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Utgått

## Purpose

Mathematics is part of our global cultural heritage. Throughout the ages humankind has used and developed mathematics to systematise experiences, to describe and relationships in nature and society and to explore the universe. Another source of inspiration for the development of the subject has been the joy people have felt when simply working with mathematics. The subject is part of many vital societal areas, including medicine, economy, technology, communication, energy management and construction. Solid competence in mathematics is thus a requirement for developing society. Active democracy requires citizens who are able to study, understand and critically assess quantitative information, statistical analyses and economic prognoses. Hence mathematical competence is required to understand and influence processes in society.

Solid competence in mathematics involves using problem-solving techniques and modelling to analyse and transform a problem into mathematic form, solve the problem and evaluate the validity of the solution. This also has linguistic aspects, such as reasoning, communicating converse about and applying reason to ideas. Aids and technologies are used in most mathematical activities. Being able to use and assess aids and technology and being able to recognise their limitations are important aspects of the subject. Competence in mathematics is an important tool for each individual, and the subject can form the basis for pursuing further education and for participation in working life and recreational activities. Mathematics is an underpinning of important elements of our cultural history and for the development of logical thinking. Thus the subject plays a key role in general education by influencing identity, thinking and understanding of oneself.

The subject of Mathematics contributes to developing the mathematical competence needed by society and each individual. To attain this, pupils must be allowed to work both theoretically and practically. The teaching must switch between explorative, playful, creative and problem-solving activities and training in skills. Mathematics shows its usefulness as a practical tool. In school activities, central ideas, forms, structures and relations in the subject are exploited. Pupils must be challenged to communicate using mathematics in its written, oral and digital forms. Both girls and boys must have the opportunity to gain rich experiences from the subject of Mathematics that create positive attitudes to and solid competence in the subject. In this way the foundation is laid for lifelong learning.

## Main subject areas

The subject has been structured into main areas for which competence aims have been formulated. These main subject areas supplement each other and must be considered together.

There are two subject curricula for this subject. Curriculum 2T is more theoretical, while variant 2P is more practical. Both variants qualify candidates for higher education together with the common core programme subject Mathematics at level Vg1 (Vg1T/Vg1P).

### Overview of the main subject areas:

Common core subject	Main subject areas			
Vg2T	Geometry	Combinatorics and probability	Culture and modelling	
Second year (Vg2)	Numbers and algebra in practice	Statistics	Modelling	Functions in practice

The main subject area Numbers and algebra in practice focuses on developing an understanding of numbers and insight into how numbers and processing numbers are part of systems and patterns. With numbers it is possible to quantify amounts and magnitudes. Numbers include whole numbers, fractions, decimal numbers and percentages. Algebra in school generalises calculation with numbers by representing numbers with letters or other symbols. This makes it possible to describe and analyse patterns and relationships. Algebra is also used in connection with the other main subject areas.

Geometry in school focuses on analysing characteristics of two- and three-dimensional figures and carrying out constructions and calculations. Dynamic processes are studied, such as mirroring, rotation and displacement. The main subject area also covers describing locations and moving around grids, maps and coordinate systems.

Statistics covers planning, collecting, organising, analysing and presenting data. Part of data analysis is describing general characteristics of the data material. Assessing and critically considering conclusions and presentations of data are key elements in statistics. Probability focuses on expressing in numbers the likelihood that an event will occur. Combinatorics involves systematic ways of determining numbers, and is often required for calculating probability.

The main subject area Culture and modelling provides an overarching perspective on the subject of mathematics. The main area describes the logical structure of the subject and the subject's history and cultural role. Modelling is a fundamental process in the subject, where the starting point is something that actually exists. This is described in mathematical terms through a formulated model, and the results are discussed in light of the original situation.

A function unambiguously describes change or development of an amount that depends on another. Functions can be useful for making mathematical models of practical relationships. The main subject area Functions in practice deals with using functions to describe and analyse situations from daily life and working life.

## Teaching hours

Teaching hours are given in 60-minute units:

PROGRAMMES FOR GENERAL STUDIES

Vg2: 84 teaching hours

## Basic skills

Basic skills are integrated in the competence aims where they contribute to development of the competence in the subject, while also being part of this competence. In the subject of Mathematics the basic skills are understood as follows:

*Oral skills* in Mathematics involves creating meaning by listening, speaking and conversing about mathematics. It involves forming opinions, asking questions and using argumentation with help from informal language, precise terminology and the use of concepts. This also means participating in discussions, communicating ideas and elaborating on problems, solutions and strategies with other pupils. The development of oral skills in Mathematics begins with conversations about mathematics and leads to presenting, discussing and elaborating on more and more complex themes related to the subject matter. Furthermore, this development starts with a basic mathematic vocabulary that leads to precise professional terminology, the use of specific concepts and other modes of mathematical expression.

*Being able to express oneself in writing* in Mathematics involves describing and explaining a process of thought and putting words to discoveries and ideas. It involves the use of mathematical symbols and formal mathematical language to solve problems and present solutions. It also means making drawings, sketches, figures, graphs, tables and diagrams suited to recipient and situation. Writing in Mathematics is a tool for developing one's own thoughts and own learning. The development of writing related to mathematics begins with simple forms of expression and gradually moves toward more formal symbolic language and a precise terminology. The development also begins by describing and systematising simple situations with content from the subject matter to building up comprehensive argumentation concerning complex relationships.

