



Project number: 2018-1-IT02-KA201-048274

QUESTIONNAIRE B2, FOR STUDENTS: EXAMPLE OF ITEMS

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The proposed questions will be of different kinds, depending on the different types of difficulties to be identified.

Some of the exercises will address the same difficulty but will be formulated in different ways; other ones will be of the same type but with apparently different difficulties.

The aim is to determine which are the difficulties that have the greatest influence on performance and skills in mathematics.

(Application form of: “Focus on Students with Mathematics Learning Disabilities – SMiLD”, p. 44.)

1. INTRODUCTION

Karagannakis and colleagues (2016), through a review of the literature on mathematical learning disabilities (MLD) and low achievement in mathematics (LA), proposed a model classifying mathematical skills involved in learning mathematics into four domains: Core number, Memory, Reasoning, and Visual-spatial. Their findings support the hypothesis that difficulties in learning mathematics can have multiple origins and provide a mean for sketching students’ mathematical learning profiles.

For this reason, while in B1 questionnaire we proposed items with different levels of difficulty, in B2 questionnaire no different levels of difficulty are foreseen.

According to Karagannakis and colleagues’ theoretical model, we considered Core number, Memory, Reasoning and Visual-spatial as the cognitive areas of investigation. Moreover, we designed items in Arithmetic, Geometry and Algebra domains (see Table 1).

Through this four-pronged model, Questionnaire B2 aims to detect strengths and weaknesses in learning mathematics of students with some difficulties in maths, with LA (low achievement in maths) or with MLD, who were previously identified by the B1 questionnaire.

Mathematical contents:

- Arithmetic
- Geometry
- Algebra

Cognitive area:

- Core number (not implemented on all mathematics domains)
- Memory,
- Reasoning
- Visual-spatial

	Arithmetic	Geometry	Algebra
Memory			
Reasoning			





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Visuo-spatial			
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Table 1: Distribution of items with respect to mathematical contents and cognitive areas

As a methodological indication, we recommend not to not set a time limit for B2 (except in the items indicated), but keep record of the time students employ to carry out the B2 questionnaire, since it can provide further information on their difficulties.

Note that the items proposed in section 2 (“Example of items in areas of interest”) can be considered as a sort of guide to design questionnaire B2, according to the students’ needs and SMiLD aims. For each cognitive area, we provide information on the theoretical considerations that framed the choice of items.

Moreover, if the results of some items related to the different cognitive areas are not significant to define a student's profile of difficulties in maths, it could be useful to proceed with an individual interview. For this, we propose some examples in section3 (“Attachments”).

2. EXAMPLE OF ITEMS IN AREAS OF INTEREST

2.1 Core number

1. Order the following *numbers* from *the smallest to the greatest*:
0.233, 0.3, 0.32, 0.35, 0.208

2. Write in digits:

- 3 tens 5 cents 0 units 8 tenths 3 hundreds
- 4 cents 7 tens 1 hundreds 9 tenths 0 units
- 3 hundreds 1 thousand 8 units 4
- 0 tens 7 units 0 hundreds 9 thousands
- 9 cents 0 tens 7 hundreds 4 tenths 5 units
- 4 tens 1 units 7 hundreds 3 thousand
- 5 units 3 cents 7 tens 0 tenths 9 hundreds
- 14 tenths, 5 units, 0 tens, 1 hundreds

3. Find the largest number of each of the following four series of numbers:

1.	a) 6,87	b) 3^2	c) $\frac{1}{2}$	d) 8,51	e) $\frac{5}{2}$
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2.	a) 3,84	b) $\frac{45}{9}$	c) 4,97	d) 1^9	e) 2,01
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3.	a) 14,62	b) 4^2	c) $\frac{24}{2}$	d) 15^1	e) 16,001
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4.	a) 27^0	b) 19,86	c) $\frac{12}{3}$	d) 23,57	e) 3^2
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4. Perform the following calculations:

$$7524,8 + 462,35 =$$

$$119 - 94,36 =$$

$$2527 \times 3 =$$

$$1140,5 : 21$$

2.2 Memory (retrieval and processing):

	Arithmetic	Geometry	Algebra
Memory			
Reasoning			
Visuo-spatial			

According to Karagannakis et al.'s model, mathematical skills associated with memory domain concern:

Retrieving numerical facts; decoding terminology (numerator, denominator, isosceles, equilateral); remembering theorems and formulas; performing mental calculations fluently; remembering procedures and properties and keeping track of steps.

