

## Sample Questions for the Core Test

### Subtest "Solving Quantitative Problems"

The subtest "Solving Quantitative Problems" provides practical problems to be solved by using basic arithmetic operations. This test measures mathematical thought and the ability to solve basic mathematical problems. The level of the arithmetic operations to be performed is elementary.

#### Instructions

Working time: **45 minutes**

Here you will find some problems which you have to solve.

**Example:**

A student works in a factory during the holidays. He is paid a wage of 10 Euro an hour. He works 8 hours a day and 5 days a week. How much has he earned after four weeks of work?

- (A) 800 Euro
- (B) 1 200 Euro
- (C) 1 600 Euro
- (D) 2 000 Euro

**Answer:**

(C) 1 600 Euro.

**How to reach the solution:**

The student earns 10 Euro an hour  $\times$  8 hours a day = 80 Euro a day  $\times$  5 days a week = 400 Euro per week  $\times$  4 weeks = 1,600 Euro.

Please mark the correct solution (A, B, C or D) on your answer sheet.

#### Example 1

2,600 bottles contain 650 litres of a soft drink. How many litres do 5,000 bottles hold?

- (A) 338 litres
- (B) 1 000 litres
- (C) 1 250 litres
- (D) 1 300 litres

Degree of difficulty: low

**Example 2**

Corinna has a photo which is 9 cm wide and 6 cm high. She would like to have it enlarged to a width of 15 cm. The ratio of width to height is to remain the same. How high will the photo be?

- (A) 11 cm
- (B) 10 cm
- (C) 9 cm
- (D) 8 cm

Degree of difficulty: medium

**Example 3**

Together, two sports clubs (A and B) have  $x$  members; A has  $a$  members and B has  $b$  members. Some of the persons are members of both sports clubs. Which of the following expressions describes how many persons are members in only one of the two sports clubs?

- (A)  $x + a - b$
- (B)  $2(a + b) - 2x$
- (C)  $ab - 2x$
- (D)  $2x - (a + b)$

Degree of difficulty: high

<b>Solutions</b>
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**Subtest “Solving Quantitative Problems”****Example 1**

2,600 bottles contain 650 litres of a soft drink. One bottle therefore contains  $650 / 2,600 = 0.25$  litres of soft drink. 5,000 bottles contain 5,000 times as much soft drink as one bottle, i.e. 5,000 bottles  $\times$  0.25 litres per bottle = 1,250 litres of soft drink.

(C) is therefore the correct solution.

**Example 2**

Ratio width : height is to remain the same. In the case of the original photo, it is 9 cm : 6 cm, or 3 : 2. Now the width is to be increased from 9 to 15 cm. The width : height ratio is to remain at 3 : 2. The new height is calculated as follows:  $15 : 3 = 5$ .  $5 \times 2 = 10$ . The new photo will be 10 cm high. The solution is therefore (B).

**Example 3**

The number of persons who are members in only one sports club can be calculated by subtracting the number of persons who are in both clubs from the total number of persons ( $x$ ).

Let  $n$  be the number of persons who are in both sports clubs. Let  $m$  be the number of persons who are only in one sports club.  $x$  is the total number of persons.

The number of persons who are only members in one sports club is:  $m = x - n$  (the total number of persons minus the number of persons who are members in both sports clubs). In order to calculate  $m$ , we therefore have to know how large  $n$  is.

How large is the number of persons who are members in both sports clubs, i.e.  $n$ ? If none of the persons were members in both sports clubs, then  $n = 0$  and  $x = a + b$ . Since  $n$  persons are in both clubs, it holds that  $x + n = a + b$ ; if we solve for  $n$ , then  $n = a + b - x$ .

How large is the number of persons who are members in only one sports club, i.e.  $m$ ?  $m = x - n$  (see above).  $n$  is replaced with  $a + b - x$ . Therefore  $m = x - (a + b - x)$ ; transformed:  $m = x - (a + b) + x$ ;  $m = 2x - (a + b)$ .

(D) is therefore the correct solution.

## Subtest "Inferring Relationships"

In the subtest "Inferring Relationships," each question consists of two pairs of words. Two of the four words are missing, and you are to identify the matching words so that both pairs of words have an analogous relationship. This requires that you find the rule governing the analogy and select the words accordingly.

This test measures logical linguistic thought. Test takers have to identify meaning, and generalise and abstract in order to find the rule. Eventually the rule has to be concretised in order to fill the gaps.

### Instructions

Working time: **10 minutes**

"Dark : light = hot : cold" – "dark" is the opposite of "light" and "hot" is the opposite of "cold". Between the first and the second word, therefore, there is an analogous relationship, as there is between the third and the fourth word.

Each of the following problems contains two gaps. Your task is to work out which words fill the two gaps in such a way that an analogous relationship results on the left- and the right-hand side of the "=" .

