



Leave blank

1. On a particular day the height above sea level,  $x$  metres, and the mid-day temperature,  $y^\circ\text{C}$ , were recorded in 8 north European towns. These data are summarised below

$$S_{xx} = 3\,535\,237.5 \quad \sum y = 181 \quad \sum y^2 = 4305 \quad S_{xy} = -23\,726.25$$

- (a) Find  $S_{yy}$  (2)
- (b) Calculate, to 3 significant figures, the product moment correlation coefficient for these data. (2)
- (c) Give an interpretation of your coefficient. (1)

A student thought that the calculations would be simpler if the height above sea level,  $h$ , was measured in kilometres and used the variable  $h = \frac{x}{1000}$  instead of  $x$ .

- (d) Write down the value of  $S_{hh}$  (1)
- (e) Write down the value of the correlation coefficient between  $h$  and  $y$ . (1)

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---







3. The discrete random variable  $Y$  has probability distribution

$y$	1	2	3	4
$P(Y=y)$	$a$	$b$	0.3	$c$

where  $a$ ,  $b$  and  $c$  are constants.

The cumulative distribution function  $F(y)$  of  $Y$  is given in the following table

$y$	1	2	3	4
$F(y)$	0.1	0.5	$d$	1.0

where  $d$  is a constant.

(a) Find the value of  $a$ , the value of  $b$ , the value of  $c$  and the value of  $d$ .

**(5)**

(b) Find  $P(3Y + 2 \geq 8)$ .

**(2)**

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---



Leave blank

4. Past records show that the times, in seconds, taken to run 100 m by children at a school can be modelled by a normal distribution with a mean of 16.12 and a standard deviation of 1.60

A child from the school is selected at random.

- (a) Find the probability that this child runs 100 m in less than 15 s. (3)

On sports day the school awards certificates to the fastest 30% of the children in the 100 m race.

- (b) Estimate, to 2 decimal places, the slowest time taken to run 100 m for which a child will be awarded a certificate. (4)

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---



5. A class of students had a sudoku competition. The time taken for each student to complete the sudoku was recorded to the nearest minute and the results are summarised in the table below.

Time	Mid-point, $x$	Frequency, $f$
2 - 8	5	2
9 - 12		7
13 - 15	14	5
16 - 18	17	8
19 - 22	20.5	4
23 - 30	26.5	4

(You may use  $\sum fx^2 = 8603.75$ )

- (a) Write down the mid-point for the 9 - 12 interval. (1)
- (b) Use linear interpolation to estimate the median time taken by the students. (2)
- (c) Estimate the mean and standard deviation of the times taken by the students. (5)

The teacher suggested that a normal distribution could be used to model the times taken by the students to complete the sudoku.

- (d) Give a reason to support the use of a normal distribution in this case. (1)

On another occasion the teacher calculated the quartiles for the times taken by the students to complete a different sudoku and found

$$Q_1 = 8.5 \quad Q_2 = 13.0 \quad Q_3 = 21.0$$

- (e) Describe, giving a reason, the skewness of the times on this occasion. (2)

---

---

---

---

---

---

---

---

---

---

---







- 6. Jake and Kamil are sometimes late for school.  
The events  $J$  and  $K$  are defined as follows

$J$  = the event that Jake is late for school  
 $K$  = the event that Kamil is late for school

$$P(J) = 0.25, P(J \cap K) = 0.15 \text{ and } P(J' \cap K') = 0.7$$

On a randomly selected day, find the probability that

- (a) at least one of Jake or Kamil are late for school, (1)
- (b) Kamil is late for school. (2)

Given that Jake is late for school,

- (c) find the probability that Kamil is late. (3)

The teacher suspects that Jake being late for school and Kamil being late for school are linked in some way.

- (d) Determine whether or not  $J$  and  $K$  are statistically independent. (2)
- (e) Comment on the teacher's suspicion in the light of your calculation in (d). (1)

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---





Leave blank

7. A teacher took a random sample of 8 children from a class. For each child the teacher recorded the length of their left foot,  $f$  cm, and their height,  $h$  cm. The results are given in the table below.

$f$	23	26	23	22	27	24	20	21
$h$	135	144	134	136	140	134	130	132

(You may use  $\sum f = 186$     $\sum h = 1085$     $S_{ff} = 39.5$     $S_{hh} = 139.875$     $\sum fh = 25291$ )

- (a) Calculate  $S_{fh}$  (2)
  
- (b) Find the equation of the regression line of  $h$  on  $f$  in the form  $h = a + bf$ .  
Give the value of  $a$  and the value of  $b$  correct to 3 significant figures. (5)
  
- (c) Use your equation to estimate the height of a child with a left foot length of 25 cm. (2)
  
- (d) Comment on the reliability of your estimate in (c), giving a reason for your answer. (2)

The left foot length of the teacher is 25 cm.

- (e) Give a reason why the equation in (b) should not be used to estimate the teacher's height. (1)

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---





Leave blank

8. A spinner is designed so that the score  $S$  is given by the following probability distribution.

$s$	0	1	2	4	5
$P(S = s)$	$p$	0.25	0.25	0.20	0.20

- (a) Find the value of  $p$ . (2)
- (b) Find  $E(S)$ . (2)
- (c) Show that  $E(S^2) = 9.45$  (2)
- (d) Find  $\text{Var}(S)$ . (2)

Tom and Jess play a game with this spinner. The spinner is spun repeatedly and  $S$  counters are awarded on the outcome of each spin. If  $S$  is even then Tom receives the counters and if  $S$  is odd then Jess receives them. The first player to collect 10 or more counters is the winner.

- (e) Find the probability that Jess wins after 2 spins. (2)
- (f) Find the probability that Tom wins after exactly 3 spins. (4)
- (g) Find the probability that Jess wins after exactly 3 spins. (3)

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---