We implement these skills in Arithmetic, Geometry and Algebra.

Arithmetic

1. Calculate:

$$2^0 = \dots\dots\dots$$

$$(-2) \times (-3) = \dots\dots\dots$$

$$\frac{3}{3^2} = \dots\dots\dots$$

$$\sqrt{0} = \dots\dots\dots$$

$$2 + 3 \times 4 = \dots\dots\dots$$

2. The denominator of the fraction $\frac{2}{5}$ is

3. Is the colored digit in 2³8 called “unit”, “ten” or “tenth”?





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4. Calculate the values of the following expressions

$$\frac{3}{4} - \frac{2}{3} = \dots$$

$$\frac{3}{4} : \frac{3}{7} = \dots$$

$$\sqrt{25} + 2\sqrt{25} =$$

$$(-12) \times (23) =$$

$$57,8 \times 2,94 =$$

$$\frac{7}{2} \times \frac{18}{21} = \dots$$

$$2^7 \times 2^3 = \dots$$

$$\sqrt{5} \times \sqrt{20} = \dots$$

$$75 : (-25) = \dots$$

$$61,5 : 4,1 =$$

$$5^7 : 5^2 =$$

$$\sqrt{2} : \sqrt{6} =$$

Algebra

1. Solve the following expressions:

$$a \times a =$$

$$a + a =$$

$$2a : a =$$

$$\frac{2a}{a} = \dots$$

$$\sqrt[2]{a^3} = a^{\dots}$$

$$a + 2a = \dots$$

$$a \times (b+c) = \dots$$

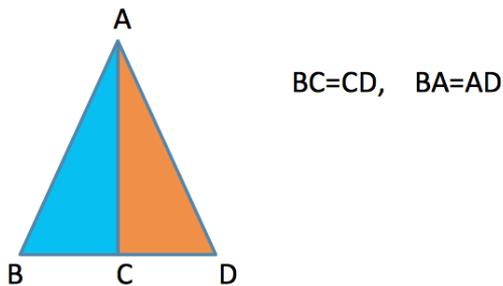


2. If $a+2b=5$ and $c=3$, what is the value of $a + 2(b + c)$?

3. If $x = -3$, what is the value of $-(-x)$?

Geometry

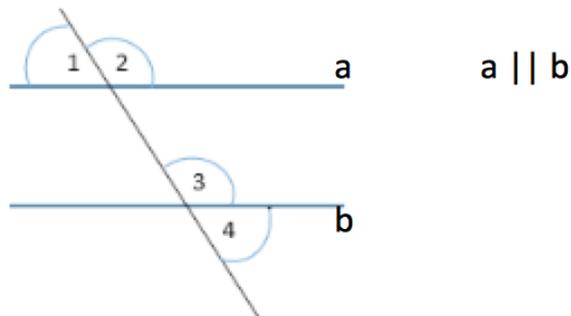
1.



Which kind of triangle is CDA?

Which kind of triangle is BDA?

2. The sum of the interior angles of a triangle is equal to



Which sentences are true?

- A. Angles 1 and 4 are equal
- B. Angles 2 and 3 have the sum 180°
- C. Angles 1 and 2 have the sum 180°
- D. Angle 3 is greater than angle 2



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2.3 Reasoning

	Arithmetic	Geometry	Algebra
Memory			
Reasoning			
Visuo-spatial			

According to Karagannakis et al.'s model, mathematical skills associated with Reasoning domain concern:

Grasping mathematical concepts, ideas and relations; understanding multiple steps in complex procedures/algorithms; grasping basic logical principles (conditionality – “if ... then ...” statements – commutativity, inversion); grasping the semantic structure of problems; (strategic) decision-making; generalizing.

We implement these skills in Arithmetic, Geometry and Algebra.

Arithmetic

1. Solve the following problems:

- a) “Stella has washed 5 pairs of socks. When she went to take them out of the washing machine one sock was missing. How many socks did Stella take out of the washing machine?”

- b) “Peter has 40 cards. If Alex loses 10 cards, he will have as many as cards Peter does. How many cards does Alex have?”

- c) “One family has 3 children. Each child of the family drinks 2 glasses of milk every day. How many glasses of milk will the family drink during 10 days?”

- d) To make 4 handbags crocheted in cotton, 6 cotton balls are needed. How many balls do you need to make 20 handbags?

- e) Sara received 24 euros as a gift, Marta received 6 euros less. How many euros have the two girls in total?





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2. Represent in algebraic form the following game: "Think of a number, double it, add 4, divide by 2, remove the number you thought"

If you perform the game, you get 2 as a result: why?

