

Curriculum for Mathematics year 1–10

This is a translation from Norwegian Nynorsk of the official Norwegian subject curriculum text.

Established as regulations by the Ministry of Education and Research on 15 November 2019. The examination scheme was established by the Ministry of Education and Research on 29 June 2020.

Valid from 01.08.2020

About the subject

Relevance and central values

Mathematics is an important subject for understanding the patterns and relationships within society and nature through the use of modelling and applications. Mathematics shall help pupils to develop a precise language for reasoning, critical thinking and communication through abstraction and generalisation. Mathematics shall prepare pupils for a society and working life in development by providing them with the competence to explore and solve problems.

All subjects shall help the pupils to understand the value system for learning. Critical thinking in mathematics includes critical evaluation of reasonings and arguments and can arm the pupils to make their own decisions and take a stand on important questions in their own life and in society. When the pupils are given the time to think, reflect, reason mathematically, ask questions and experience that the subject is relevant, the subject facilitates creativity and innovation. Mathematics shall help pupils to develop their ability to work independently and to collaborate with others through exploration and problem solving, and can help pupils to become more aware of their own learning. Giving the pupils the opportunity to solve problems and master challenges on their own contributes to developing perseverance and independence.

Core elements

Exploration and problem solving

Exploration in mathematics means that the pupils search for patterns, find relationships and discuss their way to a shared understanding. The pupils shall place more emphasis on strategies and approaches than on solutions. Problem solving in mathematics means that the pupils develop a method for solving a problem not previously encountered. Computational thinking is important in the process of developing strategies and approaches to solve problems, and means breaking a problem down into sub-problems that can be solved systematically. This also includes evaluating whether sub-problems can be solved best with or without digital tools. Problem solving also means analysing and reformulating known and unknown problems, solving them and evaluating whether the solutions are valid.

Modelling and applications

A model in mathematics is a description of reality using mathematical language. The pupils shall gain insight into how mathematical models are used to describe everyday life, working life and society in general. Modelling in

mathematics means creating such models. It also means to critically evaluate whether the models are valid and what limitations the models have, evaluate the models in view of the original situations, and evaluate whether they can be used in other situations. Applications in mathematics means giving the pupils insight into how to use mathematics in different situations within and outside of the subject.

Reasoning and argumentation

Reasoning in mathematics means the ability to follow, evaluate and understand mathematical chains of thought. It means that the pupils shall understand that mathematical rules and results are not random, but have clear reasons. The pupils shall formulate their own reasoning in order to both understand and solve problems. Argumentation in mathematics means that the pupils give reasons for their approaches, reasonings and solutions, and prove that these are valid.

Representation and communication

Representations in mathematics are ways of expressing mathematical concepts, relationships and problems. Representations can be concrete, contextual, visual, verbal and symbolic. Communication in mathematics means that the pupils use mathematical language in conversations, argumentation and reasoning. The pupils shall have the opportunity to use mathematical representations in different contexts through their own experiences and in mathematical conversations. The pupils shall have the opportunity to explain and give reasons for the choice of form of representation. The pupils must be able to switch between mathematical representations and everyday language and to switch between different representations.

Abstraction and generalisation

Abstraction in mathematics means gradually developing formalisation of thoughts, strategies and mathematical language. The development goes from concrete descriptions to formal symbol language and formal reasoning. Generalisation in mathematics refers to the pupils discovering relationships and structures without being presented a finished solution. This means that the pupils can explore numbers, calculations and figures to find relationships, and then formalise by using algebra and suitable representations.

Mathematical fields of knowledge

The mathematical fields of knowledge include numbers and understanding numbers, algebra, functions, geometry, statistics and probability. The pupils shall early gain a strong concept of numbers and develop a variety of numeracy strategies. Algebra refers to exploring structures, patterns and relationships, and is an important prerequisite for enabling the pupils to

generalise and model in mathematics. Functions provide the pupils with an important tool for studying and modelling change and development. Geometry is important for enabling the pupils to develop good spatial understanding. Knowledge of statistics and probability gives the pupils a good foundation for making choices in their own lives, in society and in working life. The fields of knowledge form the basis the pupils need in order to develop their mathematical understanding by exploring relationships within and between the mathematical fields of knowledge.

