1. A shop keeper recorded daily sales *s* of ice cream along with the daily maximum temperature *t*°C. The results for one week are shown below.

t	29	31	34	23	19	20	27
s	104	92	112	48	56	72	66

(a) Write down the equation of the regression line for *s* on *t*.

(3)

(b) Use your equation to predict the ice cream sales on a day when the maximum temperature is 24 °C. Give your answer correct to the nearest whole number.

(3)
(Total 6 marks)

2. The marks obtained by 8 candidates in Physics and Chemistry tests are given below.

Physics (*x*)	6	8	10	11	10	5	4	12
Chemistry (*y*)	8	11	14	13	11	7	5	15

(a) Write down the product moment correlation coefficient, *r*.

(1)

(b) Write down, in the form $y = mx + c$, the equation of the regression line *y* on *x* for the 8 candidates.

(2)

A ninth candidate obtained a score of 7 in the Physics test but was absent for the Chemistry test.

(c) Use your answer to (b) to estimate the score he would have obtained on the Chemistry test.

(2)

(d) Give a reason why it is valid to use this regression line to estimate the score on the Chemistry test.

(1)
(Total 6 marks)

3. The heat output in thermal units from burning 1 kg of wood changes according to the wood's percentage moisture content. The moisture content and heat output of 10 blocks of the same type of wood each weighing 1 kg were measured. These are shown in the table.

Moisture content % (x)	8	15	22	30	34	45	50	60	74	82
Heat output (y)	80	77	74	69	68	61	61	55	50	45

(a) Draw a scatter diagram to show the above data. Use a scale of 2 cm to represent 10 % on the x-axis and a scale of 2 cm to represent 10 thermal units on the y-axis.

(4)

(b) Write down

(i) the mean percentage moisture content, $\bar{x}$;

(ii) the mean heat output, $\bar{y}$.

(2)

(c) Plot the point ($\bar{x}, \bar{y}$) on your scatter diagram and label this point M.

(2)

(d) Write down the product-moment correlation coefficient, r.

(2)

The equation of the regression line y on x is $y = -0.470x + 83.7$.

(e) Draw the regression line y on x on your scatter diagram.

(2)

(f) Estimate the heat output in thermal units of a 1 kg block of wood that has 25 % moisture content.

(2)

(g) State, with a reason, whether it is appropriate to use the regression line y on x to estimate the heat output in part (f).

(2)
(Total 16 marks)

4. At the end of the year, only seven of the female Science students sat examinations in Science and French.

The marks for these seven students are shown in the following table.

Science (S)	23	51	56	62	12	73	72
French (F)	65	45	45	40	70	36	30

(a) Using a scale of 2 cm to represent 10 marks for each axis, draw a labelled scatter diagram for this data.

(4)

(b) Use your graphic display calculator to find

(i) $\overline{S}$, the mean of S;

(ii) $\overline{F}$, the mean of F.

(2)

(c) Plot the point M($\overline{S}, \overline{F}$) on your scatter diagram.

(1)

(d) Use your graphic display calculator to find the equation of the regression line of F on S.

(2)

(e) Draw the regression line on your scatter diagram.

(2)

Carletta's mark on the Science examination was 44. She did not sit the French examination.

(f) Estimate Carletta's mark for the French examination.

(2)

Monique's mark on the Science examination was 85. She did not sit the French examination. Her French teacher wants to use the regression line to estimate Monique's mark.

(g) State whether the mark obtained from the regression line for Monique's French examination is reliable. Justify your answer.

(2)
(Total 15 marks)

5. In an environmental study of plant diversity around a lake, a biologist collected data about the number of different plant species (y) that were growing at different distances (x) in metres from the lake shore.

Distance (x)	2	5	8	10	13	17	23	35	40
Plant species (y)	35	34	30	29	24	19	15	13	8

(a) Draw a scatter diagram to show the data. Use a scale of 2 cm to represent 10 metres on the x-axis and 2 cm to represent 10 plant species on the y-axis.

(4)

(b) Using your scatter diagram, describe the correlation between the number of different plant species and the distance from the lake shore.

(1)

(c) Use your graphic display calculator to write down

(i) $\bar{x}$, the mean of the distances from the lake shore;

(ii) $\bar{y}$, the mean number of plant species.

(2)

(d) Plot the point $(\bar{x}, \bar{y})$ on your scatter diagram. **Label this point M.**

(2)

(e) Write down the equation of the regression line y on x for the above data.

(2)

(f) Draw the regression line y on x on your scatter diagram.

(2)

(g) Estimate the number of plant species growing 30 metres from the lake shore.

(2)
(Total 15 marks)

6. Alex and Kris are riding their bicycles together along a bicycle trail and note the following distance markers at the given times.

Time (t hours)	1	2	3	4	5	6	7
Distance (d km)	57	65	72	81	89	97	107

(a) Draw a scatter diagram of the data. Use 1 cm to represent 1 hour and 1 cm to represent 10 km.

(3)

(b) Write down for this set of data

    (i)   the mean time, $\bar{t}$;

    (ii)   the mean distance, $\bar{d}$.

(2)

(c) Mark and label the point $M(\bar{t}, \bar{d})$ on your scatter diagram.

(2)

(d) Draw the line of best fit on your scatter diagram.

(2)

(e) **Using your graph**, estimate the time when Alex and Kris pass the 85 km distance marker. Give your answer correct to **one decimal place**.

(2)

(f) Write down the equation of the regression line for the data given.

(2)

(g) (i) **Using your equation** calculate the distance marker passed by the cyclists at 10.3 hours.

    (ii)   Is this estimate of the distance reliable? Give a reason for your answer.

(4)
(Total 17 marks)