U5 L7 Modelling Data with Functions Handout

Part A - For each table, **graph the data** and draw a **curve of best fit.** Then define your variables and determine an algebraic model for each situation. If necessary, restrict the domain of your function so it makes sense for the situation.

1. The following table shows the population of a small town from 2000 – 2005. Determine an algebraic model for the population as a function of time.

Think exponential!

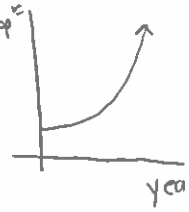
Year	Population	1st ratios
2000	2000	1.1
2001	2200	1.1
2002	2420	1.1
2003	2662	1.1
2004	2928.2	1.1
2005	3221.02	

$B = 1.1$ (the first ratio)

a = initial value 2000

$$P(t) = 2000\,(1.1)^t$$

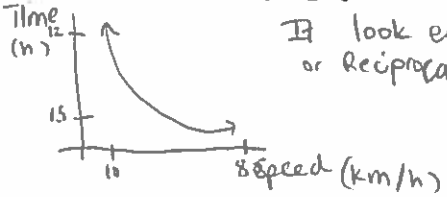
This looks exponential



2. The following table shows the length of time needed to drive a fixed distance at varying speeds. Determine an algebraic model for time as a function of speed

Speed (km/h)	Time (h)	First Ratios	
10	12.0	Too different, ∴ not exponential	
15	8.0	0.66	120
20	6.0	0.76	120
25	4.8	0.83	120
30	4.0	0.75	120
40	3.0	0.8	120
50	2.4	0.0625	120
80	1.5		

Check product of (x X y)



It look exponential or Reciprocal

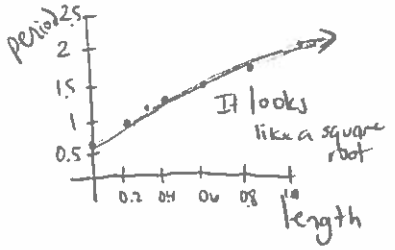
This means it's reciprocal! $f(x) = \frac{1}{x}$ ∴ $a = 120$

$$T(s) = \frac{120}{X}$$

3. The following table shows the lengths and periods for different pendulums. Determine an algebraic model for the period as a function of the length

Length (m)	Period (s)	Check 1st ratios
0.1	0.64	
0.2	0.90	
0.3	1.10	
0.4	1.27	
0.5	1.49	
0.6	1.55	
0.7	1.70	1.03
0.8	1.76	1.07
0.9	1.90	2.01
1.0	2.01	

Too different to be exponential!



It looks like a square root

use a point to solve for "a" in a square root function

$y = a\sqrt{x}$

$2.01 = a\sqrt{1}$

$2 = a$

repeat to check... ✓

$$P(\ell) = 2\sqrt{\ell}$$

Part B – Determine an algebraic model for each table of values. You may wish to graph the data first to help you.

1.

x	y
-2	$\frac{5}{9}$
-1	$\frac{5}{3}$
0	5
1	15
2	45
3	135
4	405

This looks exponential
Check 1st diffs:

3
3
3
3
3
3

$B = 3$

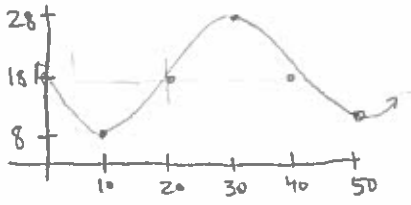
$a = 5$

$$y = 5(3)^x$$

2.

x	y
10	8
20	18
30	28
40	18
50	8
60	18
70	28

Sketch it:



$|a| = 10$

$c = 18$

period $= 40$

$K = \frac{360}{40}$

$K = 9$

$g(x) = -10 \sin 9x + 18$

$g(x) = 10 \sin[9(x-20)] + 18$

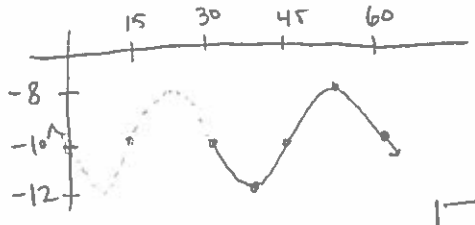
$g(x) = 10 \cos[9(x-30)] + 18$

$g(x) = -10 \cos[9(x-10)] + 18$

at least 4 choices!

3.

x	y
30.0	-10.0
37.5	-12.0
45.0	-10.0
52.5	-8.0
60.0	-10.0
67.5	-12.0
75.0	-10.0



$|a| = 2$

$c = -10$

period $= 30$

$K = \frac{360}{30}$

$K = 12$

$$g(x) = -2 \sin(12x) - 10$$