Logarithms and Non-linear Data

Specification: AQA 7357: F4, F6, F7 · Edexcel 9MA0: 6.4, 6.6, 6.7

HOMEWORK Consolidation

1 For $y = 8x^3$, write the log form. What should be plotted, and what are the gradient and intercept?
AQA F4, F6 · Edexcel 6.4, 6.6

2 For $y = 2.5 \times 3^x$, write the log form. What should be plotted, and what are the gradient and intercept?
AQA F4, F6 · Edexcel 6.4, 6.6

3 For $y = ax^n$, $\log y$ against $\log x$ has gradient 0.4 and intercept 1.7. Find a and n.
AQA F6 · Edexcel 6.6

4 For $y = kb^x$, $\log y$ against x has intercept 0.95 and gradient -0.12. Find k and b.
AQA F6 · Edexcel 6.6

5 For $y = ax^n$, the line of $\log y$ against $\log x$ passes through $(0.3, 1.4)$ and $(1.3, 3.9)$. Find a and n.
AQA F6 · Edexcel 6.6

6 A pupil wants a straight-line graph for data that follow $y = 5 \times 1.2^x$. Which axes should they use? Explain.
AQA F6 · Edexcel 6.6

7 A model is $P = 200 \times 1.05^t$. Find when $P = 400$, to 3 s.f.
AQA F5 · Edexcel 6.5

8 The graph of $\ln y$ against x is a straight line with gradient 0.3 and intercept 2. Write y in terms of x.
AQA F3, F6 · Edexcel 6.3, 6.6

9 The data follow $y = ax^n$: when $x = 4$, $y = 40$, and when $x = 25$, $y = 625$. By finding two points on the graph of $\log y$ against $\log x$, find n and a.
AQA F6 · Edexcel 6.6

10 Kepler's third law links a planet's orbit radius r (AU) and its orbital period T (years).

	Mercury	Venus	Earth	Mars	Jupiter
r	0.387	0.723	1	1.524	5.203
T	0.241	0.615	1	1.881	11.86

Assuming $T = ar^n$, use Mercury and Jupiter to estimate a and n.
AQA F6 · Edexcel 6.6

11 *Edexcel-style*. The time, T seconds, for one swing of a pendulum of length L metres is modelled by $T = aL^n$. A graph of $\log T$ against $\log L$ is a straight line with gradient 0.5 that passes through $(0, 0.302)$.
(a) Show that $\log T = n \log L + \log a$. [2 marks]
(b) Find a and n. [3 marks]
(c) Predict T when $L = 0.8$. [1 mark]
AQA F4, F6 · Edexcel 6.4, 6.6 · Edexcel-style

12 *AQA-style*. The value V (£) of a car t years after it was bought is shown.

t	1	2	3	4	5
V	14 100	11 900	10 000	8400	7100
$\log V$					

It is suggested that $V = kb^t$.
(a) Explain why a graph of $\log V$ against t should be a straight line. [2 marks]
(b) Using $t = 1$ and $t = 5$, estimate k and b. [3 marks]
(c) Interpret b in context. [1 mark]
AQA F6, F7 · Edexcel 6.6, 6.7 · AQA-style