Interdisciplinary topics

Health and life skills

In mathematics the interdisciplinary topic of health and life skills refers to giving the pupils competence in problem solving, in statistics and in personal finance. Through the subject, the pupils shall develop an understanding of technology, statistics and mathematical representations and models that can help them to make responsible life choices.

Democracy and citizenship

In mathematics the interdisciplinary topic of democracy and citizenship refers to giving the pupils the competence to explore and analyse findings from real datasets and data collected from nature, society, working life and everyday life. It also refers to the pupils learning how to evaluate the validity of such findings. This type of competence is important in order to formulate one's own arguments and participate in public debate. The subject shall make the pupils conscious of the underlying conditions and premises for the mathematical models which form the basis for decisions in their own lives and in society.

Basic skills

Oral skills

Oral skills in mathematics refers to creating meaning through dialogue in and about mathematics. This means communicating ideas and discussing mathematical problems, strategies and solutions with others. The development of oral skills in mathematics goes from using an everyday language to gradually using a more precise mathematical language.

Writing

Writing in mathematics refers to describing and explaining relationships, discoveries and ideas using suitable representations. Writing in mathematics is a tool for developing one's own thoughts and learning. This means the ability to solve problems and to present solutions that are adapted to the

receiver and the situation. The development of writing skills in mathematics goes from using an everyday language to gradually using a more precise mathematical language.

Reading

Reading in mathematics refers to creating meaning in texts from everyday life, society and the field of mathematics. Reading in mathematics means being able to sort information, analyse and evaluate its form and content, and summarise information in multimodal texts. The development of reading skills in mathematics refers to finding and using information in increasingly complex texts with advanced symbolic language and use of concepts.

Numeracy

Numeracy in mathematics refers to using mathematical representations, concepts and approaches to do calculations and evaluate whether solutions are valid. This means recognising concrete problems that can be solved using numeracy skills and formulating questions about these. Mathematics has a particular responsibility for teaching numeracy. Development of numeracy skills in mathematics means analysing and solving a range of increasingly more complex problems with effective and suitable concepts, symbols, methods and strategies.

Digital skills

Digital skills in mathematics refers to the ability to use graphing tools, spreadsheets, CAS, dynamic geometry software and programming to explore and solve mathematical problems. It also means finding, analysing, processing and presenting information using digital tools. The development of digital skills refers to increasingly being able to choose and use suitable digital tools as aids for exploring, solving and presenting mathematical problems.

Competence aims and assessment

Competence aims and assessment year 2

Competence aims after year 2

The pupil is expected to be able to

- order numbers, sets and shapes based on their properties, compare them, and reflect on whether they can be ordered in more ways

- explore numbers, sets and counting through play, nature, visual art, music and children's literature, represent the numbers in different ways and translate between the different representations
- experiment with counting, both up and down, choosing different starting points and various intervals, and describe patterns in the countings
- explore and describe general properties of even and odd numbers
- describe the positional system using different representations
- place numbers on the number line, and use the number line for calculations and solving problems
- explore addition and subtraction and use this to formulate and solve problems from play and one's own everyday life
- explore the commutative and associative properties of addition and use these in mental arithmetic
- recognise and describe the repeating units in patterns, and make one's own patterns
- explore, draw and describe geometric shapes from one's own local environment and argue for ways to sort them by properties
- measure and compare quantities relating to length and area, using non-standard and standardised units of measurement, describe how and discuss the results
- explain how to tell the time using a clock and calendar
- create and follow rules and step-by-step instructions during play and games

Formative assessment

Formative assessment shall help to promote learning and develop competence in mathematics. The pupils demonstrate and develop competence in the subject in years 1 and 2 when they can experiment with and describe different properties and structures in patterns of numbers and shapes, in exploratory play, art and everyday situations. The pupils also demonstrate and develop competence in mathematics when they wonder, ask mathematical questions and explain and argue for their own solutions. They also demonstrate and develop competence by using simple subject-related terminology.

