



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

## QUESTIONNAIRE B1, GUIDELINES FOR TEACHERS: EXAMPLE OF ITEMS

*A first questionnaire to be proposed to all students in order to make an initial analysis that allows to divide students into specific categories. For example: without obvious difficulties, with difficulties in reading, with medium difficulties, with serious difficulties.*

*The questionnaire will be composed of exercises and questions of variable difficulty, including exercises in which linguistic analysis is decisive in the successful understanding of the text and therefore for the answering to the question.*

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

### 1. INTRODUCTION

In line with the aim of the Questionnaire B1 and with a view to proposing effective items able to categorize students with respect their **difficulties in math**, we consider the following two axes of analysis: mathematical contents and cognitive areas.

#### 1) Mathematical contents:

- Number
- Geometry
- Algebra

#### 2) Cognitive area:

- Knowing (concepts)
- Application Knowing (using concepts)
- Reasoning /Solving Problems

For each math content we propose 6 items: 2 items for each Cognitive area (see table 1). The items proposed as example for questionnaire B1 are taken from “TIMSS 2003 Released Items: Eighth Grade Mathematics” following some included Content domains (in particular, Number, Algebra, Geometry) and Cognitive domains (in particular, Knowing concepts, Using concepts and Reasoning), according to our axes of analysis.

Indeed, being TIMSS questionnaire part of an international assessment system, it allows us proposing the same tasks in the different countries included in Smild project.

Moreover, each item is validated with respect to its degree of complexity in the mathematical contents and also in the cognitive area (i.e. with respect to the main axes that B1 intends to evaluate). This allows us proposing items of increasing difficulty functional to the categorization of the students.

**Difficulty level** (DL of mathematical cognitive skills):

1 simple 2 middle difficulty 3 difficult



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	Number	Geometry	Algebra
Knowing	2 items: MO22199 MO32690	2 items MO22142(4) MO32403	2 items MO22194 M120042
Application Knowing	2 items MO32570 MO22198	2 items MO12026 MO12039	2 items MO22251 MO32044
Reasoning /Solving Problems	2 items MO22191 MO32079	2 items: MO22202 MO22154	2 items MO32557 MO22261

Table 1: Distribution of items in relation to Math contents and cognitive area

## 2. EXAMPLE OF ITEMS IN AREAS OF INTEREST

### 2.1 NUMBER

<b>NUMBER</b> Knowing	2 items: Q1: MO22199 Q2: MO32690
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#### Q1: MO22199

$$\frac{3}{5} + \left( \frac{3}{10} \times \frac{4}{15} \right) =$$

(A)  $\frac{3}{51}$

(B)  $\frac{1}{6}$

(C)  $\frac{6}{25}$

(D)  $\frac{11}{25}$

(E)  $\frac{17}{25}$

MO22199



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DL : 1

Calculate expression of fractions:

- Knowing of rules devoted to the managing of fractions and operations between fractions – Memory (retrieval and processing);
- Managing of visual – spatial perception linked to fraction as single number compose of two integer numbers (Core number- representation of symbols)

## Q2: MO32690

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Which of these is equal to  $370 \times 998 + 370 \times 2$ ?

- (A)  $370 \times 1,000$
- (B)  $372 \times 998$
- (C)  $740 \times 998$
- (D)  $370 \times 998 \times 2$

DL: 2

- Knowing of distributive property;
- Recognizing the application of that property;
- Connected with working memory;
- Visual-spatial perception.

<b>NUMBER</b>	2 items
Application	MO32570
Knowing	MO22198

## Q3: MO32570

At a play,  $\frac{3}{25}$  of the people in the audience were children.

What percent of the audience was this?

- (A) 12%
- (B) 3%
- (C) 0.3%
- (D) 0.12%





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DL: 2

- Connected with mathematical reasoning, it links percentage definition with fraction definition;
- Semantic memory (“ $3/25$  of ...”).

### Q3: MO22198

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In which list are the numbers ordered from greatest to least?

- (A) 0.233, 0.3, 0.32, 0.332
- (B) 0.3, 0.32, 0.332, 0.233
- (C) 0.32, 0.233, 0.332, 0.3
- (D) 0.332, 0.32, 0.3, 0.233

DL: 1

- Core number (representation of symbols);
- Application Knowing: Ordering associated with rational numbers;
- Working memory.

<b>NUMBER</b>	2 items
Reasoning /Solving Problems	MO22191 MO32079

### Q5: MO22191

Two-thirds of the people present at the beginning of a meeting are men. Nobody leaves but 10 more men and 10 more women arrive at the meeting. Which of the following statements is true?

- (A) There would then be more men than women at the meeting.
- (B) There would then be the same number of men as there are women at the meeting.
- (C) There would then be more women than men at the meeting.
- (D) From the information given, you cannot tell whether there would be more women or men.

DL:3

- Reasoning: Updating relevant information, shifting from one operation-strategy to another;
- Knowing meaning of fraction;





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### Q6: MO32079

John and Cathy were told to divide a number by 100. By mistake John multiplied the number by 100 and obtained an answer of 450. Cathy correctly divided the number by 100. What was her answer?

