Lower 6 Chapter 14

Exponentials and logarithms

Chapter Overview

1. Sketch exponential graphs.
2. Use and interpret models that use exponential functions.
3. Be able to differentiate e^{kx}.
4. Understand the log function and use laws of logs.
5. Use logarithms to estimate values of constants in non-linear models.

6 **Exponentials and logarithms**	6.1	Know and use the function a^x and its graph, where a is positive. Know and use the function e^x and its graph	Understand the difference in shape between $a < 1$ and $a > 1$
	6.2	Know that the gradient of e^{kx} is equal to ke^{kx} and hence understand why the exponential model is suitable in many applications.	Realise that when the rate of change is proportional to the y value, an exponential model should be used.

6 **Exponentials and logarithms** *continued*	6.3	Know and use the definition of $\log_a x$ as the inverse of a^x, where a is positive and $x \geqslant 0$ Know and use the function $\ln x$ and its graph Know and use $\ln x$ as the inverse function of e^x	$a \neq 1$ Solution of equations of the form $e^{ax+b} = p$ and $\ln(ax + b) = q$ is expected.
	6.4	Understand and use the laws of logarithms: $\log_a x + \log_a y = \log_a(xy)$ $\log_a x - \log_a y = \log_a\left(\frac{x}{y}\right)$ $k\log_a x = \log_a x^k$ (including, for example, $k = -1$ and $k = -\frac{1}{2}$)	Includes $\log_a a = 1$
	6.5	Solve equations of the form $a^x = b$	Students may use the change of base formula. Questions may be of the form, for example, $2^{3x-1} = 3$
	6.6	Use logarithmic graphs to estimate parameters in relationships of the form $y = ax^n$ and $y = kb^x$, given data for x and y	Plot $\log y$ against $\log x$ and obtain a straight line where the intercept is $\log a$ and the gradient is n Plot $\log y$ against x and obtain a straight line where the intercept is $\log k$ and the gradient is $\log b$
	6.7	Understand and use exponential growth and decay; use in modelling (examples may include the use of e in continuous compound interest, radioactive decay, drug concentration decay, exponential growth as a model for population growth); consideration of limitations and refinements of exponential models.	Students may be asked to find the constants used in a model. They need to be familiar with terms such as initial, meaning when $t = 0$. They may need to explore the behaviour for large values of t or to consider whether the range of values predicted is appropriate. Consideration of a second improved model may be required.

Contrasting exponential graphs

On the same axes sketch $y = 3^x,\ y = 2^x, y = 1.5^x$

On the same axes sketch $y = 2^x$ and $y = \left(\frac{1}{2}\right)^x$

Graph Transformations

Sketch $y = 2^{x+3}$

Exercise 14A Pg 313-314