The teacher shall facilitate for pupil participation and stimulate their desire to learn by allowing the pupils to explore mathematics through movement, play, wonder and using their senses. The teacher shall engage in dialogue with the pupils about their development in numeracy and understanding of numbers. The pupils shall have the opportunity to try and fail. With the competence the pupils have demonstrated as the starting point, they shall be given the opportunity to express what they experience mastery in and what they master better than before. The teacher shall provide guidance on further learning and adapt the teaching to enable the pupils to use the guidance provided to

develop their competence in exploration and problem solving related to numbers and patterns and in communicating using mathematical concepts.

Competence aims and assessment year 3

Competence aims after year 3

The pupil is expected to be able to

- develop and use suitable strategies for subtracting in practical situations
- explore and explain relationships between addition and subtraction and use this in one's own mental arithmetic and problem solving
- explore multiplication by counting
- experiment with multiplication and division in everyday situations
- represent multiplication in different ways and switch between the different representations
- use commutative, associative and distributive properties to explore and describe strategies in multiplication
- describe equality and inequality in comparing sizes, sets, expressions and numbers and use the symbol for equals and does not equal
- explore equilibrium and balance in practical situations, represent this in different ways and switch between the different representations
- use different units of measurement for length and mass in practical situations and argue for the choice of unit of measurement
- experiment with and explain positions in the coordinate system
- create and follow rules and step-by-step instructions in play and games related to the coordinate system

Formative assessment

Formative assessment shall help to promote learning and develop competence in the mathematics subject. The pupils demonstrate and develop competence in the subject in year 3 when they explore and discover relationships in the arithmetical operations, and use this to explain their thought processes. The pupils also demonstrate and develop competence when they use different problem solving strategies to explore mathematics in everyday life. They also demonstrate and develop competence in mathematics when they wonder, ask mathematical questions, test and use mathematical concepts, and explain and argue for their own solutions.

The teacher shall facilitate for pupil participation and stimulate their desire to learn by allowing the pupils to explore mathematics through moving, playing, being creative and having a sense of wonder. The teacher and pupils shall engage in dialogue about their development in numeracy and understanding of numbers. The pupils shall have the opportunity to try and fail. With the competence the pupils have demonstrated as the starting point, they shall be

given the opportunity to express what they believe they have achieved and how they have improved their skills. The teacher shall provide guidance on further learning and adapt the teaching to enable the pupils to use the guidance provided to develop their competence in exploring and solving problems related to numeracy strategies and their competence in communicating using mathematical concepts.

Competence aims and assessment year 4

Competence aims after year 4

The pupil is expected to be able to

- explore and use measurement division and partitive division in practical situations
- represent division in different ways and switch between the different representations
- explore, use and describe different strategies for division
- explore and explain relationships between the four arithmetical operations and use the relationships in a suitable way in calculations
- model situations from one's own everyday life and explain one's own thought processes
- make arithmetic expressions for practical situations and find practical situations that fit given arithmetic expressions
- explore, describe and compare properties of two and three dimensional figures using angles, edges and corners
- use non-standard units of measurement for area and volume in practical situations and argue for the choice of unit of measurement
- explore and describe structures and patterns in play and games
- create algorithms and express them using variables, conditions and loops

Formative assessment

Formative assessment shall help to promote learning and to develop competence in the mathematics subject. The pupils demonstrate and develop competence in the subject in year 4 when they use suitable strategies and representations in their work with the four arithmetical operations, and in explaining their thought processes. The pupils also demonstrate and develop competence when they are given the opportunity to use their knowledge and skills to solve problems and explore mathematical relationships. They also demonstrate and develop their competence in mathematics when they wonder, ask mathematical questions, test and use mathematical concepts and explain and argue for their own solutions.