3. $\frac{4}{5}$ of the animals on the farm are cows. Express the number of cows as a percentage of the total of animals of the farm.

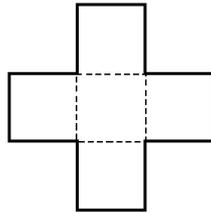
4. Complete:
 $\dots : 2 = 400$, choosing between 200 and 800

5. Enter the appropriate operation to make the equality true
 $37 _ 5 = 185$
 $10 _ 8 _ 79 = 1$

Geometry

1.

The figure consists of 5 squares of equal area. The area of the whole figure is 245 cm^2 .



A. Find the area of one square.

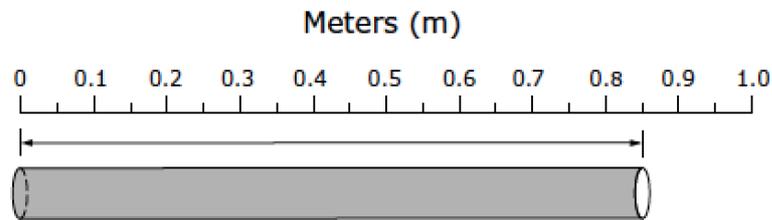
Answer: _____ cm^2





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2.



What is the length of the pipe being measured?

- (A) 0.085 m
- (B) 0.805 m
- (C) 0.85 m
- (D) 8.5 m

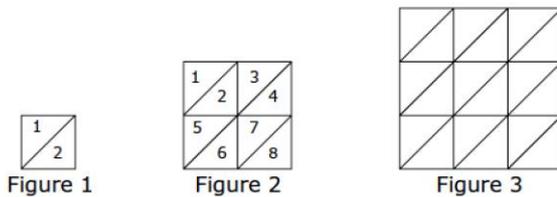
Algebra

1. If $a=3$ what is the value of $2a+1$?
2. If $x= -4$, what is the value of $24/x$?
 - A. 6
 - B. $1/6$
 - C. $-1/6$
 - D. -6
 - E. 20
3. If $2 \cdot n$ represents a generic even number, how would you write a generic multiple of 7?



4.

The three figures below are divided into small congruent triangles.



A. Complete the table below. First, fill in how many small triangles make up Figure 3. Then, find the number of small triangles that would be needed for the 4th figure if the sequence of figures is extended.

Figure	Number of Small Triangles
1	2
2	8
3	
4	

B. The sequence of figures is extended to the 7th figure. How many small triangles would be needed for Figure 7?

Distinguishing between solution strategies developed through generalization or through counting. In the first case, algebra language is exploited to develop reasoning generalized, instead, in second case, the reasoning is still in arithmetical form (algebra is not an instrument of solution)

2.4 Visuo-spatial

	Arithmetic	Geometry	Algebra
Memory			
Reasoning			
Visuo-spatial			

According to Karagannakis's model, mathematical skills associated with visuo-spatial domain concern:

Interpreting and using spatial organization of representations of mathematical objects (for example, numbers in decimal positional notation, exponents, geometrical 2D and 3D figures or rotations); placing numbers on a number line; confusing Arabic numerals and mathematics symbols; performing written calculation when position is important (e.g. borrowing/carrying); interpreting graphs and tables

We implement these skills in Arithmetic, Geometry and Algebra.



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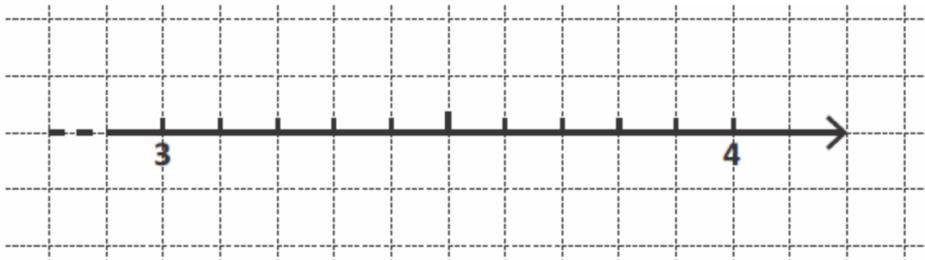
Arithmetic

