Data Modeling with Exponential functions.

Linear data

x	y	y diff
1	7	
2	14	7
3	21	7
4	28	7
5	35	7
⋮	⋮	

slope = 7

Exponential data

x	y	y ratio
1	7	
2	14	$14/7 = 2$
3	28	$28/14 = 2$
4	56	$56/28 = 2$
5	112	$112/56 = 2$

base = 2

$y = a \cdot 2^x$

when $x = 1$, $y = 7$

$7 = a \cdot 2 \Rightarrow a = 7/2$

$\Rightarrow \boxed{y = \left(\frac{7}{2}\right) \cdot 2^x}$

$x = 2 \Rightarrow y = \frac{7}{2} \cdot 2^2 = 14$

Example :

	Time in months	0	1	2	3	4	5
y	Contaminant level difference	64	45.44	32.26	22.91	16.26	11.55

(a) Use exponential function to model the data (y is an exp. function of x)

(b) Use the model to estimate y when x is 7

Exponential Model:

$y = a \cdot b^x$

$\Rightarrow y = a \cdot (.71)^x$

To find a set $x = 0$ and $y = 64$

x	y	y-ratio (b)
0	64	
1	45.44	$45.44 / 64 = .71$
2	32.26	$32.26 / 45.44 = .71$
3	22.91	$22.91 / 32.26 = .71$
4	16.26	$16.26 / 22.91 = .71$
5	11.55	$11.55 / 16.26 = .71$

$64 = a \cdot (.71)^0$

$\Rightarrow 64 = a \Rightarrow \boxed{a = 64}$

The model is $\boxed{y = 64 \cdot (.71)^x}$

(b) $x = 7 \rightarrow y = 64 \cdot (.71)^7 = \boxed{5.82}$

Assignment 7

The salinity of a saltwater aquarium is being raised to a target value of 32 parts per thousand of dissolved solids in the tank. The table below shows the difference D between the target salinity and the current salinity S after t hours. Both D and S are measured in parts per thousand.

t = time in hours	0	1	2	3	4
D = salinity difference	32	25.60	20.48	16.38	13.11

(*) Make a model of D as an exponential function of t. Find a formula that gives the salinity S as a function of t.

(*) use the model to estimate D when $t = 9$

Notice: Show all your work to get to the answer. (set up the equation to find a, b)