# Practice Test with Solutions– Linear Modeling

**1a.** *[2 marks]*

There are nine books on a shelf. For each book, *x* is the number of pages, and *y* is the selling price in pounds (£). Let *r* be the correlation coefficient.

Write down the possible minimum and maximum values of *r* .

## Markscheme

min value of *r* is , max value of *r* is 1 ***A1A1 N2***

**1b.** *[1 mark]*

Given that  , which of the following diagrams best represents the data.



## Markscheme

C ***A1 N1***

**1c.** *[2 marks]*



For the data in diagram D , which **two** of the following expressions describe the correlation between *x* and *y* ?

perfect, zero, linear, strong positive, strong negative, weak positive, weak negative

## Markscheme

linear, strong negative ***A1A1 N2***

**2a.** *[2 marks]*

Each day, a factory recorded the number (  ) of boxes it produces and the total production cost (  ) dollars. The results for nine days are shown in the following table.



Write down the equation of the regression line of *y* on *x* .

## Markscheme

 ***A1A1 N2***

**2b.** *[2 marks]*

Use your regression line from part (a) as a model to answer the following.

Interpret the meaning of

(i) the gradient;

(ii) the *y*-intercept.

## Markscheme

(i) additional cost per box (unit cost) ***A1 N1***

(ii) fixed costs ***A1 N1***

 **2c.** *[2 marks]*

Estimate the cost of producing 60 boxes.

## Markscheme

attempt to substitute into regression equation ***M1***

e.g.  , 

 (accept  from 3 s.f. values) ***A1 N2***

**2d.** *[3 marks]*

The factory sells the boxes for $19.99 each. Find the least number of boxes that the factory should produce in one day in order to make a profit.

## Markscheme

setting up inequality (accept equation) ***M1***

e.g. 

 ***A1***

13 boxes (accept 14 from  , using 3 s.f. values) ***A1 N2***

**2e.** *[4 marks]*

Comment on the appropriateness of using your model to

(i) estimate the cost of producing 5000 boxes;

(ii) estimate the number of boxes produced when the total production cost is $540.

## Markscheme

(i) this would be extrapolation, not appropriate ***R1R1 N2***

(ii) this regression line cannot predict *x* from *y*, not appropriate ***R1R1 N2***

**3a.** *[2 marks]*

The following table shows the average weights ( *y* kg) for given heights (*x* cm) in a population of men.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Heights (*x***  **cm)** | 165 | 170 | 175 | 180 | 185 |
| **Weights (*y***  **kg)** | 67.8 | 70.0 | 72.7 | 75.5 | 77.2 |

The relationship between the variables is modeled by the regression equation .

Write down the value of  and of .

## Markscheme

 (exact) ***A1 N1***

 (exact),  ***A1 N1***

**3b.** *[2 marks]*

The relationship between the variables is modeled by the regression equation .

Hence, estimate the weight of a man whose height is 172 cm.

## Markscheme

correct substitution ***(A1)***

*eg* 



 (kg) ***A1 N2***

**3c.** *[1 mark]*

Write down the correlation coefficient.

## Markscheme



 ***A1 N1***

**3d.** *[2 marks]*

State which **two** of the following describe the correlation between the variables.

|  |  |  |
| --- | --- | --- |
| strong  | zero  | positive |
| negative  | no correlation  | weak |

## Markscheme

strong, positive (must have both correct) ***A2 N2***