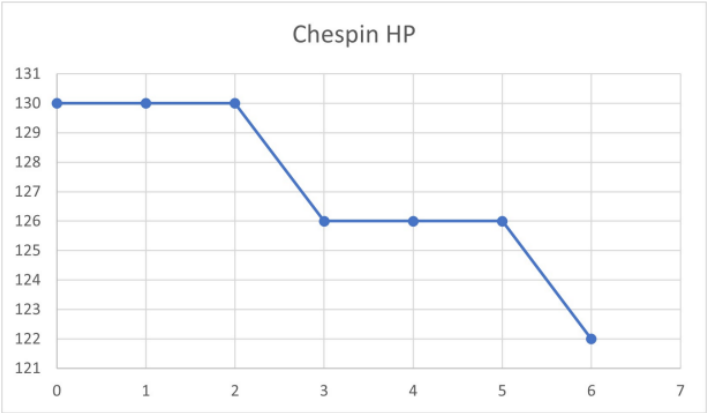
Pokémath: Homework 8

Popular curve:

Pokémon® Problems



Above is a plot of Chespin's HP (on the y-axis) over turns (on the x-axis). Use the plot to answer the following questions.

1) To find one linear model for Chespin's HP, give the equation of the line through the two end points: (0, 130) and (6, 122).

2) Draw the linear model you found in question 1 on the given plot. Do you think this is the linear model that fits the 'best' just by looking at the plots? (Fitting the 'best' means the line is the closest to the data set. We will give a more rigorous explanation later.)

3) Try and find a better fitting linear model by making a model using points (1, 130) and (4, 126). Note

that the y-intercept for this model should be different from the previous one!

4) Draw the linear model you found in question 3 on the given plot. Do you think this is the linear model that fits the 'best' just by looking at the plots?

5) The residual measures how well a model fits a data set at one specific point. It is defined as the difference between the output of the linear model and the actual data value at a specific input. Fill in the following chart with the residuals from the two models (question 1 and question 3).

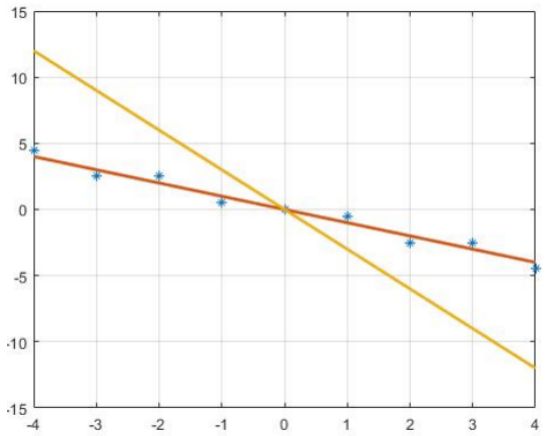
Input (x)	0	1	2	3	4	5	6
Actual Data Output	130	130	130	126	126	126	122
Question 1 Model Output (y)	130	128.67					122
Question 1 Model Residual	0	1.33					0
Question 3 Model Output (y)	131.33	130			126		
Question 3 Model Residual	−1.33	0			0		

6) One way to measure how well the model fits a data set is to compute the sum of its residuals at all points. Intuitively, the sum of residuals represents the distance between the linear model and data set. Write and compare the residual sums for each of the models from question 1 and question 3.

7) Is the following statement always true?

The closer the residual sum is to zero, the better the model fits the data set.

Hint: Consider the following plot. The blue stars are the data set, and the yellow and red lines are two linear models. Both of them have zero residual sum. Do you think they are both the 'best' fitting linear models of the given data set? Why?



8) Since comparing the direct sum of residuals has some drawbacks, we now consider the sum of the square of residuals. By taking the square of the residual, we prevent the canceling between the positive and negative residuals. Hence we want the sum of the squares of residuals to be as small as possible. Fill in the following chart with the squares of the residuals and their sum from the two models (question 1 and question 3).

Input (x)	0	1	2	3	4	5	6	Sum
Actual Data Output	130	130	130	126	126	126	122	N/A
Q1 Model Output (y)	130	128.67					122	N/A
Q1 Model Residual Squared	0	1.7689					0	
Q3 Model Output (y)	131.33	130			126			N/A
Q3 Model Residual Squared	1.7689	0			0			

9) Write and compare the sums of the squares of the residuals for each of the models from question 1 and question 3.

10) Using the model that has the smallest sum of square of residuals, on what turn will Chespin's HP reach 0?