 NESA exemplar question solutions

MS-S4 Bivariate data analysis

Solutions for questions from the NESA topic guidance related to bivariate data analysis.

1. Ahmed collected data on the age ($a$) and the height ($h$) of males aged $11$ to $16$ years. He created a scatterplot of the data and constructed a line of best fit to model the relationship between the ages and height of males.



1. Determine the gradient of the line of best fit shown on the graph.

Solution: Line of best fit passes through the points ($11,146$) and ($15, 170$)

$$m=\frac{y\_{2}-y\_{1}}{x\_{2}-x\_{1}}$$

$$m=\frac{170-146}{15-11}$$

$$m=\frac{24}{4}$$

$$m=6$$

$∴$ The gradient of the line of best fit is $6$

1. Explain the meaning of the gradient in the context of the data.

Solution: The gradient is positive which indicates that as age increases the height of the male also increases at a rate of approximately $6$cm per year.

1. Determine the equation of the line of best fit shown on the graph.

*Solution:* $m=6$ passing through the point ($15,170$)

$$y=mx+b$$

$$h=ma+b$$

$$170=6\left(15\right)+b$$

$$170=90+b$$

$$bbb=170-90$$

$$bbb=80$$

$∴$ The equation for the line of best fit is $h=6a+80$

1. Use the line of best fit to predict the height of a typical $17$-year-old male.

Solution: when $a=17$

$$h=6\left(17\right)+80$$

$$h=182$$

$∴$ The height of a typical $17$-year-old male is $182$ cm.

1. Why would this model not be useful for predicting the height of a typical $45$-year-old male?

Solution: when $a=45$

$$h=6\left(45\right)+80$$

$$h=350$$

Using this model the height of a typical $45$-year-old male would be $350$ cm. This is not a reasonable solution and assumes that males continue to grow at the same rate for the rest of their life. This model is not useful for predicting the height of a typical $45$-year-old male as it is extrapolating the data.

| Height (cm) | 165 | 153 | 146 | 138 | 149 | 172 | 170 | 158 | 163 | 154 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Right Foot (cm) | 26 | 21 | 20 | 19 | 22 | 24 | 25 | 23 | 22 | 25 |

1. The height and length of the right foot of $10$ high school students were measured. The results were tabulated as follows:
2. Using technology, calculate the Pearson correlation coefficient for the data.

Solution: $r=0.7835811345$

1. Describe the strength of the association between height and length of the right foot

Solution: the Pearson correlation coefficient of $0.78$ (correct to 2 decimal places) indicates a strong positive linear association between a students height and the length of their right foot.