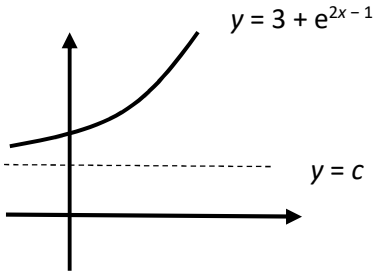
Pure 23 - Linearising

Please **complete** this homework by _____. Start it early. If you can't do a question you will then have time to ask your teacher for help or go to a drop in session.

Section 1 – Review of previous topics. Please complete all questions.

1.



The diagram shows the curve with the equation $y = 3 + e^{2x-1}$ and the asymptote of the curve which has the equation $y = c$.

a State the value of the constant c.

b Find the exact coordinates of the point where the curve crosses the y-axis.

c Find the x-coordinate of the point on the curve where $y = 7$, giving your answer in the form $a + \ln b$, where a is rational and b is an integer.

2. Solve each equation, giving your answer in exact terms.

a) $\ln x = 15$ b) $\ln(\frac{1}{2}x + 3) = 2.5$ c) $e^x = 0.7$ d) $e^{4t+1} = 12$ e) $2e^{2x} + 12 = 11e^x$

f) $\ln(3x^2 - 10x + 8) - \ln(x^2 - 5x + 6) = \ln 2x$

Section 2 – Consolidation of this week's topic. Please complete all questions.

1. The population of a country, P millions, in t years' time is modelled by the formula $P=Ac^t$ where A and c are constants.

a) Show that a graph of logP against t is a straight line. **(5)**

The gradient of the straight line is 0.0128 and the intercept on the log P axis is (0, 1.97).

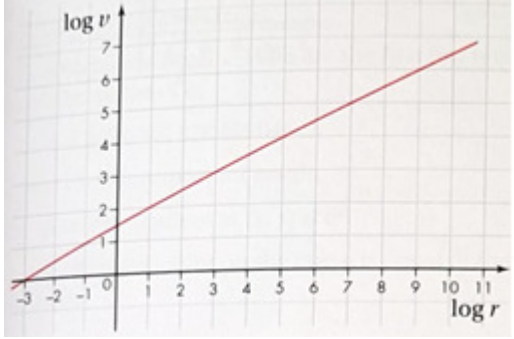
b) Find the values of A and c. **(5)**

c) Find the annual rate of growth of the population. **(2)**

d) Explain why the model might not be accurate for a large value of t. **(1)**

2. The formula connecting two variables, v and t, is $v = ar^n$ where a and n are constants.

Here is a graph of logv against logr:



a) Find the gradient of the graph. **(2)**

b) Explain why loga = 1.5. **(4)**

c) Find the values of a and n. **(3)**

d) Use the formula to find the value of v when r = 100. **(2)**

3. Below is data for the moons of Saturn.

It is believed that $R = kT^n$, where R = radius of moon and T = time to orbit Saturn.

Moon	Tethys	Dione	Rhea	Titan	Iapetus
Radius, R ($x10^5$ km)	2.9	3.8	5.3	12.2	35.6
Period, T (days)	1.9	2.7	5.4	15.9	79.3

a) Show that logR = logk + nlogT **(3)**

b) Plot a graph of logT on the horizontal axis and logR on the vertical axis. **(4)**

c) Measure the gradient of the line of best fit and use this to calculate n. Also calculate k from your graph. **(5)**

d) A new moon was discovered to have a radius of 1.4×10^5 km, estimate how many days it takes to orbit Saturn. **(4)**

TOTAL 40 MARKS

Section 3 – Extension questions. If you are aiming for a top grade, you should attempt these questions.

MOORE'S LAW

Moore's law relates the number of transistors (T) that can be fitted on a computer chip to the number of years from 1971 (t). It is of the from $T = ae^{kt}$

Using the data in the table below, plot a graph of ln(T) against t and use your graph to find the values of a, and k. Use your formula to predict the number of transistors on a computer chip in 2010. Check and comment on your answer by googling the number of transistors on a computer chip in 2010.

(NOTE: if you use a spreadsheet such as Excel it can do the calculations for you and plot the graph)

Date	t	Transistors (T)
1971	0	2,300
1972	1	2,500
1974	3	4,500
1978	7	29,000
1982	11	134,000
1985	14	275,000
1989	18	1,200,000
1993	22	3,100,000
1997	26	7,500,000
1999	28	9,500,000
2000	29	42,000,000
2002	31	220,000,000
2004	33	592,000,000