1. Which digit would you insert in place of the stain, to make the operation correct?

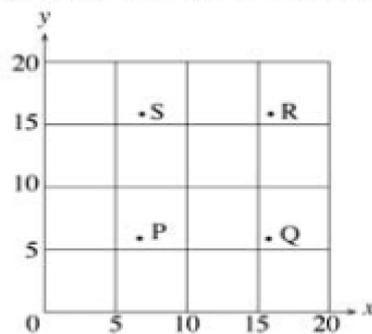
$$\begin{array}{r} 25 + \\ \blacksquare 7 = \\ \hline 62 \end{array}$$

2. Place the following numbers in the correct position on the number line

$$\pi; \quad \sqrt{16}; \quad 3,60; \quad \frac{335}{100}$$



3. Which point on the graph could have coordinates (7,16)?



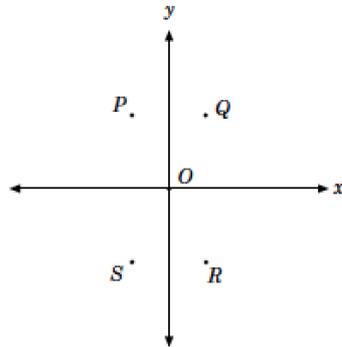
- A. Point P
- B. Point Q
- C. Point R
- D. Point S





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4.

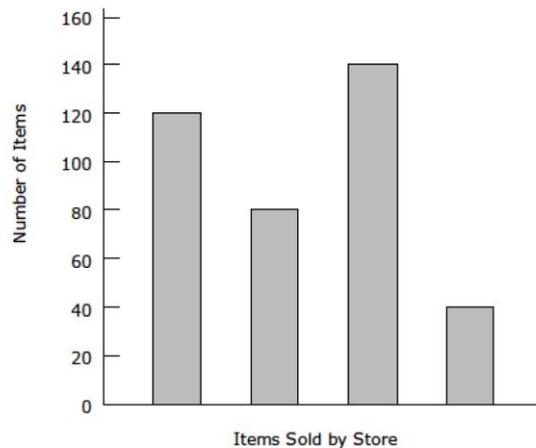


In the coordinate plane above, which point could have coordinates $(2, -4)$?

- (A) P
- (B) Q
- (C) R
- (D) S

5.

The graph shows the number of pens, pencils, rulers, and erasers sold by a store in one week.



The names of the items are missing from the graph. Pens were the item most often sold, and fewer erasers than any other item were sold. More pencils than rulers were sold. How many pencils were sold?

- (A) 40
- (B) 80
- (C) 120
- (D) 140



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6. Calculate the following expression containing fractions:

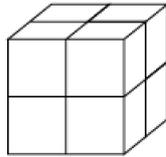
$$\left(\frac{5}{6} \times \frac{3}{4}\right) - \frac{3}{16} =$$

Geometry

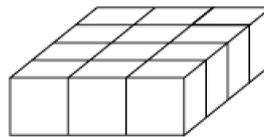
1.

All the small blocks are the same size. Which stack of blocks has a different volume from the others?

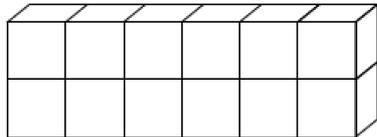
(A)



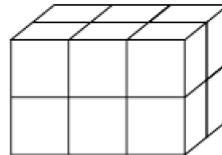
(B)



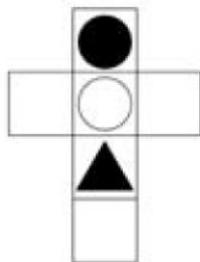
(C)



(D)



2.



Which of these cubes could be made by folding the figure above?

A.



B.



C.



D.





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Algebra

1. Complete:

$$(a^2)^3 = \dots$$

$$a^{2+3} = \dots$$

2. Choose the correct expression:

$$\square \sqrt[2]{a^3} = a^{\frac{2}{3}}$$

$$\square \sqrt[2]{a^3} = a^{\frac{3}{2}}$$

3. If $a=10$, then $a^2+3 = \dots$

4. If $x=2$, complete the following expressions:

$$x^2 = \dots$$

$$2x = \dots$$

$$x^2 = \dots$$





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3. ATTACHMENTS

If the results of some items related to the different cognitive areas are not significant to define a student's profile, it could be useful to proceed with an individual interview.

Here some examples of possible items in the case of memory related to calculation.

APPROXIMATE CALCULATION

In this test you will have little time, just two minutes. So you certainly can't do the calculations. Choose and block what in your opinion is the correct result without performing the operation.