- (A) 0.0045
- (B) 0.045
- (C) 0.45
- (D) 4.5

DL: 3

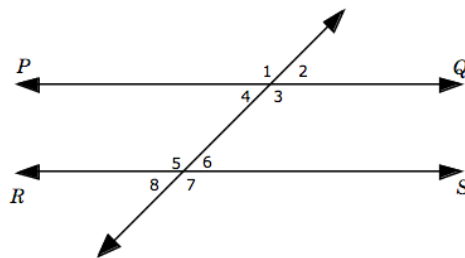
- Core number: representation of symbols;
- Memory retrieval;
- Mathematical reasoning: comparing results;
- Visual-spatial: Interpret and use spatial organization of representations of mathematical objects.

## 2.2 GEOMETRY

<b>GEOMETRY</b> Knowing	2 items MO22142(4) MO32403
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### Q7: MO22142(4)

In this figure,  $PQ$  and  $RS$  are parallel.



Of the following, which pair of angles has the sum of  $180^\circ$ ?

- (A)  $\angle 5$  and  $\angle 7$
- (B)  $\angle 3$  and  $\angle 6$
- (C)  $\angle 1$  and  $\angle 5$
- (D)  $\angle 1$  and  $\angle 7$
- (E)  $\angle 2$  and  $\angle 8$



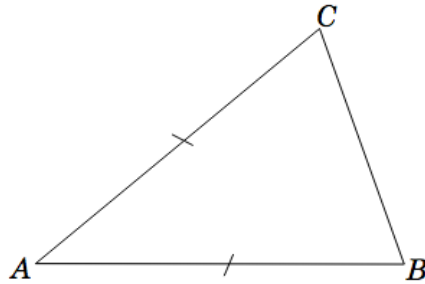


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DL: 2

- Reasoning: Grasping mathematical concepts and relation (angles in parallel lines);
- Visuo-spatial reasoning: Interpret and use spatial organization of representations of mathematical objects.

**Q8: MO32403**



The triangle  $ABC$  has  $AB = AC$ .

Draw a line to divide triangle  $ABC$  into two congruent triangles.

DL: 1

- Knowing: geometrical relations among part of a geometrical figure;
- Visual-Spatial: Visualizing and analysing geometric figures (or subparts of them);
- Reasoning: inhibition of irrelevant information (due to prototypic position of triangle), Updating relevant information (equal sides).



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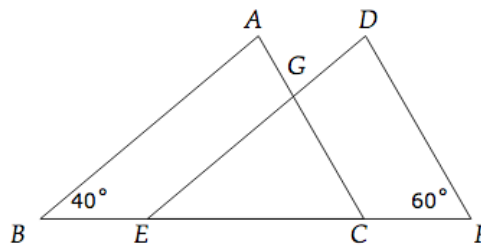


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<b>GEOMETRY</b>	2 items
Application	MO12026
Knowing	MO12039

### Q9: MO12026

In this figure, triangles  $ABC$  and  $DEF$  are congruent with  $BC = EF$ .



What is the measure of angle  $EGC$  ?

- (A)  $20^\circ$
- (B)  $40^\circ$
- (C)  $60^\circ$
- (D)  $80^\circ$
- (E)  $100^\circ$

DL:3

- Visuo-spatial reasoning/perception: Interpreting and using spatial organization of representations of geometrical objects;
- Visualizing and analyzing geometric figures (and subparts of them), in particular visualizing rigid motions (translation) in order to grasp geometrical relation;
- Memory: recovered theorem.

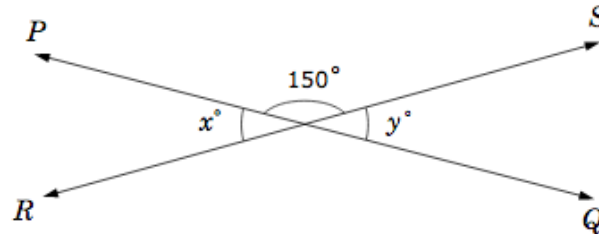




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### Q10: MO12039

In the figure,  $PQ$  and  $RS$  are intersecting straight lines.



What is the value of  $x + y$  ?

- (A) 15
- (B) 30
- (C) 60
- (D) 180
- (E) 300

DL 1

- Visuo-spatial perception and reasoning: Interpreting and using spatial organization of representations of geometrical objects;
- Visualizing and analyzing geometric figures in order to grasp geometrical relation;
- Memory: recovered theorem.