The teacher shall facilitate for pupil participation and stimulate the desire to learn by allowing the pupils to explore mathematics through playing, being

creative, having a sense of wonder and talking about mathematics. The teacher and pupils shall engage in dialogue about their development in numeracy and understanding of numbers. The pupils shall have the opportunity to try and fail. With the competence the pupils have demonstrated as the starting point, they shall have the opportunity to express what they believe they have achieved and how they have improved their skills. The teacher shall provide guidance on further learning and adapt the teaching to enable the pupils to use the guidance provided to develop their competence in exploring different representations and problem solving strategies and their competence in communicating using mathematical concepts.

Competence aims and assessment year 5

Competence aims after year 5

The pupil is expected to be able to

- explore and explain relationships between fractions, decimal numbers and percentages, and use these in mental arithmetic
- describe fractions as parts of the whole, as parts of a set and as numbers on the number line, and evaluate and name the quantities
- represent fractions in different ways and switch between the different representations
- develop and use different strategies for calculations with positive numbers and fractions, and explain one's own thought processes
- formulate and solve problems from one's own everyday life that are related to fractions
- discuss randomness and probability in games and practical situations and relate this to fractions
- solve equations and inequalities through logical reasoning and explain what it means that a number is a solution to an equation
- create and solve tasks in a spreadsheet related to personal finance
- formulate and solve problems from one's own everyday life that are related to time
- create and programme algorithms with the use of variables, conditions and loops

Formative assessment

Formative assessment shall help to promote learning and develop competence in the mathematics subject. The pupils demonstrate and develop competence in the subject in year 5 when they explore and reflect on different mathematical concepts, representations and strategies when working with fractions and informal solving of equations and inequalities. The pupils also demonstrate and develop competence when they use their knowledge and skills to formulate and solve problems related to everyday life and society.

They also demonstrate and develop their competence in mathematics when they reason about and argue for solutions and mathematical relationships.

The teacher shall facilitate for pupil participation and stimulate the desire to learn by allowing the pupils to explore mathematics and solve mathematical problems by being creative, and by reasoning and reflecting. The teacher and pupils shall engage in dialogue about their development in programming and understanding of numbers. The pupils shall have the opportunity try and fail. With the competence the pupils have demonstrated as the starting point, they shall have the opportunity to express what they believe they have achieved and how they have improved their skills. The teacher shall provide guidance on further learning and adapt the teaching to enable the pupils to use the guidance provided to develop their competence in exploring different representations and problem solving strategies and in arguing using mathematical concepts.

Competence aims and assessment year 6

Competence aims after year 6

The pupil is expected to be able to

- explore, name and place decimal numbers on the number line
- explore strategies for calculating with decimal numbers and compare this with strategies for calculating with whole numbers
- formulate and solve problems from one's own everyday life related to decimal numbers, fractions and percentages, and explain one's own thought processes
- describe properties and minimum definitions of two and three dimensional figures, and explain what properties the figures have in common, and what properties distinguish them from one another
- explore and describe symmetry in patterns and carry out congruent mapping with and without a coordinate system
- measure the radius, diameter and circumference of circles, and explore and argue for how they are interrelated
- explore measures for area and volume in practical situations and represent them in different ways
- use different strategies to calculate area and circumference, and explore the relationships between these
- use variables and formulas to express relationships in practical situations
- use variables, loops, conditions and functions in programming to explore geometric figures and patterns

Formative assessment

Formative assessment shall help to promote learning and develop competence in the mathematics subject. The pupils demonstrate and develop competence in the subject in year 6 when they use mathematical concepts in communication and argumentation. The pupils also demonstrate and develop competence when they use different representations and strategies to explore relationships when working with patterns, geometric figures and decimal numbers. They also demonstrate and develop competence in mathematics when they use their knowledge and skills to explore, formulate and solve problems related to practical situations. Furthermore, they also demonstrate and develop competence in mathematics when they reason about and argue for solutions and mathematical relationships.

The teacher shall facilitate for pupil participation and stimulate the desire to learn by allowing the pupils to explore mathematics and solve mathematical problems by being creative, and by reasoning and reflecting. The teacher and pupils shall engage in dialogue about their development in programming and geometry. The pupils shall have the opportunity to try and fail. With the competence the pupils have demonstrated as the starting point, they shall have the opportunity to express what they believe they have achieved and how they have improved their skills. The teacher shall provide guidance on further learning and adapt the teaching to enable the pupils to use the guidance provided to develop their competence to see relationships between different representations and problem solving strategies.

