

1. A random sample of 10 cars of different makes and sizes is taken and the published miles per gallon, p , and the actual miles per gallon, m , are recorded. The data are coded using variables $x = \frac{p}{10}$ and $y = m - 25$

The results for the coded data are summarised below.

x	6.89	3.67	5.92	5.04	4.87	3.92	4.71	5.14	3.65	5.23
y	30	3	22	15	13	8	15	13.5	3	19

(You may use $\sum y^2 = 2628.25$ $\sum xy = 768.58$ $S_{xx} = 9.25924$ $S_{yy} = 74.664$)

- (a) Show that $S_{yy} = 626.025$ (2)
- (b) Find the product moment correlation coefficient between x and y . (2)
- (c) Give a reason to support fitting a regression model of the form $y = a + bx$ to these data. (1)
- (d) Find the equation of the regression line of y on x , giving your answer in the form $y = a + bx$.
Give the value of a and the value of b to 3 significant figures. (3)

A car's published miles per gallon is 44

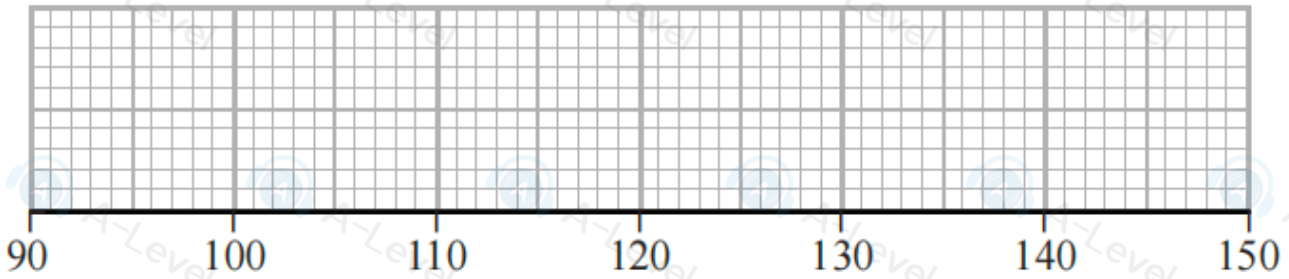
- (e) Estimate the actual miles per gallon for this particular car. (3)
- (f) Comment on the reliability of your estimate in part (e). Give a reason for your answer. (2)

4. The cumulative distribution function of the discrete random variable W , which takes only the values 6, 7 and 8, is given by

$$F(W) = \frac{(w+3)(w-1)}{77} \quad \text{for } w = 6, 7, 8$$

Find $E(W)$

(4)

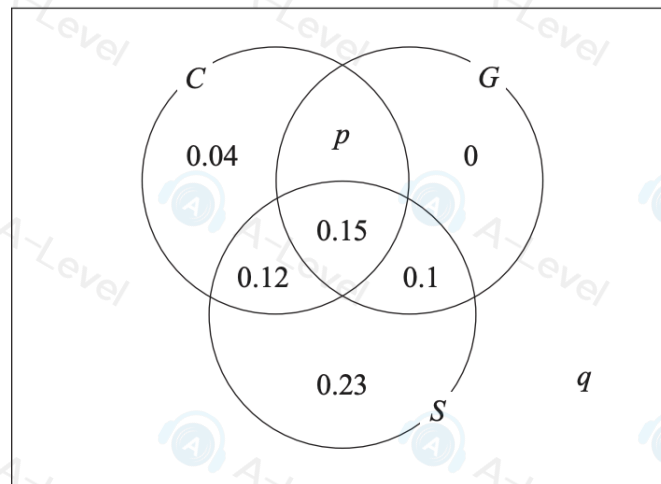


Turn over for a spare diagram if you need to redraw your plot.

6. The Venn diagram shows the probabilities related to teenagers playing 3 particular board games.

C is the event that a teenager plays Chess
 S is the event that a teenager plays Scrabble
 G is the event that a teenager plays Go

where p and q are probabilities.