I)	$29'550 : 3 =$	a) 56	b) 9'850	c) 437
II)	$324 \times 18 =$	a) 5'832	b) 522	c) 11'583
III)	$5'014 - 3'728 =$	a) 712	b) 1'286	c) 11'006
IV)	$574'326 + 454'652 =$	a) 62'978	b) 891'627	c) 1'028'978
V)	$2'596 - 1'510 =$	a) 1'086	b) 1'236	c) 855
VI)	$60'102 : 318 =$	a) 189	b) 80	c) 976
VII)	$54,29 \times 0,7 =$	a) 53	b) 38,003	c) 9,803
VIII)	$654,86 + 77,09 =$	a) 689,5	b) 1'001,05	c) 731,95
IX)	$34'500 \times 5 =$	a) 4'935	b) 172'500	c) 56'000
X)	$10'280 - 7'509 =$	a) 2'771	b) 911	c) 7'231
XI)	$1'751 : 17 =$	a) 103	b) 1'223	c) 51
XII)	$763'312 + 642'234 =$	a) 1'405'546	b) 565'647	c) 29'565'544
XIII)	$293'457,001 - 983 =$	a) 10'675	b) 292'474,001	c) 372
XIV)	$3'548 + 1'098 =$	a) 564	b) 10'666	c) 4'646
XV)	$390 : 12 =$	a) 12	b) 1'143	c) 32,5
XVI)	$6'987 \times 22 =$	a) 153'714	b) 828	c) 9'905





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ARITHMETICAL FACTS, PROCEDURES AND PRINCIPLES

- You are presented with a series of operations already carried out in the first column (carried out), these will help you solve the operations of the second column (To be calculated). Quickly find ways to do as many operations as possible in the time you are given (2 minutes).

Carried out			To be calculated		
a)	$24 + 37 =$	61	a)	$37 + 24 =$	
b)	$48 + 23 =$	71	b)	$47 + 23 =$	
c)	$34 \times 6 =$	204	c)	$204 : 6 =$	
d)	$45 + 38 =$	83	d)	$83 - 38 =$	
e)	$60 + 29 =$	89	e)	$29 + 61 =$	
f)	$37 + 18 =$	55	f)	$370 + 180 =$	
g)	$56 \times 17 =$	952	g)	$17 \times 56 =$	
h)	$45 \times 8 =$	360	h)	$80 \times 450 =$	
i)	$37 \times 6 =$	222	i)	$36 \times 6 =$	
j)	$7 + 7 + 7 =$	21	j)	$7 \times 3 =$	
k)	$51 + 39 =$	90	k)	$50 + 39 =$	
l)	$68 + 43 =$	111	l)	$111 - 43 =$	
m)	$71 \times 9 =$	639	m)	$639 : 9 =$	
n)	$38 + 23 =$	61	n)	$61 - 38 =$	
o)	$27 \times 5 =$	135	o)	$5 \times 270 =$	
p)	$29 + 14 =$	43	p)	$290 + 140 =$	

Anxiety is certainly a determining factor for the success of the tests and also for the effectiveness in math performances. For this, we suggest to take into account a questionnaire about. Here some examples of possible items taken from AMAS (Abbreviated Math Anxiety Scale) questionnaire.

The AMAS questionnaire (Hopko, Mahadevan, Bare and Hunt, 2003) is a standardized questionnaire that allows us to compare the scores obtained by each child with the normative data. Like any standardized questionnaire, it does not fit perfectly in all situation, but it provides a comparable measures on a sample of the same age and schooling and thus highlighting boys with a significantly higher level of anxiety of peers.





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READ CAREFULLY THE FOLLOWING SENTENCES AND THINK BACK TO YOUR EXPERIENCE WITH MATHEMATICS.

FOR EACH OF THE DESCRIBED SITUATIONS, PLEASE TELL THE LEVEL OF ANXIETY YOU EXPERIENCED.

	LITTLE ANXIETY			BIG ANXIETY	
1. Use the tables in the mathematics textbook	1	2	3	4	5
2. Think about the mathematics homework that is due tomorrow / tomorrow's mathematics test	1	2	3	4	5
3. Look at the teacher who is solving an equation at the blackboard.	1	2	3	4	5
4. Do a mathematics test	1	2	3	4	5
5. Have to do many difficult mathematics problems for the next math class	1	2	3	4	5
6. Listen to the teacher's explanation during the math class	1	2	3	4	5
7. Listen to another student explaining a mathematical formula	1	2	3	4	5
8. Have to do an unexpected test during the math class	1	2	3	4	5
9. Start a new topic in the mathematics textbook	1	2	3	4	5

