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GPS # 6 1.6 FITTING LINES TO DATA POINTS: MODELING LINEAR FUNCTIONS Class Time: 11:30 A.M. Date: 1/17/07

20/20

Useful Definitions:

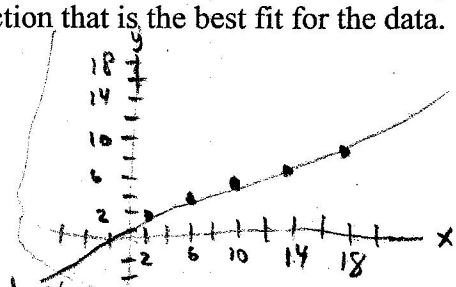
* Linear Model: A linear model is an equation of the form $f(x) = a + bx$,
* Linear Regression (the least-square method): A procedure which defines the best-fit line as the line for which the sum of the squares of vertical distances from the data points to the line is a minimum.
* Constant first differences: If the first differences of data outputs are constant (for equally spaced inputs), a linear model can be found that fits the data exactly. If the first differences are "nearly constant," a linear model can be found by an approximate fit for the data.
* Discrete: It is used to describe the data or a function that is presented in the form of a table or in a scatterplot.
* Continuous: It is used to describe a function or graph when the inputs can be any real number.

1. Construct a scatter plot of the data in the table. Can the scatter plot be fit exactly or only approximately by a linear function? How do you know? Find the linear function that is the best fit for the data.

+4 +4 +4 +4

x	2	6	10	14	18
y	2	4	6	8	10

+2 +2 +2 +2



Fits exactly

Both equally spaced output and input. x and y

On Calc: Stat Edit

2nd Stat plot
Plot 1 on off

L1 (x)	L2 (y)
2	2
6	4
10	6
14	8
18	10

Window
Xmin = 0
Xmax = 20
Ymin = 0
Ymax = 12

Type
X list : L1
Y list : L2

Stat Cal to find A and B
8: a+bx (L1, L2)
2nd L1, L2 Enter

$f(x) = a + bx$

$f(x) = 1 + \frac{1}{2}x$

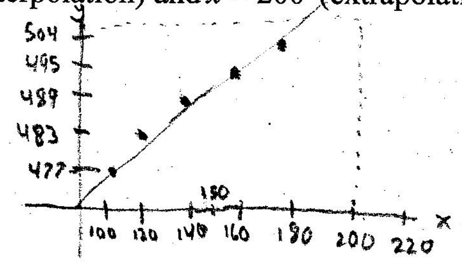
2. a) Find the least-squares regression line in the form $f(x) = a + bx$.

b) Use the regression line to estimate y when $x = 150$ (interpolation) and $x = 200$ (extrapolation).

20 20 20 20

x	100	120	140	160	180
y	477	483	489	495	504

6 6 6 9



Fits approx.

f(x)a+bx

a = 443.40
b = .33x

f(x) = 443.40 + .33x

Part B:

x = 150 f(x) = 443.40 + .33(150)
= 492.9

3. If $400 is invested at 4% simple interest, the future value S in t years is given in the table below.

a) Is the rate of change of the future value constant for uniform inputs? yes

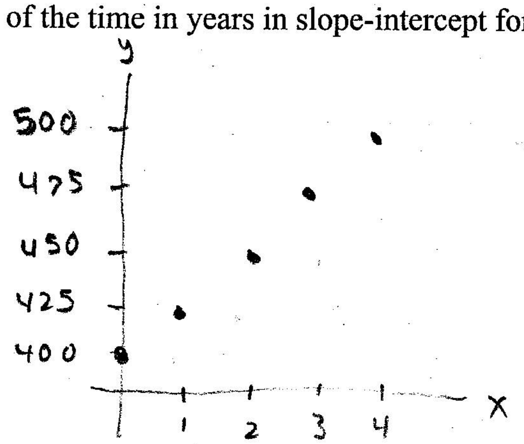
b) Can the future value be modeled by a linear function? yes

c) Write the equation that gives the future value as a function of the time in years in slope-intercept form.

+1 +1 +1 +1

Year(t)	0	1	2	3	4
Future Value (S)	400	425	450	475	500

+25 +25 +25 +25



Exact fit

S(t)

$\frac{425 - 400}{1 - 0} = \frac{25}{1} = 25$

m = 25

y = 400 + 25x

S(t) = 400 + 25t