- (a) Find the probability that a randomly selected teenager plays Chess but does not play Go.

(1)

Given that the events C and S are independent,

- (b) find the value of p

(4)

- (c) Hence find the value of q

(2)

- (d) Find (i) $P((C \cup S) \cap G')$

(1)

- (ii) $P(C | (S \cap G))$

(2)

A youth club consists of a large number of teenagers.
 In this youth club 76 teenagers play Chess and Go.

- (e) Use the information in the Venn diagram to estimate how many of the teenagers in the youth club do not play Scrabble.

(3)

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4. The random variable $Y \sim N(\mu, \sigma^2)$

Given that $P(Y < 17) = 0.6$ find

(a) $P(Y > 17)$ (1)

(b) $P(\mu < Y < 17)$ (2)

(c) $P(Y < \mu | Y < 17)$ (2)

3. The distance that Jenny throws a javelin is normally distributed with mean 42 m and standard deviation 5 m.

(a) Find the probability that the distance Jenny throws the javelin is less than 40 m. (3)

Jenny enters a javelin competition. To qualify for the final she has 3 attempts to throw the javelin a distance of more than 40 m. Once she has qualified she does not use any of her remaining attempts.

Given that Jenny qualified for the final and that throws of the javelin are independent,

(b) find the probability that she qualified for the final on her third throw with a distance greater than 45 m. (5)

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6. A manufacturer fills bottles with oil.

The volume of oil in a bottle, V ml, is normally distributed with $V \sim N(100, 2.5^2)$

(a) Find $P(V > 104.9)$ (3)

(b) In a pack of 150 bottles, find the expected number of bottles containing more than 104.9 ml (2)

(c) Find the value of r , to 2 decimal places, such that $P(V > r | V < 104.9) = 0.2801$ (6)

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3. The discrete random variable X has probability distribution

$$P(X = x) = \frac{1}{5} \quad x = 1, 2, 3, 4, 5$$

(a) Write down the name given to this distribution.

(1)

Find

(b) $P(X = 4)$

(1)

(c) $F(3)$

(1)

(d) $P(3X - 3 > X + 4)$

(2)

(e) Write down $E(X)$

(1)

(f) Find $E(X^2)$

(2)

(g) Hence find $\text{Var}(X)$

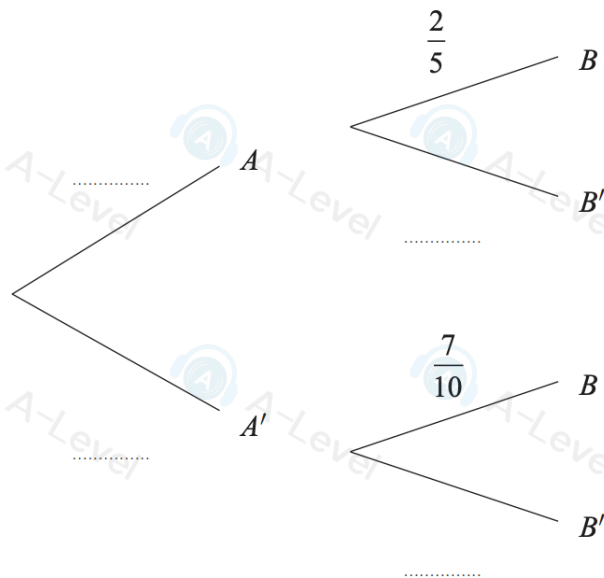
(2)

Given that $E(aX - 3) = 11.4$

(h) find $\text{Var}(aX - 3)$

(4)

4. The following incomplete tree diagram shows the relationships between the event A and the event B .



Given that $P(B) = \frac{9}{20}$

- (a) find $P(A)$ and complete the tree diagram,

(6)

- (b) find $P(A' | B')$.

(2)

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