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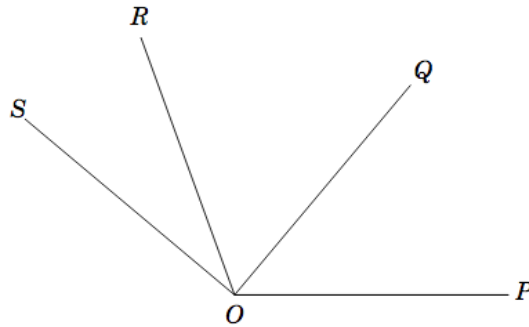


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<b>GEOMETRY</b>	2 items:
Reasoning /Solving Problems	MO22202
	MO22154

### Q11: MO22202

In the figure, the measure of  $\angle POR$  is  $110^\circ$ , the measure of  $\angle QOS$  is  $90^\circ$ , and the measure of  $\angle POS$  is  $140^\circ$ .



What is the measure of  $\angle QOR$ ?

Answer: \_\_\_\_\_

DL: 3

- Visualizing and analyzing geometric figures (and subparts of them)
- Visuo-spatial reasoning/perception: Interpreting and using spatial organization of representations of geometrical objects;
- Reasoning: grasping basic logical principles (if...then)

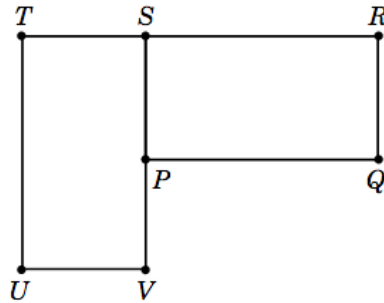




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### Q12: MO22154

Rectangle  $PQRS$  can be rotated (turned) onto rectangle  $UVST$ .



What point is the center of rotation?

- (A)  $P$
- (B)  $R$
- (C)  $S$
- (D)  $T$
- (E)  $V$

DL: 2

- Visuo-spatial reasoning: Interpreting and using spatial organization of representations of geometrical objects;
- Visualizing and analyzing geometric figures in particular visualizing rotation in order to grasp geometrical relation





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### 2.3 ALGEBRA

<b>ALGEBRA</b> Knowing	2 items MO22196 M012042
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#### Q13: MO22196

If  $L = 4$  when  $K = 6$  and  $M = 24$ , which of the following is true?

(A)  $L = \frac{M}{K}$

(B)  $L = \frac{K}{M}$

(C)  $L = KM$

(D)  $L = K + M$

(E)  $L = M - K$

DL: 1

- Knowing in core number: Representation of symbols;
- Memory: Semantic memory;
- Written calculation, especially where position is important (as in algebraic formula).





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**Q14: M012042**

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

- (A)  $-9$
- (B)  $-6$
- (C)  $-1$
- (D)  $1$
- (E)  $9$

DL: 1

- Knowing meaning of variable;
- Knowing rules of multiplication between integer numbers;
- Memory: working memory (performing mental calculation); remember rules.

<b>ALGEBRA</b>	2 items
Application	MO22251
Knowing	MO32044

**Q15: MO22251**

Graham has twice as many books as Bob. Chan has six more books than Bob. If Bob has  $x$  books, which of the following represents the total number of books the three boys have?

- (A)  $3x + 6$
- (B)  $3x + 8$
- (C)  $4x + 6$
- (D)  $5x + 6$
- (E)  $8x + 2$





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DL: 2

- Memory: (Arithmetic) problem solving (keeping track of steps);
- Application: Transcoding verbal orally presented task in algebraic expression.

**Q16: MO32044**

Carla paid  $x$  zeds for 3 cartons of juice. What is the price in zeds of 1 carton of juice?

- (A)  $\frac{x}{3}$
- (B)  $\frac{3}{x}$
- (C)  $3 + x$
- (D)  $3x$

DL: 2

Application: Transcoding verbal orally presented task in algebraic expression  
Grasping mathematical relations (one third of...)

<b>ALGEBRA</b>	2 items
Reasoning /Solving Problems	MO32557 MO22261

**Q17: MO32557**

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

Answer: \_\_\_\_\_

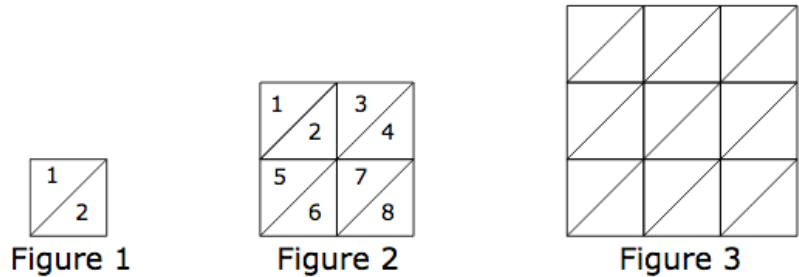
DL: 2

- Memory: processing literal expression by multiplication;
- Visuo-spatial: Interpret the spatial organization of representations of algebraic objects;
- Reasoning: exploiting the arithmetical rule of associative property of multiplication.



**Q18: MO22261**

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?

Answer: \_\_\_\_\_

C. The sequence of figures is extended to the 50th figure. Explain a way to find the number of small triangles in the 50th figure that does not involve drawing it and counting the number of triangles.

DL: 3

Reasoning: Updating relevant information, shifting from one strategy to another  
Generalizing numerical reasoning.