Answer **all** questions in the answer booklet provided. Please start each question on a new page. You are advised to show all working, where possible. Where an answer is incorrect, some marks may be given for a correct method, provided this is shown by written working. Solutions found from a graphic display calculator should be supported by suitable working, for example, if graphs are used to find a solution, you should sketch these as part of your answer.

1. [Maximum mark: 16]

A healthy human body temperature is $37.0\,^{\circ}\mathrm{C}$. Eight people were medically examined and the difference in their body temperature (°C), from $37.0\,^{\circ}\mathrm{C}$, was recorded. Their heartbeat (beats per minute) was also recorded.

Temperature difference from 37°C (x)	–0.2	0.3	–0.3	–0.2	–0.1	0	0.2	0.5
Heartbeat (y)	63	77	70	74	65	78	79	86

(a) Draw a scatter diagram for temperature difference from $37\,^{\circ}\mathrm{C}$ (x) against heartbeat (y). Use a scale of $2\,\mathrm{cm}$ for $0.1\,^{\circ}\mathrm{C}$ on the horizontal axis, starting with $-0.3\,^{\circ}\mathrm{C}$. Use a scale of $1\,\mathrm{cm}$ for 2 heartbeats per minute on the vertical axis, starting with 60 beats per minute. [4]

(b) Write down, for this set of data

(i) the mean temperature difference from $37\,^{\circ}\mathrm{C}$, $\overline{x}$;

(ii) the mean number of heartbeats per minute, $\overline{y}$. [2]

(c) Plot and label the point $\mathrm{M}(\overline{x}, \overline{y})$ on the scatter diagram. [2]

(d) (i) Use your graphic display calculator to find the Pearson's product–moment correlation coefficient, r.

(ii) Hence describe the correlation between temperature difference from $37\,^{\circ}\mathrm{C}$ and heartbeat. [4]

(e) Use your graphic display calculator to find the equation of the regression line y on x. [2]

(f) Draw the regression line y on x on the scatter diagram. [2]

3. [Maximum mark: 17]

The Malvern Aquatic Center hosted a 3 metre spring board diving event. The judges, Stan and Minsun awarded 8 competitors a score out of 10. The raw data is collated in the following table.

Competitors	A	B	C	D	E	F	G	H
Stan's score (x)	4.1	3	4.3	6	7.1	6	7.5	6
Minsun's score (y)	4.7	4.6	4.8	7.2	7.8	9	9.5	7.2

(a) (i) Write down the value of the Pearson's product–moment correlation coefficient, r.

(ii) Using the value of r, interpret the relationship between Stan's score and Minsun's score. [4]

(b) Write down the equation of the regression line y on x. [2]

(c) (i) Use your regression equation from part (b) to estimate Minsun's score when Stan awards a perfect 10.

(ii) State whether this estimate is reliable. Justify your answer. [4]

The Commissioner for the event would like to find the Spearman's rank correlation coefficient.

(d) **Copy** and complete the information in the following table. [2]

Competitors	A	B	C	D	E	F	G	H
Stan's Rank		8					1	4
Minsun's Rank		8					1	4.5

(e) (i) Find the value of the Spearman's rank correlation coefficient, r_s.

(ii) Comment on the result obtained for r_s. [4]

The Commissioner believes Minsun's score for competitor G is too high and so decreases the score from 9.5 to 9.1.

(f) Explain why the value of the Spearman's rank correlation coefficient r_s does not change. [1]