Logarithms

Simplifying Logarithms:

1. (a) $\frac{1}{2} \log_{10} 625 + 2 \log_{10} 2$ (b) $\log_4 10 + 3\log_4 2 - \frac{1}{2} \log_4 25$

Solving Equations:

2. (a) $\log_a x + \log_a (x - 1) = \log_a 2$ (b) $\log_2 (8x + 2) - \log_2 x = 4$

   (c) $\log_3 6x - \log_3 (x - 2) = 2$ (d) $2\log_x 6 - \frac{2}{3} \log_x 8 = 2$

Exponential Growth and Decay:

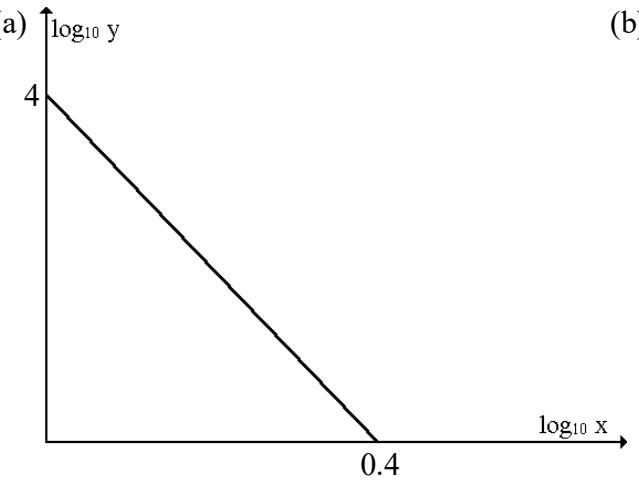
3. A radioactive material has mass m, at time t years, given by $m = m_o e^{-0.03t}$, where m_o is the original mass.
   (a) If the original mass is 400g, find the mass after 20 years.
   (b) Find the percentage of the material left after 15 years.

4. For a radioactive substance $A = A_o e^{-kt}$, where A_o is the original mass and t is the time in minutes. In 5 minutes, 60g of this substance is reduced to 48g.
   (c) Find k to 2 significant figures.
   (d) Find the half life of this substance (the time taken for the amount of the substance to fall by half).

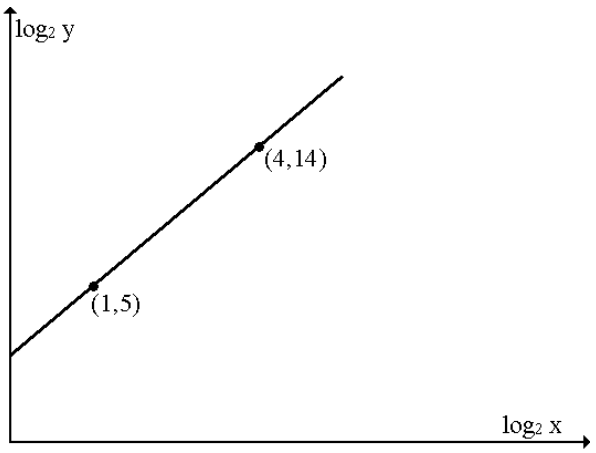
Graphs of experimental data:

5. Each graph below illustrates a relationship of the form $y = kx^n$.
   Find the values of k and n.

(a)

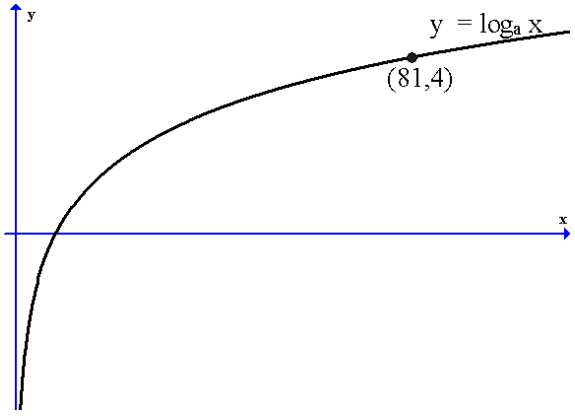


(b)



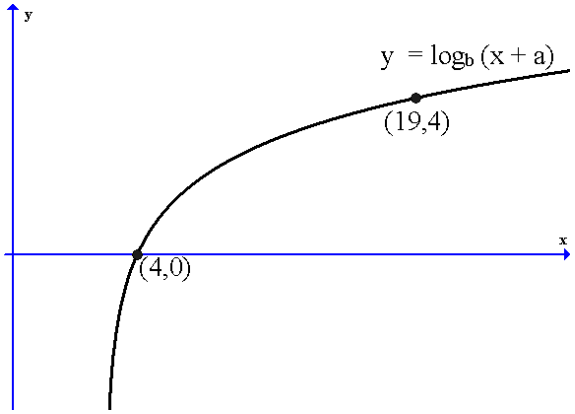
Logarithmic Graphs:

6. The diagram shows part of the graph of $y = \log_a x$.



(a) Determine the value of a.
(b) Sketch the graph of $y = \log_a 9x^2$
(c) Sketch the graph of $y = \log_a \frac{1}{x}$.

7. The diagram shows the graph of $y = \log_b (x + a)$.



Find the values of a and b.