*Being able to read* in Mathematics involves understanding and using symbolic language and forms of expression to create meaning from texts in day-to-day life, working life and from mathematic texts. The subject matter of Mathematics is characterised by complex texts that may include mathematical expressions, graphs, tables, symbols, formulas and logical reasoning. Reading in Mathematics involves sorting through information, analysing and evaluating form and content, and summarising information from different elements in the texts. The development of reading in Mathematics begins with finding and using information in the texts by means of simple symbolic language and moves toward finding meaning and reflecting on complex professional and technical literature with advanced symbolic language and concepts.

*Numeracy* in Mathematics involves the use of symbolic language, mathematical concepts, methods of approach and varied strategies to solve problems and explore mathematics by taking a point of departure in practical day-to-day situations and mathematical problems. This involves learning to pinpoint and describe situations where mathematics is involved and using mathematical methods to deal with problems. The pupil must also communicate and evaluate the validity of his or her solutions. The development of numeracy in Mathematics begins with a basic understanding of numbers, pinpointing and solving problems in simple situations and gradually leads to analysing and solving a wide range of complex problems using a varied selection of strategies and methods. It also involves an increasing use of different tools for calculations, modelling and communication.

*Digital skills* in Mathematics involves using digital tools to learn through play, exploration, visualisation and presentation. It also involves learning how to use and assess digital aids and tools for calculating, problem solving, simulation and modelling. It also means it is important to find information, analyse, process and present data using appropriate tools, and being critical of sources, analyses and results. The development of digital skills involves working with complex digital texts with an increasing degree of complexity. It also involves developing an increasing awareness of the new digital tools that exist for learning in the subject of Mathematics.

## Competence aims

### Geometry

*The aims of the studies are to enable pupils to*

- elaborate on the geometric picture of vectors as arrows in a plane, and calculate sums, differences and scalar products of vectors and the product of numbers and vectors
- calculate with plane vectors written in coordinate form, calculate lengths, distances and angles using vector arithmetic and determine when two vectors are parallel or orthogonal
- draw and describe curves in parametric form and calculate intersection points between such curves

### Combinatorics and probability

*The aims of the studies are to enable pupils to*

- give an account of and use the concepts of independent and conditional probability and apply Bayes' theorem to two events, and evaluate and interpret the results
- calculate probability in the event of ordered sampling with and without repetition, and in the event of non-ordered sampling without repetition
- calculate with binomic and hypergeometric probability, recognising and modelling such spreads in different situations

### Culture and modelling

*The aims of the studies are to enable pupils to*

- analyse theoretical and practical problems, find patterns and structures in different situations and describe relationships with help from mathematical models
- explore mathematical models, compare different models, evaluate the kinds of information the models can provide and what areas of validity and limitations they have
- use digital tools for exploration, model building and presentations
- find, evaluate and present examples from the multicultural history of mathematics and discuss and elaborate on the importance of mathematics for natural science, technology, societal life and culture

## Numbers and algebra in practice

*The aims of the studies are to enable pupils to*

- calculate using powers and numbers in the standard form with positive and negative exponentials, and use this in practical contexts
- calculate using percentage and growth factor, perform successive interest calculations and calculate practical tasks with exponential growth

## Statistics

*The aims of the studies are to enable pupils to*

- plan, carry out and assess statistical examinations
- calculate and elaborate on measures of central tendency and measures of spread
- calculate and give an account of cumulative and relative frequency, represent data in tables and graphs and discuss and elaborate on different data presentations and the impression they can give
- group data and calculate measures of central tendency for a grouped data material
- use spreadsheets for statistical calculations and presentations

## Modelling

*The aims of the studies are to enable pupils to*

- make measurements in practical experiments and formulate mathematical models based on the observed data
- analyse practical problems related to daily life, economy, statistics and geometry, find patterns and structures in different situations and describe relationships with help from mathematical models
- explore mathematical models, compare different models that describe the same practical situation, evaluate the kinds of information the models can provide and what areas of validity and limitations they have
- use digital tools for exploration, model building and presentations

## Functions in practice

*The aims of the studies are to enable pupils to*

- use digital aids to investigate combinations of polynomial functions, rational functions, exponential functions and power functions that describe practical situations by determining zero, minimum or maximum and gradient, average rate of change, and approximate values for instantaneous rates of change
- use functions to model and discuss and analyse practical relationships

## Assessment

### Common core subject of Mathematics 2T and 2P

Provisions for final assessment:

#### Overall achievement grades

Year Level	Provision
Vg2 programmes for general studies	Pupils shall have one overall achievement grade.

#### Examinations for pupils

Year Level	Provision
Vg2 programmes for general studies	Pupils may be selected for a written or oral examination. The written examination is prepared and graded centrally. The oral examination is prepared and graded locally.

#### Examinations for external candidates

Year Level	Provision
Vg2 programmes for general studies	External candidates shall sit for a written examination. The examination is prepared and graded centrally.

The general provisions on assessment have been laid down in the Regulations relating to the Norwegian Education Act.