



1. As part of a statistics project, Gill collected data relating to the length of time, to the nearest minute, spent by shoppers in a supermarket and the amount of money they spent. Her data for a random sample of 10 shoppers are summarised in the table below, where  $t$  represents time and  $\pounds m$  the amount spent over  $\pounds 20$ .

$t$ (minutes)	$\pounds m$
15	-3
23	17
5	-19
16	4
30	12
6	-9
32	27
23	6
35	20
27	6

- (a) Write down the actual amount spent by the shopper who was in the supermarket for 15 minutes. (1)

- (b) Calculate  $S_{tt}$ ,  $S_{mm}$  and  $S_{tm}$ .

(You may use  $\Sigma t^2 = 5478$   $\Sigma m^2 = 2101$   $\Sigma tm = 2485$ ) (6)

- (c) Calculate the value of the product moment correlation coefficient between  $t$  and  $m$ . (3)

- (d) Write down the value of the product moment correlation coefficient between  $t$  and the actual amount spent. Give a reason to justify your value. (2)

On another day Gill collected similar data. For these data the product moment correlation coefficient was 0.178

- (e) Give an interpretation to both of these coefficients. (2)

- (f) Suggest a practical reason why these two values are so different. (1)

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2. In a factory, machines  $A$ ,  $B$  and  $C$  are all producing metal rods of the same length. Machine  $A$  produces 35% of the rods, machine  $B$  produces 25% and the rest are produced by machine  $C$ . Of their production of rods, machines  $A$ ,  $B$  and  $C$  produce 3%, 6% and 5% defective rods respectively.
- (a) Draw a tree diagram to represent this information. (3)
- (b) Find the probability that a randomly selected rod is
- (i) produced by machine  $A$  and is defective,
  - (ii) is defective. (5)
- (c) Given that a randomly selected rod is defective, find the probability that it was produced by machine  $C$ . (3)





3. The random variable  $X$  has probability function

$$P(X = x) = \frac{(2x-1)}{36} \quad x = 1, 2, 3, 4, 5, 6.$$

(a) Construct a table giving the probability distribution of  $X$ . (3)

Find

(b)  $P(2 < X \leq 5)$ , (2)

(c) the exact value of  $E(X)$ . (2)

(d) Show that  $\text{Var}(X) = 1.97$  to 3 significant figures. (4)

(e) Find  $\text{Var}(2 - 3X)$ . (2)

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4. Summarised below are the distances, to the nearest mile, travelled to work by a random sample of 120 commuters.

Distance (to the nearest mile)	Number of commuters
0–9	10
10–19	19
20–29	43
30–39	25
40–49	8
50–59	6
60–69	5
70–79	3
80–89	1

For this distribution,

- (a) describe its shape, (1)

- (b) use linear interpolation to estimate its median. (2)

The mid-point of each class was represented by  $x$  and its corresponding frequency by  $f$  giving

$$\Sigma fx = 3550 \quad \text{and} \quad \Sigma fx^2 = 138020$$

- (c) Estimate the mean and the standard deviation of this distribution. (3)

One coefficient of skewness is given by

$$\frac{3(\text{mean} - \text{median})}{\text{standard deviation}}$$

- (d) Evaluate this coefficient for this distribution. (3)

- (e) State whether or not the value of your coefficient is consistent with your description in part (a). Justify your answer. (2)



















