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1. The volume of a sample of gas is kept constant. The gas is heated and the pressure, p , is measured at 10 different temperatures, t . The results are summarised below.

$$\sum p = 445 \quad \sum p^2 = 38\,125 \quad \sum t = 240 \quad \sum t^2 = 27\,520 \quad \sum pt = 26\,830$$

- (a) Find S_{pp} and S_{pt} .

(3)

Given that $S_{tt} = 21\,760$,

- (b) calculate the product moment correlation coefficient.

(2)

- (c) Give an interpretation of your answer to part (b).

(1)



2. On a randomly chosen day the probability that Bill travels to school by car, by bicycle or on foot is $\frac{1}{2}$, $\frac{1}{6}$ and $\frac{1}{3}$ respectively. The probability of being late when using these methods of travel is $\frac{1}{5}$, $\frac{2}{5}$ and $\frac{1}{10}$ respectively.

(a) Draw a tree diagram to represent this information. **(3)**

(b) Find the probability that on a randomly chosen day
(i) Bill travels by foot and is late,
(ii) Bill is not late. **(4)**

(c) Given that Bill is late, find the probability that he did not travel on foot. **(4)**



3. The variable x was measured to the nearest whole number. Forty observations are given in the table below.

x	10 – 15	16 – 18	19 –
Frequency	15	9	16

A histogram was drawn and the bar representing the 10 – 15 class has a width of 2 cm and a height of 5 cm. For the 16 – 18 class find

(a) the width, **(1)**

(b) the height **(2)**

of the bar representing this class.



4. A researcher measured the foot lengths of a random sample of 120 ten-year-old children. The lengths are summarised in the table below.

Foot length, l , (cm)	Number of children
$10 \leq l < 12$	5
$12 \leq l < 17$	53
$17 \leq l < 19$	29
$19 \leq l < 21$	15
$21 \leq l < 23$	11
$23 \leq l < 25$	7

- (a) Use interpolation to estimate the median of this distribution. (2)

- (b) Calculate estimates for the mean and the standard deviation of these data. (6)

One measure of skewness is given by

$$\text{Coefficient of skewness} = \frac{3(\text{mean} - \text{median})}{\text{standard deviation}}$$

- (c) Evaluate this coefficient and comment on the skewness of these data. (3)

Greg suggests that a normal distribution is a suitable model for the foot lengths of ten-year-old children.

- (d) Using the value found in part (c), comment on Greg's suggestion, giving a reason for your answer. (2)





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Question 4 continued

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5. The weight, w grams, and the length, l mm, of 10 randomly selected newborn turtles are given in the table below.

l	49.0	52.0	53.0	54.5	54.1	53.4	50.0	51.6	49.5	51.2
w	29	32	34	39	38	35	30	31	29	30

(You may use $S_{ll} = 33.381$ $S_{wl} = 59.99$ $S_{ww} = 120.1$)

- (a) Find the equation of the regression line of w on l in the form $w = a + bl$. (5)
- (b) Use your regression line to estimate the weight of a newborn turtle of length 60 mm. (2)
- (c) Comment on the reliability of your estimate giving a reason for your answer. (2)



6. The discrete random variable X has probability function

$$P(X = x) = \begin{cases} a(3-x) & x = 0, 1, 2 \\ b & x = 3 \end{cases}$$

(a) Find $P(X = 2)$ and complete the table below.

x	0	1	2	3
$P(X = x)$	$3a$	$2a$		b

(1)

Given that $E(X) = 1.6$

(b) Find the value of a and the value of b .

(5)

Find

(c) $P(0.5 < X < 3)$,

(2)

(d) $E(3X - 2)$.

(2)

(e) Show that the $\text{Var}(X) = 1.64$

(3)

(f) Calculate $\text{Var}(3X - 2)$.

(2)



7. (a) Given that $P(A) = a$ and $P(B) = b$ express $P(A \cup B)$ in terms of a and b when
- (i) A and B are mutually exclusive,
 - (ii) A and B are independent.
- (2)**

Two events R and Q are such that

$$P(R \cap Q') = 0.15, \quad P(Q) = 0.35 \text{ and } P(R|Q) = 0.1$$

Find the value of

- (b) $P(R \cup Q)$, **(1)**
- (c) $P(R \cap Q)$, **(2)**
- (d) $P(R)$. **(2)**



8. The lifetimes of bulbs used in a lamp are normally distributed.
A company X sells bulbs with a mean lifetime of 850 hours and a standard deviation of 50 hours.

(a) Find the probability of a bulb, from company X , having a lifetime of less than 830 hours. **(3)**

(b) In a box of 500 bulbs, from company X , find the expected number having a lifetime of less than 830 hours. **(2)**

A rival company Y sells bulbs with a mean lifetime of 860 hours and 20% of these bulbs have a lifetime of less than 818 hours.

(c) Find the standard deviation of the lifetimes of bulbs from company Y . **(4)**

Both companies sell the bulbs for the same price.

(d) State which company you would recommend. Give reasons for your answer. **(2)**





Question 8 continued

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Lined area for writing the answer to Question 8.



