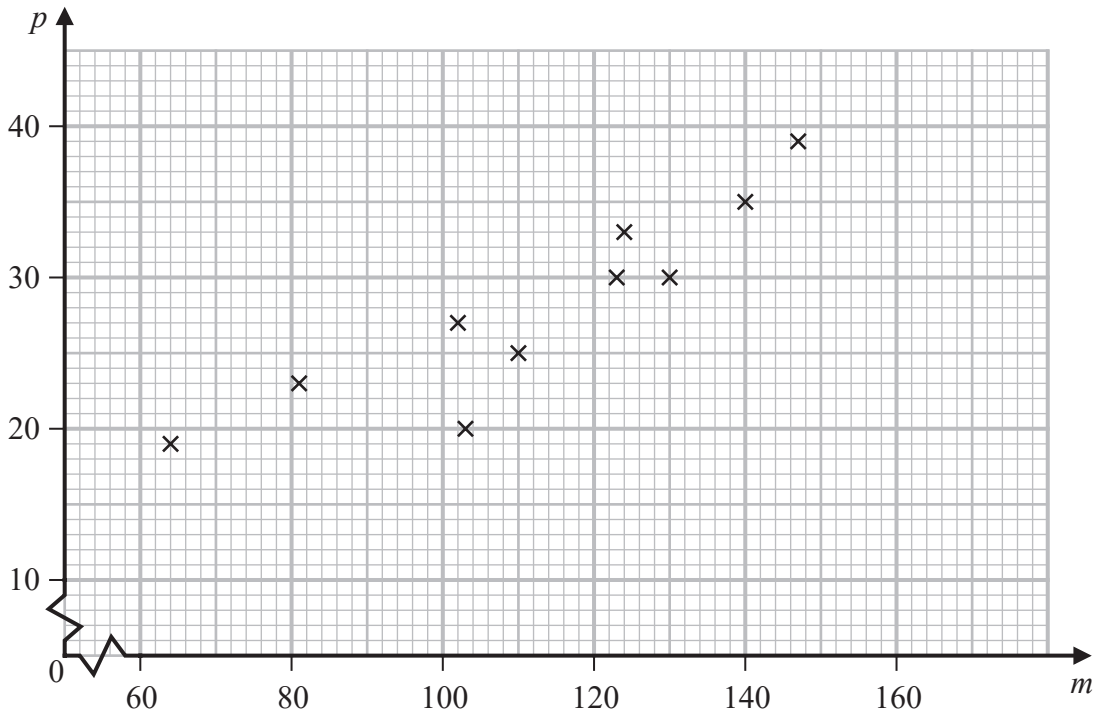
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3. *Soapern* sells washing machines. When a customer buys a washing machine from *Soapern*, the customer is also invited to buy a guarantee policy to cover breakdowns and repairs for the next three years.

The manager of *Soapern* believes that the relationship between the number of washing machines sold (m) and the number of guarantee policies sold (p) can be modelled by a straight line.

She collected data each month for 10 months. The scatter diagram below illustrates these data.



The data are summarised by the following statistics.

$$\sum m = 1124 \quad \sum p = 281 \quad \sum mp = 32\,958 \quad S_{mm} = 6046.4 \quad S_{pp} = 382.9$$

(a) Show that $S_{mp} = 1373.6$

(1)

(b) Find the value of the product moment correlation coefficient for these data.

(2)

(c) State, giving a reason, whether or not the data are consistent with the manager's belief.

(1)

The manager noticed that the total number of washing machines sold was k times the total number of guarantee policies sold and suggests a model of the form $p = \frac{1}{k}m$, where k is an integer.

(d) Find the value of k.

(2)

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Jiang works for *Soapern* and thought that this model oversimplified the situation and suggested that a linear regression of p on m may be more appropriate.

(e) Find the equation of the linear regression of p on m, giving your answer in the form $p = a + bm$, where a and b should be given to 3 significant figures.

(4)

(f) Use Jiang's model to estimate the number of guarantee policies sold when 70 washing machines are sold in a month.

(1)

Usually about 70 washing machines are sold in January. *Soapern* decides to offer a bonus to staff during January based on the number of guarantee policies sold. If the number of guarantee policies sold is greater than the number estimated by the model, the bonus will be paid.

(g) State, giving your reasons, whether you would recommend that the staff use the manager's model or Jiang's model.

(2)

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Question 3 continued

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Question 3 continued

(Total 13 marks)

Q3