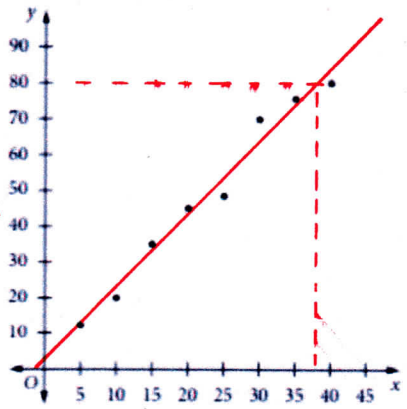
MODELLING BY FINDING THE EQUATION OF THE LINE OF BEST FIT

1 Consider the following scatterplot.



(a) Copy the scatterplot and on it sketch a line of best fit.
(b) Find the y-intercept and the gradient of this line of best fit.
(c) What is the equation of this line? Round the gradient and y-intercept to the nearest whole number.

b) y-intercept is $\simeq 3$; gradient is $\frac{80-3}{38} = 2$ approx

$y = 2x + 3$

2 The data from a weather balloon measuring the air temperature every kilometre as it rises through the atmosphere are shown below.

Altitude (km)	0	1	2	3	4	5	6	7
Temperature (°C)	15.0	8.5	2.0	−4.5	−11.0	−17.5	−23.9	−30.5

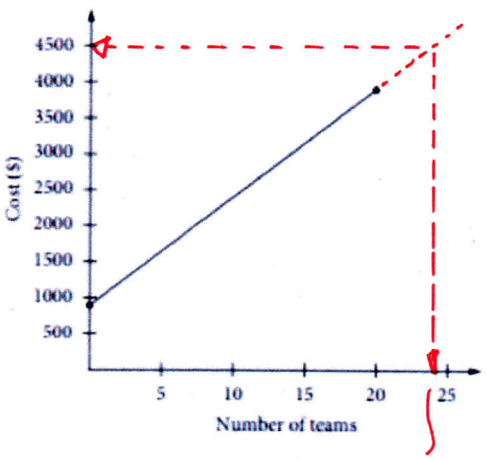
(a) Use technology to find r and the least squares regression equation for the line of best fit.
(b) Comment on the association.

a) Using EXCEL $r = -1$ $y = -6.5x + 15$ (=SLOPE(Array of y, Array of x))
b) There is a strong, negative, linear association between the variables.
For every increase in altitude of 1 km, the temperature decreases by 6.5°C

3 The following experimental equation links the length and diameter of octopus tentacles. The original data set for this equation included lengths between 0 and 4 m: length (m) = 0.2 + 0.7 × diameter (mm)
Complete the following table:

Length (m)	Diameter (mm)	Interpolation/Extrapolation
0.9	1	interpolation
2.3	3	interpolation
10	14	extrapolation

4 Sonya is arranging a round robin tournament for the local Netball Association. Her fixed costs are the cost of hiring the courts and buying the trophies. The extra costs, which depend upon the number of teams that enter, are for umpires and catering.
The maximum number of teams who can be accepted is 24 due to the availability of courts. The graph below shows the total cost of running the event depending upon the number of teams entered.



(a) Find the cost of hiring the courts and buying the trophies.
(b) Find the extra cost for every team that enters.

a) This is the y-intercept, $\simeq 850$ dollars.
b) gradient is $\frac{4580-850}{24} = 152$
so about $152 per extra team that enters

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7 Some believe that you can predict a person's height by measuring the length of their arm span. The results for 20 students were recorded as shown in the table below.

Person	Height, h (cm)	Arm span, a (cm)
1	128	132
2	138	134
3	141	136
4	142	138
5	145	138
6	144	140
7	152	141
8	145	142
9	148	143
10	144	144

Person	Height, h (cm)	Arm span, a (cm)
11	148	144
12	149	144
13	152	145
14	150	145
15	150	146
16	147	148
17	152	148
18	154	155
19	172	164
20	168	170

(a) Use the table of data to choose the correct options given for the following sentences:

(i) This is [**bivariate** / **univariate**] data, since there are [**one** / **two**] measurements for each person.

(ii) The data is ranked according to increasing [**arm span** / **height**]

(iii) The other variable follows [**a decreasing** / **an increasing**] linear trend.

(iv) As both sets of data are increasing together, this would suggest a [**negative** / **positive**] linear trend.

(b) Choose the correct options to complete the statements below.

Statement	Options
To show any association you could draw a	scatterplot
As this is recorded data you need to check for	outliers
To find the equation for the line of best fit you find the	least squares regression line
To check on the strength of the association you calculate the	correlation coefficient r
The independent variable is most likely to be	height
The dependent variable is most likely to be	arm span
The independent variable should be plotted on the	horizontal axis
The dependent variable should be plotted on the	vertical axis

(c) Use the table of data to complete the following:

(i) The range of heights measured go from [128] cm to [172] cm.

(ii) The range of arm spans measured go from [132] cm to [170] cm.

(d) Which is a suitable scale to use, so that there are between 5 and 10 even divisions on both the vertical and horizontal axes?

A From 0 to 180 with divisions every 10 cm

B From 0 to 180 with divisions every 50 cm

C From 125 to 175 with divisions of 2 cm

D From 125 to 175 with divisions of 5 cm

(f) Calculate the value of r, correct to 2 decimal places.

Using EXCEL $r = 0.92$

(g) Find the regression equation.

$h = 11.61 + 0.94a$

(h) From this limited data set, do you think the arm span is a good way of predicting height? Explain.

A correlation of 0.92 shows a strong correlation, meaning that arm span is a good predictor of height.