

# 1 Exponential- und Logarithmusfunktionen

## Englische Aufgaben

- 1.1** A wildlife magazine published an article in which it was reported that the number of rhinos in an area had been decreasing by 9 % per year since 2000. There were 800 rhinos in 2000.
- Work out a formula for the number  $R$  of these rhinos that will live in the same area  $t$  years after 2000.
  - Calculate the number of rhinos in 2012.
  - Assuming the same rate of decrease, calculate when the rhinos in this area will become extinct.

[rhino ... Nashorn; extinct ... ausgestorben]

- 1.2** The time taken for polonium 241 to halve is 14 years. Calculate how long it takes for 100 g to reduce to 20 g.

[to halve ... halbieren]

- 1.3** Complete the following table which summarizes some of the properties of exponential and logarithmic functions.

	exponential function	logarithmic function
function	$\exp: \mathbb{R} \rightarrow \mathbb{R}, t \mapsto a^t$	
domain		$x > 0$
range		all real numbers
intercept	$y = 1$	
increasing	when $a > 1$	
decreasing		when $0 < a < 1$

- 1.4** Assume that there were 19 600 microorganisms in a Petri dish at the end of two days and 32 141 997 at the end of 24 days.
- Give the equation to calculate the number  $M$  of microorganisms after  $t$  hours.
  - Work out the number of microorganisms at the beginning of the count.
  - Calculate the number of microorganisms at the end of one week.
  - Calculate the number of days at the end of which there are 38 416 microorganisms in the Petri dish.

[to assume ... annehmen; Petri dish ... Petrischale]

- 1.5** The following table shows the air distances (in statute miles) between London and five other world cities.

	Buenos Aires	Honolulu	Paris	Shanghai	Sydney
London	6916	7288	213	5715	10564

Summarize the above data in a suitable logarithmic scale.

[statute mile ... britische Landmeile]

- 1.6** Which of the following statements are true?

- ☐ A The graph of an exponential function  $\exp: \mathbb{R} \rightarrow \mathbb{R}, t \mapsto a^t$  crosses the y-axis at  $(0, 1)$ .
- ☐ B The graph of an exponential function  $\exp: \mathbb{R} \rightarrow \mathbb{R}, t \mapsto a^t$  increases when  $a < 1$ .
- ☐ C The inverse of an exponential function  $\exp: \mathbb{R} \rightarrow \mathbb{R}, t \mapsto a^t$  is not a function.
- ☐ D The graph of an exponential function  $\exp: \mathbb{R} \rightarrow \mathbb{R}, t \mapsto a^t$  is asymptotic to the x-axis.
- ☐ E The graph of an exponential function  $\exp: \mathbb{R} \rightarrow \mathbb{R}, t \mapsto a^t$  has a maximum.
- ☐ F The graph of an exponential function  $\exp: \mathbb{R} \rightarrow \mathbb{R}, t \mapsto a^t$  is always above the x-axis.

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- 1.7** The following sketch shows part of the graph of an exponential function  $f(x) = c \cdot a^x$ , where  $c$  and  $a$  are positive constants. The given points lie on the graph.
- Work out the values of  $c$  and  $a$ .
  - Calculate the value of the  $y$ -coordinate of  $A$ .
  - Work out the coordinates of the point where the graph of the function crosses the  $y$ -axis.
- 1.8** Draw the graphs of the functions  $f(x) = 5^x$  and  $g(x) = 0.2^x$  on the same axes. Compare and comment on the two graphs.
- 1.9** Bill inherited 100 000 € from his uncle. Calculate how long he has to leave that money in an account that pays 2 % interest annually in order to double his inheritance.  
[to inherit ... erben; inheritance ... Erbe]
- 1.10** In 1954 about 20 000 people lived in Dubai. Six years later the population was approximately 40 000.
- If the population has doubled every 6 years since that time, work out an equation to calculate the population after  $n$  years.
  - Use your equation to calculate the population of Dubai in the years 2008 and 2014. Compare your results with the actual number of people living in Dubai.
- 1.11** The increase of a fungal culture under constant conditions is given by the exponential function  $m(t) = 25 \cdot 2^{0.3t}$ , where  $m(t)$  is the amount of the organism in gram and  $t$  the time in days.
- Calculate the time it takes the fungal culture to double its mass.
  - Work out how many grams of the fungal culture were at  $t = 0$ .
  - Imagine an unlimited growth of the fungal culture. Calculate the amount of the organism in gram after one year.
- [fungal culture ... Pilzkultur]
- 1.12** Jane buys rainbow coloured paper  $80\text{g/m}^2$  with a thickness of 0.1 mm. She folds the paper in half.
- Work out the equation which gives the number of layers of paper in terms of the number of folds  $f$ .
  - Work out the equation which gives the thickness of all layers of paper in terms of the number of folds  $f$ .
  - Jane folds the paper 7 times. Calculate the thickness of all the layers of paper.
  - Calculate how often Jane has to fold the paper to get a stack of paper that has her size of 1.60 m.
  - Calculate the thickness of all the layers of paper if such a sheet is folded in half 50 times.
- [stack of paper ... Papierstoß]