Competence aims and assessment year 7

Competence aims after year 7

The pupil is expected to be able to

- develop and use suitable strategies in calculations with fractions, decimal numbers and percentages, and explain one's own thought processes
- represent and use fractions, decimal numbers and percentages in different ways and explore the mathematical relationships between these representations
- explore negative numbers in practical situations
- use a number line in calculations with positive and negative numbers
- use compound mathematical expressions to describe and do calculations
- use different strategies to solve linear equations and inequalities, and evaluate whether the solutions are valid
- explore and use suitable measures of central tendency in one's own and others' statistical inquiries

- log, sort, present and read data in tables and diagrams, and argue for the choice of representation
- create and evaluate budgets and accounts by using spreadsheets with cell references and formulas
- use programming to explore data in tables and datasets

Formative assessment

Formative assessment shall help to promote learning and develop competence in the mathematics subject. The pupils demonstrate and develop competence in the subject in year 7 when they explore and reflect on mathematical relationships, use mathematical concepts in communication and use different representations and problem solving strategies. They also demonstrate and develop competence when they use their knowledge and skills to formulate and solve problems related to practical situations in everyday life and in society. Furthermore, they also demonstrate and develop competence in mathematics when they reason about and argue for solutions and mathematical relationships.

The teacher shall facilitate for pupil participation and stimulate the desire to learn by allowing the pupils to explore mathematics and solve mathematical problems by being creative, and by reasoning and reflecting. The teacher and pupils shall engage in dialogue about their development in programming and strategies to solve problems. The pupils shall have the opportunity to try and fail. With the competence the pupils have demonstrated as the starting point, they shall have the opportunity to express what they believe they have achieved and how they have improved their skills. The teacher shall provide guidance on further learning and adapt the teaching to enable the pupils to use the guidance provided to develop their competence to discover relationships in mathematics and their competence in solving problems and communication about mathematics.

Competence aims and assessment year 8

Competence aims after year 8

The pupil is expected to be able to

- use powers and square roots in exploration and problem solving, and argue for approaches and results
- develop and communicate strategies for mental arithmetic in calculations
- explore and describe prime number factorisation and use it while calculating with fractions
- explore rules of algebra
- describe and generalise patterns in one's own words and algebraically
- create and solve problems related to compound units of measurement

- make and explain mathematical expressions with numbers, variables and constants related to practical situations
- create, solve and explain equations related to practical situations
- explore, explain and compare functions related to practical situations
- represent functions in different ways and show the relationships between the representations
- explore how algorithms can be created, tested and improved by means of programming

Formative assessment

Formative assessment shall help to promote learning and develop competence in the mathematics subject. The pupils demonstrate and develop competence in the subject in year 8 when they explore and generalise mathematical relationships algebraically. They also demonstrate and develop competence when they explore practical contexts and translate between representations in problem solving and modelling. Furthermore, they also demonstrate and develop competence in mathematics when they reason about and argue for approaches and solutions.

The teacher shall facilitate for pupil participation and stimulate the desire to learn by allowing the pupils to explore mathematics and solve mathematical problems by using strategies, and by being creative, reasoning and reflecting. The teacher and pupils shall engage in dialogue about their development in mathematics. The pupils shall have the opportunity to try and fail. With the competence the pupils have demonstrated as the starting point, they shall have the opportunity to express what they believe they have achieved and how they have improved their skills. The teacher shall provide guidance on further learning and adapt the teaching to enable the pupils to use the guidance provided to develop their competence in discovering relationships in functions and algebra, their competence in solving problems and their competence in arguing for solutions.

