

# Prior knowledge of mathematics: Test problems

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For the module **Mathematics** in the **economics and service** programmes (Business Administration, Tourism, Sport Management, Service Design, Digital Business Management) of the University of Applied Sciences of the Grisons, **prior knowledge** is required as follows:

## Terms

- know the basic arithmetic operations, and be able to perform them.
- be able to rearrange and simplify terms.
- be able to expand and factorise terms.
- know the quadratic binomial theorems, and be able to apply them.
- be able to reduce and expand fractions.
- be able to rearrange and simplify terms with fractions.
- know the power rules, and be able to apply them to powers with integer exponents.
- be able to determine the domain of a term.

## Equations

- be able to solve a linear equation in one variable.

## Functions

- be able to calculate values of a basic function if the equation of the function is given.
- know and understand the graph as a representation of a function.
- be able to determine values and special points if the graph of a basic function is given.
- know and understand what a linear function is.
- know and understand the graph of a linear function.
- be able to treat basic tasks regarding the graph of a linear function.

Concretely, it is expected to be able to solve the test problems below **without aids** (calculator, formulary, etc.):

## Test problems

### Terms

1. Calculate the expressions below:

a)  $2 + 3 \cdot 4$

b)  $3^{-2}$

c)  $-2^4$

d)  $\sqrt{16}$

2. Simplify the expressions below:

a)  $7x - 5z + 10y + 3y + 8z - 4x$

b)  $(32m + 13q) - (14m + 7q)$

c)  $(15a - 2b) - (7a - (2a + b))$

d)  $5a^2b \cdot 4ab \cdot 3a^2b$

e)  $(x^3 - x^2y + xy^2 - y^3)(x + y)$

3. Expand the expressions below:

a)  $(p + q)^2$

b)  $(2x + 3y)^2$

c)  $(x - y)^2$

d)  $(2a - 3ax)^2$

e)  $(a + 2)(a - 2)$

f)  $(5xy + 3xz)(5xy - 3xz)$

4. Factorise the expressions below:

a)  $5a^2 - 10a^3 - 25a^4$

b)  $3a(x - a)^2 + 12a^2(x - a)$

5. Simplify the fractions below by reducing:

a)  $\frac{14a}{18ab}$

b)  $\frac{ab}{a^2b^2c}$

c)  $\frac{8ab}{4a^2 - 4ab}$

d)  $\frac{p^2 + p}{p^2 - 1}$

e)  $\frac{x - y}{y - x}$

6. Rearrange the fractions below such that the denominator becomes  $10a^2b^2x$ :

a)  $\frac{4y}{2a^2x}$

b)  $\frac{5}{2ax}$

7. Rewrite the expressions below in one fraction:

a)  $\frac{9x}{5} - \frac{6x}{5}$

b)  $\frac{7x-3y}{a} - \frac{2x+5y}{a}$

c)  $\frac{x}{2} + \frac{x}{3}$

d)  $\frac{a}{b} - \frac{c}{ab}$

e)  $\frac{a}{a-b} - \frac{b}{a^2-b^2}$

f)  $\frac{t+7}{3t-6} - \frac{t+4}{t^2-2t}$

8. Simplify the expressions below:

a)  $6 \cdot \frac{5}{12}$

b)  $\frac{3}{4a} \cdot \frac{2}{9b}$

c)  $\frac{d-1}{18d} \cdot \frac{12d^2}{1-d}$

d)  $\frac{12pqr}{2pr}$

e)  $\frac{16ab+12aq}{4a}$

f)  $\frac{30a^4b^3c^2}{5a^2bc}$

g)  $\frac{-2x^2-4x}{-2x}$

h)  $\frac{\frac{ax}{c}}{a}$

i)  $\frac{\frac{a}{b^2}}{\frac{a^2}{b}}$

j)  $\frac{x}{\frac{1}{y}}$

k)  $\frac{r^2 + \frac{1}{r}}{r + \frac{1}{r^2}}$

9. (see next page)

9. Simplify the expressions below and write the answers without fractions:

a)  $\frac{(a^2b^3a^4)^5}{(b^2a^3b^5)^2}$

b)  $\left(\frac{a^{-1}b^2}{a^3b^4}\right)^{-5}$

10. Determine all real numbers such that the expressions below are **not** defined:

a)  $x^2 - 7$

b)  $\frac{1}{x+2}$

c)  $\sqrt{x+3}$

d)  $\frac{1}{\sqrt{x^2-4}}$

### Equations

11. Solve the equations below for x (without discussing special cases):

a)  $22(x - 11) - 5(x - 40) = 110 - (x + 53)$

b)  $2a + cx = c - x$

c)  $\frac{45}{2x-9} - 2 = -\frac{27}{9-2x}$

d)  $\frac{x}{x-1} - \frac{x-1}{x-2} = 0$

### Functions

12. The equation of a function f is given as follows:

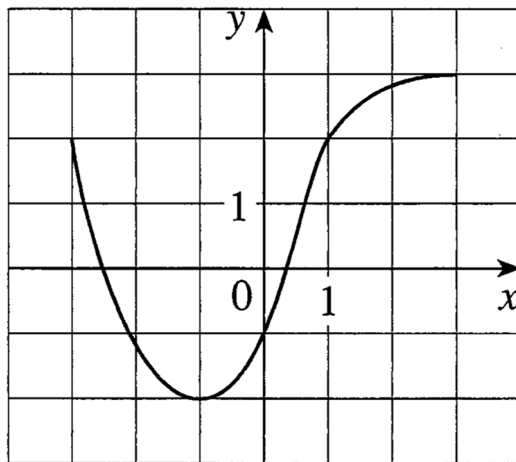
$$y = f(x) = 3x - 4$$

a) Determine both f(0) and f(-4).

b) Determine all values of x such that f(x) = 0.

13. (see next page)

13. The function  $f$  is defined on the interval  $-3 \leq x \leq 3$ . The graph of  $f$  is given as follows:



- Determine  $f(-1)$ .
  - Estimate the value of  $f(2)$ .
  - Determine the values of  $x$  such that  $f(x) = 2$ .
  - Estimate the values of  $x$  such that  $f(x) = 0$ .
14. The graph of a linear function contains the two points  $P_1(-2|5)$  and  $P_2(2|-4)$ .
- Determine the equation of the function.
  - Determine the point where the graph and the y-axis intersect.
  - Determine the point where the graph and the x-axis intersect.