

SUBJECT TEST

Mathematics

GRADE

9

This test will be re-used and is therefore protected by **Chapter 17** paragraph 4 of the **Official Secrets Act (2009:400)**. The intention is for this test to be re-used until **2017-06-30**. This should be considered when determining the applicability of the Official Secrets Act.

Spring 2011

Part A – Oral Part

Teacher Material – For copying

Student Material – For copying

Name

Teacher material – For copying

Implementation

Implementation is to be carried out in the same way for all variants. In the testing the students are to work with 4 different tasks. In Tasks 1 and 2 the students answer individually whereas Tasks 3 and 4 are discussion questions. The algebraic expressions are distributed into three different variants. Variant 1 mainly provides a basis for discussion at the grade level G, variant 2 for grade level G/VG and variant 3 for the grade level VG/MVG. Within each variant the expressions are placed in increasing order of difficulty. Choose the variant that best suits your student group.

When the group has assembled, hand out the selected variant of question to all the students in the group. Let the students study the expressions for about one minute. Then distribute the expressions so that each student gets a pair of the expressions. Explain for them that they are to describe their expressions and explain whether there are any similarities or differences between the two expressions.

Begin with the pair of expressions in pair no. 1 in the selected variant and let the students present their solution for Task 1. The student presenting his/her solution completes his/her presentation and then the other students may add something if need be. Continue with pair no. 2 etc. until all students have presented Task 1. We recommend that the fourth pair of expressions be discussed even if there are fewer than four students in the group.

Then make another round doing Task 2. Let the students have a bit of time to prepare and then ask them to “think out loud”.

Finally go on to the discussion questions in Tasks 3 and 4. The students are to discuss these questions together, but the teacher may distribute the expressions/representation forms if silence occurs or if some student takes over in presenting all the ways of showing the expressions.

While the students make their presentations the teacher makes assessments by making notes in the task specific matrix (page 4) and, when applicable, in the MVG-table (page 5).

Tasks

Questions for individual students

Task 1

- Which expressions did you get?
- What similarities and differences are there between your expressions? How can you see that?

Additional explanatory questions if the students do not understand the task: Is it the same kind of operation calculation in your expressions? What is meant by $2a$, a^2 , etc? Can any of the expressions be written in another way?

Task 2

- Can you replace a with some number to give the same value to the expression?

Additional supporting questions: What value do your expressions have if a is 3, for example. Try using other numbers. Are there more numbers that give the same value for the expression?

There is always at least one number that gives the same value for both expressions. You may abandon the task if the students get stuck on it.

Group discussion questions to be posed by the teacher

Task 3

Hand out the page with the different representations of $3a + 5$. Tell them that these are different ways of representing $3a + 5$ and that all are correct.

- Explain/motivate why the different expressions all represent $3a + 5$.

The students are to discuss this together, however the teacher may distribute the questions if silence occurs or if some student takes over explaining all ways of representing the expressions.

Follow-up questions:

- Why is the length/side a of different lengths?
- What is this way of representing an expression called? (Point at the graph.)
- How can you find 3 and 5 respectively in the graph?

Task 4

Tell the students that they now are going to work with one of the expressions they got earlier.

Variant 1: $2a$

Variant 2: $4a$

Variant 3: $2 + a$

- In what different ways can you represent this expression? Discuss this and explain your thinking for each other. Make a drawing together if you think that makes it easier.

If the discussion does not get under way spontaneously, the teacher may distribute the various forms of representation among the students.

Follow-up questions:

- Do the different ways of represent the expressions work for all values of a ? What happens, for example, if a is a negative number?

If time allows, you might discuss how to represent somewhat more difficult expressions.

For variant 1 you can discuss $2(a + 2)$, for variant 2 the expression $\frac{2a}{a}$ and for variant 3

the expression $2a^2$.

- Is there any difference if you simplify the expression?

