1 **What is the numerical value of the following logarithmic expressions**?

a) $\log_2 \sqrt{8} + \log_3 \frac{1}{3} + 6^{\log_6 1}$

b) $\log_{\frac{1}{3}} 27 + 2\log_2 4^2 + \log_5 \sqrt{5} - 2\log_5 1$

2 **Solve the following equations**:

a) $\log(2x - 5) + \log(x - 1) = 2\log 2 + \log 5$

b) $\log_2(x + 3) + \log_2(2x + 4) - \log_{11}121 = 0$

c) $3\log_a 2 + \log_a(x - 2) = \log_a 12(x + 3) - \log_a 3$

d) $\log_3(x + 4) = \log_7 7 - \log_3(x + 2)$

e) $\log(x + 3) + \log(2x - 7) = \log(2x - 1)$

f) $2^x = 3^{2x-1}$

3 Given $\log_n u = 7$ and $\log_n w = -9$, **what is the value the following expression** $\log_n\left(\frac{n^2 w^4}{u^5}\right)$?

4 Use the properties of logarithms to express $\log_2\left(\frac{\sqrt{x}(x-5)}{x^3}\right)$ as a sum, a difference or a product of logarithms.

5 Given the following equation: $2\log_a 8 + \log_a\left(\frac{1}{a}\right)^5 = 19$. **What is the numerical value of base *a***?

6 The increasing logarithmic function f has domain]5, +∞[. The graph of this function passes through the point (9, 10). **Which of the following functions could represent function f**?

A) $f(x) = 3\log_2(x - 5) + 4$

B) $f(x) = \log_4(x - 5) + 8$

C) $f(x) = 5\log_{\frac{1}{2}}(x - 1) + 5$

D) $f(x) = 15\log_{14}(x + 5) - 5$

7 If $f(x) = 3^{(x-9)}$ and $g(x) = \log_9 x$, **what is $(g \circ f)(x)$**?

8 Given $f(x) = 2(5^{x+1})$, then which **of the following represents $f^{-1}(x)$**?

A) $f^{-1}(x) = \log_5\left(\frac{x}{2} - 1\right)$

B) $f^{-1}(x) = \log_5\left(\frac{x}{2}\right) - 1$

C) $f^{-1}(x) = \log_{10}\left(\frac{x}{2} - 1\right)$

D) $f^{-1}(x) = \log_{10}(x - 1)$

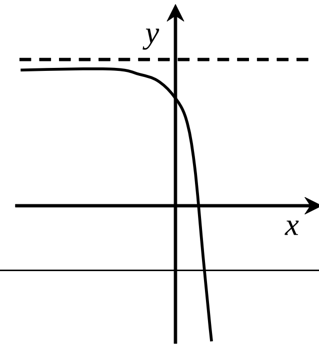
9 A microbiologist is studying two bacteria populations.

Last Monday, the 1st population numbered 2000 and the 2nd numbered 2 048 000.

He noted that the 1st population doubled every day while the 2nd population was reduced by half each day. **After how many days would the two populations of bacteria be equal in number**?

10 The rule of a function g is $g(x) = a(c)^x + k$. The equation of its asymptote is $y = 8$. This function is represented by the table of values and the graph given below. **What is the rule of function *g***?

x	y
0	6
1	2
2	-10



11 Reproduction of a certain type of insect is the focus of a laboratory experiment. There were 25 insects at the beginning of the experiment. It was noted that the number of insects increases by 3% every 7 days. **After how many days will there be 20 425 insects**?

12 The number of people living in Kilwat, Germany, varies according to the rule of an exponential function. On January 1st 1975, the city's population was 130 000. On January 1st 1985, it was 260 000. **What was the population of this German city on January 1st 2010, given that the growth rate remained constant**?

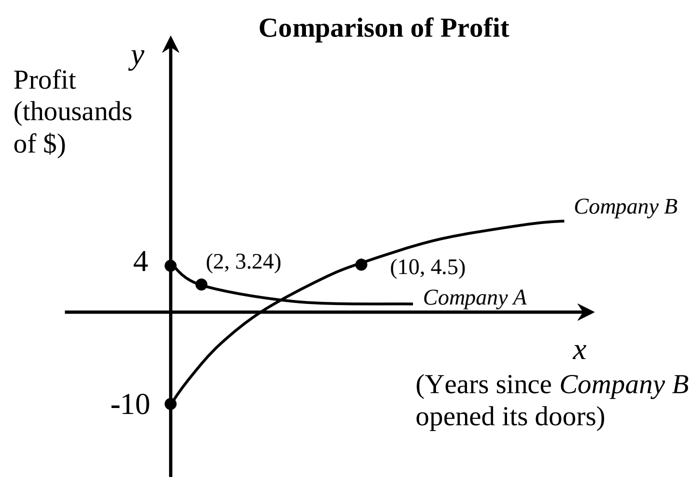
13 Three years ago Greg invested $1000 at a fixed interest rate compounded every 6 months. His investment is currently valued at $1400. Given $C_n = C_0\left(1+\frac{t}{k}\right)^{nk}$ where C_n is the capital after n years, C_0 is the capital invested, t is the annual interest rate, k is the number of times per year that interest is paid and n is the number of years, **what is the annual rate of interest**?

14 In a laboratory, the reproduction of a particular species of insect is studied. At the beginning of the experiment, there are 25 insects. The number of insects increases by 30% every 7 days. **After how many weeks will there be 20 425 insects**?

15 When Jennifer bought a new car in 2005, she paid $17 500. In 2008 the value of her car had fallen to $10 000. She decided that she would sell her car when the value fell below $5000. Assuming the decline in the price of a car is modelled by an exponential function, **how old will Jennifer's car be when its value falls below $5000**?

16 A virus appeared in South America in the middle of the last decade. Scientists knew that the number of people infected with this virus would increase according to a specific exponential function. At the beginning of 1996, authorities found 110 infected people. Five years later, the number had grown to 835. Wide-scale inoculation began once 2000 people had been infected with the virus. **In what year did these inoculations begin**?

17 *Company A* has seen a decrease in profit since its competitor, *Company B*, opened its doors. The decrease can be estimated using an exponential function in the form of $g(x) = ac^x$.
The profit of *Company B* can be estimated according to an exponential function in the form of $f(x) = ac^x + 15$. Based on these estimates, **how much more profit would *Company B* make than *Company A*, 11 years after it opened its doors**?



18 When rabbits were first brought to Australia, they had no natural enemies. From January 1865 to January 1867, the rabbit population increased exponentially from 60 000 members to 2 400 000 members. According to this exponential model, **in which year were the first pair of rabbits brought to Australia**?