Prerequisites in Mathematics

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

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

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

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

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

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

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

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

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

7. Rewrite the expressions below in one fraction:

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

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

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

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

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

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

8. Simplify the expressions below:

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

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

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

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

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

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

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

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

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

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

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

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

a) $\dfrac{\left(a^2\,b^3\,a^4\right)^5}{\left(b^2\,a^3\,b^5\right)^2}$

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

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

a) $x^2 - 7$

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

c) $\sqrt{x+3}$

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

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

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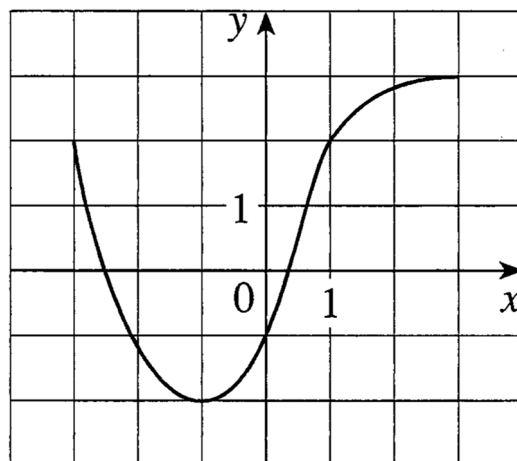
Functions

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. The graph of a function f is given as follows:

a) Determine f(-1).

b) Estimate the value of f(2).

c) Determine the values of x such that f(x) = 2.

d)   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).

    a)   Determine the equation of the function.

    b)   Determine the point where the graph and the y-axis intersect.

    c)   Determine the point where the graph and the x-axis intersect.

Answers

Terms

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) $y = f(x) = -\frac{9}{4}x + \frac{1}{2}$

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b) $S_y \left(0 \middle| \frac{1}{2}\right)$

c) $S_x \left(\frac{2}{9} \middle| 0\right)$