x$$

She wants to increase the sales of books by spending more money on advertising.

- (f) State, giving your reasons, whether the publisher should spend more money on advertising textbooks or novels.

(2)