Task specific assessment matrix

Assessment concerning	Qualitative levels			
	Lower			Higher
Understanding <i>To what extent the student shows understanding for the question and defends conclusions.</i> <i>To what extent the student makes use of relationships and generalisations.</i>	Describes some relevant similarity or difference between his/her two expressions and/or calculates the value of the expressions for some value of a e.g. 3. Interprets acceptably some representation of $3a + 5$ and/or "translates" a given expression into a simple representation.	Explains similarities and differences between his/her expressions and accounts for <i>some</i> value of a that gives the expressions the same value. Shows understanding of the different forms of representation e.g. by explaining why a can have different lengths, and discusses, explains, or draws how expressions can be shown in different ways.	Arguing well for the similarities and differences between his/her expressions, e.g. by simplifying or developing some expression, and accounts for <i>what</i> values of a that give the same value to the expression, or gives reasoning about relationships between the expressions. Shows good understanding for the different forms of representation as well as the slope of the graph and the points of intersection with the axes.	1/0 2/0 2/1 2/2 ✕
Language <i>How clear and distinct the student's account is.</i> <i>To what extent the student uses relevant mathematical language.</i>	Understandable and possible to follow.	1/0	Clear and easy to follow, with relevant mathematical terminology. 1/1	✕
Participation <i>To what extent the student participates in discussion using mathematically founded ideas.</i>	Accounts only for his/her expressions.	0/0	Contributes with his/her own ideas and explanations with regard to the accounts of others and in group discussions. 1/0	Participates in the arguments of others and helps to move the discussion forward. 1/1 ✕

<i>MVG-quality</i>	<i>shown by the students in the oral part of the examination of 2011 by</i>
Shows confidence and ability in problem-solving and calculations.	
Formulates and develops problems, uses general strategies in problem-solving.	accounting for what values of a the expressions have the same value.
Interprets and analyzes results, compares and evaluates advantages and disadvantages of different methods.	interpreting and evaluating all of the representations of the algebraic expressions including the slope of the graph and the points of intersection with the axes, as well as describing that the geometric representations, in contrast with the graph, have limitations and are not valid when a is less than 0.
Uses mathematical reasoning, participates in the arguments of others and moves the discussion forward.	arguing well for similarities and differences between his/ her expressions e.g. by simplifying or developing some expression or by using mathematical reasoning about relationships between the expressions and by moving the discussion forward.
Makes structured accounts using suitable/correct mathematical language.	making clear, well-structured accounts, with predominantly relevant mathematical terminology, e.g. "the slope of the graph is two and the graph intersects (cuts) at the origin".

Student material – For copying

Information for students

This is a description of the oral part of the examination which is part of the national examination in mathematics. This oral part is to be carried out in groups consisting of 3–4 students that sit around a table together with the teacher.

- Each of you will get a paper with some algebraic expressions. For a few minutes you will be able to look at these and think about them. Your teacher will tell you in what order you are to report.
- Each of you will tell the rest of us in the group about some of the questions. After each account the rest of you can ask questions, make additional comments and argue for or against.
- When everyone has made their account there will be a group discussion together, using questions that the teacher will give you.
- Your activity during this oral exam will be assessed according to the following three aspects:

Understanding

To what extent you show that you have understood the question, the concepts involved, and the relationships between these.

Language

How clear and distinct your account is and how well you use mathematical language.

Participation

To what extent you participate in the discussion and can defend your ideas and reasoning and respond to the explanations of others.

Remember that you can show your knowledge and abilities in your own presentation, in the discussion following the accounts of others and in the closing discussion after all presentations. Your performance in this part of the examination will be combined and assigned a number of g- and vg-points. You may also demonstrate the MVG-qualities indicated in the MVG-table (see earlier examinations and assessment guidelines at www.prim-gruppen.se). Your result on this oral part of the exam will be combined with your results on Part B and Part C.

Variant 1

Pair no. 1	$2 + a$	$2a$
Pair no. 2	$2a$	$a \cdot a$
Pair no. 3	$2a + 4$	$2(a + 2)$
Pair no. 4	$2a - a$	$a^2 - a$

Variant 2

Pair no. 1	$2a \cdot 2a$	$4a$
Pair no. 2	$\frac{2a}{a}$	$2a$
Pair no. 3	$2a$	$4 - (4 - 2a)$
Pair no. 4	$\frac{a^2}{a}$	$2a - a$

Variant 3

Pair no. 1	$4a$	$2a \cdot 2a$
Pair no. 2	$\frac{a + a}{a}$	$\frac{a^2}{a}$
Pair no. 3	$2 + a$	$\frac{2a + 4}{2}$
Pair no. 4	$2a^2$	$(2a)^2$

Different ways of representing $3a + 5$