Competence aims and assessment year 9

Competence aims after year 9

The pupil is expected to be able to

- describe, explain and present structures and progressions in geometric and numerical patterns
- explore the properties of different polygons and explain the concepts similarity and congruence
- explore, describe and argue for relationships between the length of the sides in triangles
- explore and argue for how changing the conditions in a geometric problem affects the solutions

- explore and argue for formulas for area and volume of three-dimensional figures
- interpret and critically evaluate statistical representations found in media and the local community
- find and discuss measures of central tendency and measures of variability in real datasets
- explore and argue for how representations of numbers and data can be used to promote different points of view
- calculate and evaluate probability in statistics and games
- simulate outcomes in random events and calculate the probability that something will occur by using programming

Formative assessment

Formative assessment shall help to promote learning and develop competence in the mathematics subject. The pupils demonstrate and develop competence in the subject in year 9 when they reason about and discuss geometrical properties and relationships. They also demonstrate and develop competence when they explore and analyse real datasets and when they make and argue about findings. Furthermore, they also demonstrate and develop competence in mathematics when they reason about and argue for approaches and solutions.

The teacher shall facilitate for pupil participation and stimulate the desire to learn by allowing the pupils to explore mathematics and solve mathematical problems through choosing strategies, by being creative, and by reasoning and reflecting. The teacher and pupils shall engage in dialogue about their development in mathematics. The pupils shall have the opportunity to try and fail. With the competence the pupils have demonstrated as the starting point, they shall have the opportunity to express what they believe they have achieved and how they have improved their skills. The teacher shall provide guidance on further learning and adapt the teaching to enable the pupils to use the guidance provided to develop their competence in solving problems and their competence in discovering and argue for relationships in and between statistics and other fields of mathematics.

Competence aims and assessment year 10

Competence aims after year 10

The pupil is expected to be able to

- explore and generalise multiplication of polynomials algebraically and geometrically
- explore and compare the properties of different functions using digital tools
- create, solve and explain equation sets related to practical situations

- calculate the slope of a linear function, and use it to explain the concepts change per unit and average speed
- explore the relationship between constant change by percentage, growth factors and exponential functions
- extract and interpret relevant information from texts related to purchases, sales and different types of loans, and use this to formulate and solve problems
- plan, carry out and present an exploratory work related to one's personal finances
- use functions in modelling and argue for approaches and results
- model situations related to real datasets, present the results and argue for the validity of the models
- explore mathematical properties and relationships by using programming

Formative assessment

Formative assessment shall help to promote learning and develop competence in the mathematics subject. The pupils demonstrate and develop competence in the subject in year 10 when they formalise thoughts and strategies using mathematical language. They also demonstrate and develop competence when they explore and generalise mathematical relationships and structures using algebra and suitable representations. Furthermore, they also demonstrate and develop competence in mathematics when they reason about and argue for their own and others' approaches and solutions.

The teacher shall facilitate for pupil participation and stimulate the desire to learn by allowing the pupils to explore mathematics and solve mathematical problems by being creative, modelling and reflecting. The teacher and pupils shall engage in dialogue about their development when it comes to discovering relationships between different fields of knowledge and choosing suitable strategies. The pupils shall have the opportunity to try and fail. With the competence the pupils have demonstrated as the starting point, they shall have the opportunity to express what they believe they have achieved and reflect on their development in the subject. The teacher shall provide guidance on further learning and adapt the teaching to enable the pupils to use the guidance provided to develop their competence in modelling and understanding of mathematics and how to use obtained knowledge and skills in new and unfamiliar contexts.

Assessment of coursework

The grade awarded for coursework shall express the overall competence of the pupil in mathematics after completing year 10. The teacher shall plan and facilitate for the opportunity for the pupils to demonstrate their competence in different ways, including through understanding, reflection and deliberation, and in different contexts. The teacher shall award one grade in mathematics

based on the competence the pupil has demonstrated in writing, orally and digitally, by using mathematical forms of expression, problem-solving strategies and reflecting on and arguing for solutions and models.

Type of assessment

Assessment of coursework

Year 10: The pupil shall receive one grade for coursework.

Examination for pupils

Year 10: The pupil can be selected for a written examination. The written examination is prepared and graded centrally. The pupil may also be selected for an oral-practical examination with a preparation part. The oral-practical examination is prepared and graded locally.

Examination for external candidates

Year 10: See the provisions in force for primary and lower secondary education for adults.