Lesson 6: Modeling a Context from Data

Classwork

Opening Exercise

a. Identify the type of function that each table appears to represent (e.g., quadratic, linear, exponential, square root).

A: Linear
B: Exponential
C: Quadratic

b. Explain how you were able to identify the function.

A: constant additive change
B: constant mult. change
C: change is not the same until 2nd dif

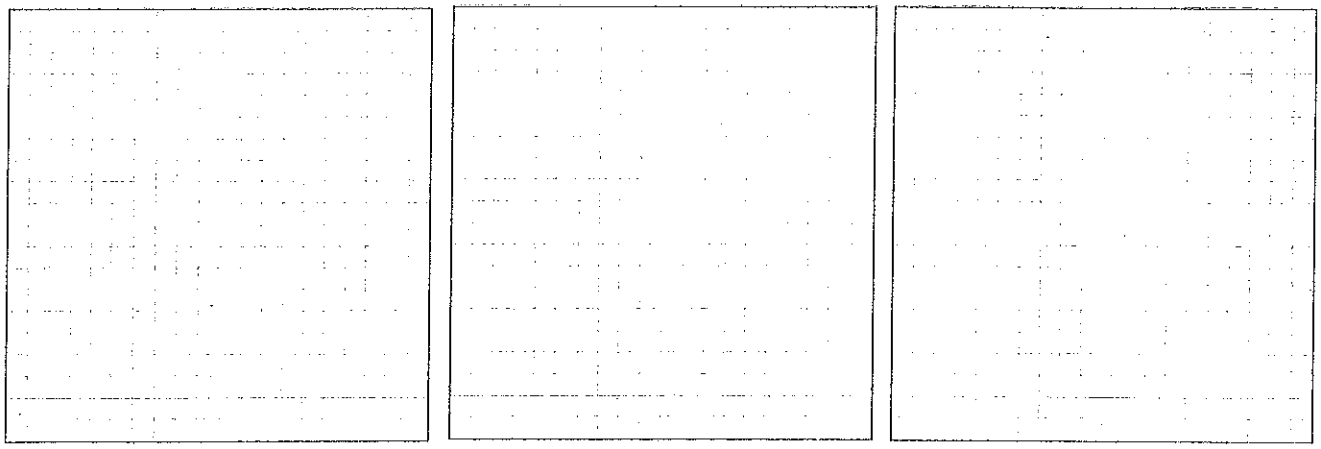
A		B		C	
x	y	x	y	x	y
1	5	1	6	1	3
2	7	2	9	2	12
3	9	3	13.5	3	27
4	11	4	20.25	4	48
5	13	5	30.375	5	75

(+2 down column A; ×1.5 down column B; 2nd dif. 9, 6, 15, 6, 21, 6, 27 down column C)

c. Find the symbolic representation of the function.

A: $y = 2x + 3$
B: $y = 4(1.5)^x$
C: $y = 3x^2$

d. Plot the graphs of your data.



Exercises

1. Bella is a BMX bike racer and wants to identify the relationship between her bike's weight and the height of jumps (a category she gets judged on when racing). On a practice course, she tests out 7 bike models with different weights and comes up with the following data.

x y

Weight (lb)	Height of Jump (ft)
20	8.9
21	8.82
22	8.74
23	8.66
24	8.58
25	8.5
26	8.42
27	8.34

-.08 -.08 -.08 -.08 -.08 -.08 -.08

so if $x = 32$
$y = -.08(32) + 10.5$
$y = 7.94$
7.94 FT

a. Bella is sponsored by Twilight Bikes and must ride a 32 lb bike. What can she expect her jump height to be?

if $x = 32$ you should first find the equation comparing wt (x) to height (y)

$y = -.08x + b$
$8.9 = -.08(20) + b$
$8.9 = -1.6 + b$
$10.5 = b$

Equation is $y = -.08x + 10.5$

b. Bella asks the bike engineers at Twilight to make the lightest bike possible. They tell her the lightest functional bike they could make is 10 lb. Based on this data, what is the highest she should expect to jump if she only uses Twilight bikes?

$y = -0.08(10) + 10.5$
$y = 9.7$

9.7 FT jump

c. What is the maximum weight of a bike if Bella's jumps have to be at least 2 ft high during a race?

$2 = 10.5 - 0.08x$
$x = 106.25$

Max wt can be 106.25 lb to jump 2 ft

2. The concentration of medicine in a patient's blood as time passes is recorded in the table below.

Time (hours)	Concentration of Medicine (ml)
0	0
0.5	55.5
1	83
1.5	82.5
2	54

t, M(t)

55.5 → 27.5 → -.5 → -28.5

-28 → -28

2nd dif. is constant so, it's quadratic.

a. The patient cannot be active while the medicine is in his blood. How long, to the nearest minute, must the patient remain inactive? What are the limitations of your model(s)?

Looks quadratic

To make an equation, you know (0,0) is a pt (the y-int or c is 0)

so

$M(t) = at^2 + bt + 0$

you could put 2 pts into the EQ, and form a system:

$\begin{cases} 83 = a(1)^2 + b(1) \Rightarrow \text{so } a+b=83 \\ 55.5 = a(.5)^2 + b(.5) \rightarrow \text{so } .25a+.5b=55.5 \end{cases}$

b. What is the highest concentration of medicine in the patient's blood?

I used substitution to solve for a and b

$a = 83-b$

$.25(83-b)+.5b = 55.5$

$20.75 - .25b + .5b = 55.5$

$+.25b = 34.75$

$b = 139$

so $a = -56$

so, the equation is:

$M(t) = -56t^2 + 139t$

to answer (b) you find the vertex $x = \frac{-b}{2a} = \frac{-139}{2(-56)} = 1.24$

$M(1.24) = -56(1.24)^2 + 139(1.24)$

$M(1.24) = 86.25$

The highest concentration of blood is at 1.24 hrs when they have 86.25 mL