

Prerequisites in Mathematics

The prerequisites for the module **Mathematics** in the Bachelor programme **Tourism** at the HTW Chur are the following:

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 problems below **without auxiliaries** (calculator, formulary, etc.):

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 is $10a^2b^2x$:

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) $\frac{ax}{c}$

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

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

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

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

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

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

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

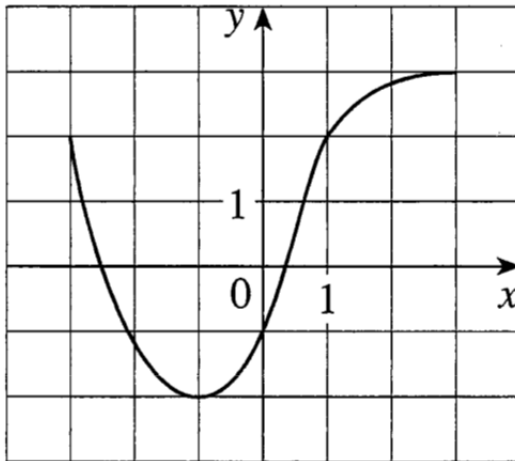
Functions

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

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

- Determine both $f(0)$ and $f(-4)$.
- Determine all values of x such that $f(x) = 0$.

13. The graph of a function 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 $P(-2|5)$ and $Q(2|-4)$.

- 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.

**Answers****Terms**

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|----|----|----------------------------------|----|----------------------------|
| 1. | a) | 14 | b) | $\frac{1}{9}$ |
| | c) | -16 | d) | 4 |
| 2. | a) | $3x + 13y + 3z$ | b) | $18m + 6q$ |
| | c) | $10a - b$ | d) | $60a^5b^3$ |
| | e) | $x^4 - y^4$ | | |
| 3. | a) | $p^2 + 2pq + q^2$ | b) | $4x^2 + 12xy + 9y^2$ |
| | c) | $x^2 - 2xy + y^2$ | d) | $4a^2 - 12a^2x + 9a^2x^2$ |
| | e) | $a^2 - 4$ | f) | $25x^2y^2 - 9x^2z^2$ |
| 4. | a) | $5a^2(1 - 2a - 5a^2)$ | b) | $3a(x - a)(x + 3a)$ |
| 5. | a) | $\frac{7}{9b}$ | b) | $\frac{1}{abc}$ |
| | c) | $\frac{2b}{a - b}$ | d) | $\frac{p}{p - 1}$ |
| | e) | - 1 | | |
| 6. | a) | $\frac{20b^2y}{10a^2b^2x}$ | b) | $\frac{25ab^2}{10a^2b^2x}$ |
| 7. | a) | $\frac{3x}{5}$ | b) | $\frac{5x - 8y}{a}$ |
| | c) | $\frac{5x}{6}$ | d) | $\frac{a^2 - c}{ab}$ |
| | e) | $\frac{a^2 + ab - b}{a^2 - b^2}$ | f) | $\frac{t + 6}{3t}$ |
| 8. | a) | $\frac{5}{2}$ | b) | $\frac{1}{6ab}$ |
| | c) | $-\frac{2d}{3}$ | d) | 6q |
| | e) | $4b + 3q$ | f) | $6a^2b^2c$ |
| | g) | $x + 2$ | h) | $\frac{x}{c}$ |
| | i) | $\frac{1}{ab}$ | j) | xy |
| | k) | r | | |
| 9. | a) | $a^{24}b$ | b) | $a^{-10}b^{10}$ |



10. a) The expression is defined for all real numbers x .
b) $x = -2$
c) $x < -3$
d) $-2 \leq x \leq 2$

Equations

11. a) $x = \frac{11}{2}$
b) $x = \frac{c-2a}{1+c}$
c) $x = 9$
d) The equation has no solution.

Functions

12. a) $f(0) = -4$
 $f(-4) = -16$
b) $x = \frac{4}{3}$
13. a) $f(-1) = -2$
b) $f(2) \approx 2.8$
c) $x_1 = -3$
 $x_2 = 1$
d) $x_1 \approx -2.5$
 $x_2 \approx 0$
14. a) $y = f(x) = -\frac{9}{4}x + \frac{1}{2}$
b) $S_y\left(0 \left| \frac{1}{2} \right. \right)$
c) $S_x\left(\frac{2}{9} \left| 0 \right. \right)$