6.3 - Modelling Data with a Line of Best Fit

Monday, December 6, 2021   10:07 AM

📄 6.3 -
Modelling...

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6.3 – MODELLING DATA WITH A LINE OF BEST FIT

Interpolation

Interpolation is the process used to estimate a value within the domain of a set of data, based on a trend.

You can graph the scatter plot and interpolate using a graphing calculator.

Step 1. Enter the data

→ Press STAT key → Select EDIT → Clear any numbers that are written in L1, L2

→ Under Column L1, enter the data (x-values)

→ Under Column L2, enter the data (y-values)

Step 2. Choose window   *Zoom → Select Zoom Stat → Enter*

→ Press ~~WINDOW~~ and adjust Xmin, Xmax, Ymin, Ymax

→ Graph

Step 3. Obtain the function

→ Press STAT key → Select CALC → Select #4 LinReg (or #5 QuadReg or #6 CubicReg)

→ Enter L1 , L2 ,   *LinReg (ax+b) L₁, L₂, Y₁*

→ VARS → Select Y-VARS → Select #1 Function → Y1

Use Technology to Determine a Linear Model for Continuous Data

Example 1: The one-hour record is the farthest distance travelled by bicycle in 1 h. The table below shows the world-record distances and the dates they were accomplished.

L₁ year after 1996   *L₁   0   2   3   6   7   8   11   12   13*

| Year	1996	1998	1999	2002	2003	2004	2007	2008	2009
Distance (km)	78.04	79.14	81.16	82.60	83.72	84.22	86.77	87.12	90.60

L₂

International Human Powered Vehicle Association

a. Use technology to create a scatter plot and to determine the equation of the line of best fit. Round to three decimal places.

$$y = ax + b$$

$$y = 0.8585x + 77.79$$

b. Interpolate a possible world-record distance for the year 2006, to the nearest hundredth of a kilometre.
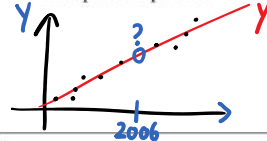
Time   distance

X = years after 1996
(L₁)
Year 2006 ⇒ X = 10

X = 10   Y = ?

2nd Calc → Select Value → X = 10
↓
Enter

Linear regression results in an equation that balances the points in the scatter plot on both sides of the line. A line of best fit can be used to predict values that are not recorded or plotted. Predictions can be made by reading values from the line of best fit on a scatter plot or by using the equation of the line of best fit.

y = 86.38 km

X = 5   Y = 82.09 km?

Year 2001

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handwritten: stat → calc → Lin Reg L_1, L_2, Y_1

Try: Consider the data in the table. Use technology to create a scatter plot and to determine the equation of the line of best fit.

handwritten: Zoom → Zoom STAT $y = 0.6929x + 5.1828$

handwritten label: L_1 / L_2

x	0	2	4.5	5.2	9.5	12
y	5.1	6.7	8.2	8.8	11.9	13.4

handwritten: 2nd Cal → select Value   2nd Calc → 5: Intersect

a. Determine, to the nearest tenth, the value of y when x is 10.6.

handwritten: (easy) $x = 10.6$
$y = 12.53$?
$X = 10.6$ ↓ Enter

b. Determine, to the nearest tenth, the value of x when y is 9.8.

handwritten: (hard) $y = 9.8$ $x = ?$
$Y=$ → Y_1 = Linear Eq.
$Y_2 = 9.8$ ∴ $X = 6.66$
move close ↓ Enter ×3

Extrapolation

Extrapolation is the process used to estimate a value outside the domain of a set of data, based on a trend.

Use Linear Regression to Solve a Problem that Involves Discrete Data

Example 2: Matt buys T-shirts for a company that prints art on T-shirts and then resells them. When buying the T-shirts, the price Matt must pay is related to the size of the order. Five of Matt's past orders are listed in the table below.

handwritten: Var ↓ Y-Var ↓ Function ↓ LinReg (ax+b) L_1, L_2, Y_1

handwritten labels: L_1 L_2

| Number of Shirts	Cost per Shirt ($)
500	3.25
700	1.95
200	5.20
460	3.51
740	1.69

Matt has misplaced the information from his supplier about price discounts on bulk orders. He would like to get the price per shirt below $1.50 on his next order.

a. Use technology to create a scatter plot and determine an equation for the linear regression function that models the data. Round to three decimal places.

handwritten: Cost
$y = ax + b$
$y = -0.0065x + 6.5$
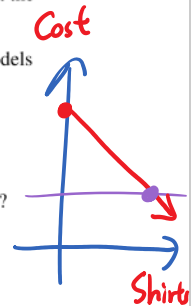
b. What do the slope and y-intercept of the equation of the linear regression function represent in this context?

handwritten: Slope = rate of cost decrease   y-int = base cost.
Shirts

c. Use the linear regression function to extrapolate the size of order necessary to achieve the price of $1.50 per shirt.

handwritten: $y = \$1.5$ $X = 769$?
cost   Shirt
Y_1 = Linear Reg.
$Y_2 = 1.5$
find Intersect !!

Assignment: p. 407 #1 – 11 (odds)