

0 4

A group of students was carrying out an investigation into rates of infiltration at different points on a transect down a valley side. Their aim was to test the hypothesis that 'The rate of infiltration will be faster on the higher land than it is on the lower land that is on or close to the flood plain.'

They timed how long it took for a measured volume of water to infiltrate into the soil at ten points along the transect. They also measured the angle of slope and the altitude at each of the ten points.

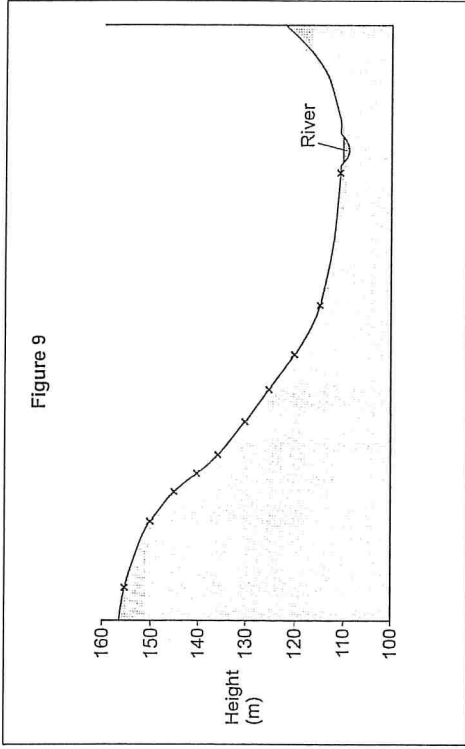
Figure 8 shows the table of data that they produced.

Figure 8

Sample site altitude (in metres)	Time taken for infiltration (in seconds)	Angle of slope (in degrees)
155 (top of valley side)	55	3
150	33	8
145	28	10
140	26	12
135	22	11
130	20	8
125	20	5
120	40	5
115	82	4
110 (on river bank)	120	2

Turn over ▶

Figure 9 is a cross section showing the locations of the sampling points.



Question 4 continues on the next page

One of the students tested for a correlation between the two sets of data in Figure 8, using a Spearman's rank correlation test. Figure 10 shows how she set out the data and started her calculations.

Figure 10

Calculation of the Spearman's rank correlation coefficient (Rs).

Sample site Altitude (m)	Rank altitude R1	Infiltration time (secs)	Rank time R2	d (R1-R2)	d ²
155	1	55	8	-7	49
150	2	33	6	-4	16
145	3	28	5	-2	4
140	4	26	4	0	0
135	5	22	3	2	4
130	6	20			
125	7	20	1.5	5.5	30.25
120	8	40	7	1	1
115	9	82	9	0	0
110	10	120	10	0	0

$\sum d^2 =$ _____	_____
$6 \times \sum d^2 =$ _____	_____
$R_s = 1 - \frac{6 \sum d^2}{n^3 - n}$	_____
= $1 -$ _____	990
= $1 -$ _____	_____
= R_s _____	_____

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0 4 . 1 Complete the calculation of Rs (show your working). [4 marks]

Figure 11 shows an extract from the table of critical values for Rs.

Figure 11

n	0.05	0.01
8	0.643	0.833
9	0.600	0.783
10	0.564	0.746
12	0.506	0.712

0 4 . 2 How confident can you be that the student's hypothesis, 'The rate of infiltration will be faster on the high land than it is on the lower land that is on or close to the flood plain' is supported by the data? [2 marks]
