

# Logarithms

IB SL/HL

1. Write  $3^4 = 81$  in logarithmic form.
2. Write  $\log_8 2 = \frac{1}{3}$  in exponential form.
3.  $x = \log_2 8$  and  $y = \log_2 16$ .
  - a) Write  $x+y$  as a single logarithm.
  - b) Write  $x-y$  as a single logarithm.
  - c) Calculate the value of both  $x$  and  $y$  and hence calculate  $x+y$ .
4. The Richter scale as a measure to determine the strength of an earthquake. The scale is given as  $M = \frac{2}{3} \log_{10} E - 2.9$ , where  $M$  is the magnitude on the Richter scale and  $E$  is the energy produced.
  - a) A recent earthquake in Greece produced an energy of  $10^{14}$ . Calculate the magnitude it registered on the Richter scale.
  - b) The 1906 earthquake in San Francisco measured 8.5 on the Richter Scale. Calculate the energy it produced.
5. Evaluate  $\log_5 125 + \log_3 243$ .
6. Write as a single logarithm in the form  $\log_8 b$ .  
 $\log_8 42 \log_8 3 - \log_8 6$ .
7.  $x = \log_c 64$  and  $y = \log_c 4$ . Find the value of  $z$  when  $z = \frac{x}{y}$ .

8. The population of India can be modeled by the equation,

$$P = P_0e^{kt}$$

where  $P$  is the population,  $P_0$  is the initial population,  $t$  is the time in years and  $k$  is a constant number.

- a) A census of the population of India was taken in 1991 and the population was 720 million. In 1992 the population was 740 million.  
Show that  $k = 0.027$  correct to 3 decimal places.
- b) Use the model to predict the population of India in the 2001 census.
- c) Use the model to calculate in what year India's population will,
- (i) double,
  - (ii) reach 2 billion (1000 million = 1 billion).

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## Answers

1.  $\log_3 81 = 4$

2.  $8^{\frac{1}{3}} = 2$

3. a)  $\log_2 128$       b)  $\log_2 \left( \frac{1}{2} \right)$       c)  $x + y = 7$

4. a)  $M = 6.43$       b)  $E = 1.26 \times 10^{17}$

5. 8

6.  $\log_8 6.$

7.  $z = 3$

8. b) 943.17 million      c) i) 2016      ii) 2028