

Mathematics self test

Dear prospective students,

In order to meet the requirements of the Bachelor in Economics (B.Sc.) at Leuphana University of Lüneburg from the very beginning, we recommend applicants to have a solid knowledge of mathematical foundations.

This test (estimated duration: 45min) contains basic questions to test your knowledge. Some exercises will probably be easy for you, while others may make you think longer. However, this does not mean that you do not meet the requirements to study economics at Leuphana. The test is rather an incentive to catch up on the gaps you might have. There are very suitable resources to prepare yourself well for your studies. Beyond the availability of textbooks on common mathematics in economics, the Leuphana offers a certificate-based Online Mathematics Bridge Course (OMB+).

We are pleased to answer any questions you may have about the mathematical self-assessment test, about further materials or about your general preparation to study at Leuphana. We are looking forward to welcoming you to Leuphana!

Kindly regards

The team of the study programme in Economics (B.Sc.)



Exercise 1

Calculate the following values (without calculator):

- a) $\log_5 25$
- b) $\log_2 16$
- c) 2^{-3}
- d) $27^{\frac{1}{3}}$

Exercise 2 (from here on a calculator may be used)

If you toss a fair coin (i.e., equal probability of heads or tails) five times, what is the probability of getting heads five times?

Exercise 3

Consider a die with six-sides (numbered 1 to 6) and equal probability for each side. What is the probability of rolling a six after having already rolled a six?

Exercise 4

What is the probability of rolling a six three times in a row?

Exercise 5

Solve the equations for x :

- a) $\frac{1}{2ax} + \frac{1}{2bx} = 2$
- b) $\frac{ax+b}{cx+d} = E$
- c) $a^4x^2 - b^4 = 0$
- d) $(3 + a^2)^x = 1$
- e) $\sqrt{2+x} + \frac{a^2x}{\sqrt{2+x}} = 0$

Exercise 6

Solve the following pairs of equations:

- a) $x - y = 8 \mid x + y = 12$
- b) $2x + 5y = 20 \mid 3x - 4y = 24$
- c) $x - 3y = -25 \mid 4x + 5y = 19$
- d) $4K + L = 16.2 \mid K + 2L = 25.8$

Exercise 7

Derive the following functions:

- a) $y = 5x^4 + 6x^3 + 7x^2 + x + 8$
- b) $y = (2x^4 - 6x) \cdot (4x)$
- c) $y = \frac{(5x^2-4)}{3x+2}$
- d) $y = (2x^3 - 3x^2)^4$

Exercise 8

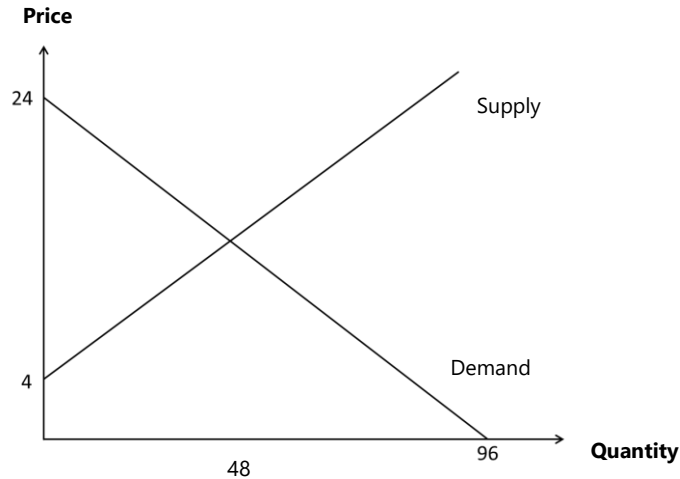
Determine the following characteristics of the function $f(x) = 5000x - 20x^2$:

- a) zeros
- b) extreme values
- c) turning points



Exercise 9

- Determine the intersection of the functions $P = 20 - X$ and $P = 2 + 2X$.
- Determine the linear supply and demand function shown in the graph below, where P denotes the price and x the quantity.



Exercise 10

Suppose that the profit $\pi(x)$ of a shoe store depends on the number of pairs of shoes sold (x) as follows: $\pi(x) = -0.5x^2 + 500x - 2000$.

- Determine the profit of the firm if it does not sell any shoes.
- Determine the number of pairs of shoes the company should sell in order to maximize its profit. Calculate the resulting profit.

Exercise 11

Assume that the total cost $C(y)$ of a bicycle store depends on the number of racing bikes sold (y) as follows: $C(y) = 1.6y^2 - 400y + 25000$.

- Determine the total cost of the firm if it does not sell any racing bike.
- Determine the number of racing bikes the firm should sell in order to minimize its total costs.



Mathematics self test (ENG) [SOLUTIONS]

Exercise 1

Calculate the following values (without calculator):

a) $\log_5 25 = 2$

b) $\log_2 16 = 4$

c) $2^{-3} = \frac{1}{8}$

d) $27^{\frac{1}{3}} = 3$

Exercise 2

$$p = \frac{1}{32}$$

Exercise 3

$$p = \frac{1}{6}$$

Exercise 4

$$p = \frac{1}{216}$$

Exercise 5

a) $x = \frac{a+b}{4ab}$

b) $x = \frac{Ed-b}{a-Ec}$

c) $x = \left(\frac{b}{a}\right)^2$

d) $x = 0$

e) $x = \frac{-2}{1+a^2}$

Exercise 6

a) $x = 10; y = 2$

b) $x = \frac{200}{23}; y = \frac{12}{23}$

c) $x = -4; y = 7$

d) $K = \frac{33}{35}; L = \frac{87}{7}$



Exercise 7

a) $\frac{dy}{dx} = 20x^3 + 18x^2 + 14x + 1$

b) $\frac{dy}{dx} = 40x^4 - 48x$

c) $\frac{dy}{dx} = \frac{15x^2 + 20x + 12}{(3x + 2)^2}$

d) $\frac{dy}{dx} = 24x(x - 1)(2x^3 - 3x^2)^3$

Exercise 8

Determine the following characteristics of the function $f(x) = 5000x - 20x^2$:

a) Zeros: $N_1(0|0)$; $N_2(800|0)$

b) extreme values: $H(400|800.000)$

c) no turning point

Exercise 9

a) $X = 4$; $P = 12$

b) Demand: $P = 24 - \frac{1}{4}x$ | Supply: $P = 4 + \frac{1}{6}x$

Exercise 10

a) $\pi(x = 0) = -2000$

b) $x = 500$; $\pi(x = 500) = 123.000$

Exercise 11

a) $C(0) = 25.000$

b) $y = 125$