Example:

house : \_\_\_\_\_ = tree : \_\_\_\_\_

- (A) window – apple tree
- (B) villa – tree trunk
- (C) roof – branch
- (D) front door – furniture

Only if you choose "(C) roof – branch" is there an analogous relationship on the left- and on the right-hand side. A roof is part of a house. A branch is part of a tree.

The first word always goes in the first space and the second word always in the second space.

Please note:

All verbs are expressed as "to" plus the infinitive, e.g. "to drink". If a word which can be either a noun or a verb appears without "to", the noun form is intended. For example, "drink" is intended in the sense of "beverage".

### Example 1

pear : fruit = \_\_\_\_\_ : \_\_\_\_\_

- (A) motor – motorcycle
- (B) hammer – tool
- (C) grass – cow
- (D) animals – elephant

Degree of difficulty: low

### Example 2

warmth : \_\_\_\_\_ = wind : \_\_\_\_\_

- (A) temperature – tornado
- (B) cold – wind velocity
- (C) flame – rain
- (D) heat – storm

Degree of difficulty: medium

### Beispiel 3

diversity : \_\_\_\_\_ = \_\_\_\_\_ : action

- (A) uniformity – success
- (B) distance – passiveness
- (C) variety – deed
- (D) uniformity – measure

Degree of difficulty: high

## Solutions

### Subtest “Inferring Relationships“

#### Example 1

**Here the solution is B.** The relationship between "hammer" and "tool" is analogous to (the same as, similar to) the relationship between "pear" and "fruit." A hammer is a tool and a pear is a fruit. Here "tool" and "fruit" are broader terms; "hammer" and "pear" are narrower terms.

In (A) and (C), there are other relationships between the words ("... is a part of a ..." and "... is food for a ...").

In (D): The terms "animal" and "elephant" are also a broader term and a narrower term. In the case of the given pair of words, however (pear – fruit), the broader term comes second. In (D), the broader term comes first. The relationship between the two words in the answer (D) is therefore not analogous to the relationship between the given words.

#### Example 2

**Here the correct answer is (D).** Analogous relationships are created on both sides of the "=" only if you choose (D): Heat is an intensification of warmth and storm is an intensification of wind.

(A), (B) and (C) do not result in analogous relationships on the two sides of the "=".

#### Example 3

**Here the correct answer is (C).** We arrive at pairs of words with an analogous relationship to one another only if we fill the blanks with "variety" and "deed." In each case, the pairs of words are synonyms, that is, they have the same meaning. "Variety" means the same as "diversity" and "deed" means the same as "action."

(A), (B) and (D) do not result in analogous relationships between the two pairs of words.

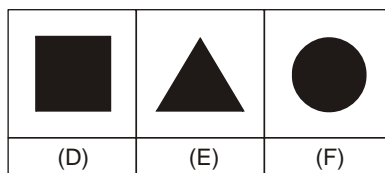
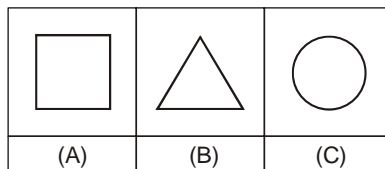
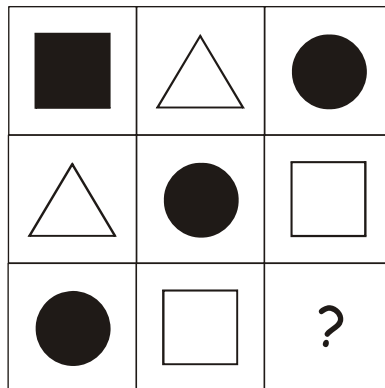
## Subtest "Completing Patterns"

In the subtest "Completing Patterns," lines, circles, quadrilateral and other geometrical shapes are arranged in the fields of a matrix according to a specific rule. You are to find the rule and apply it by identifying the missing shape in the last field.

This test measures logical graphic thought. Language skills or educational background are irrelevant.

**Instructions** Working time: **20 minutes**

Each of the following items consists of nine fields. Eight of the fields contain figures. In the ninth field (at the bottom right) is a question mark.



The arrangement of the figures has been carried out according to certain rules. Your task is to recognize these rules and apply them in order to find the ninth figure.

The rules apply









- from left to right,
- OR from top to bottom,
- OR from left to right **AND** from top to bottom.




**There are no other directions (e.g. diagonal) in which the rules can apply!**




In order to solve an item, you need one, two or three rules. It is also possible that one rule applies horizontally and another rule vertically.

Below the nine fields, you will find six figures (A, B, C, D, E and F). Select the figure which should take the place of the question mark.

**Example 1**






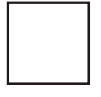

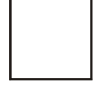
		
		
		?



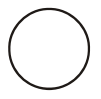
		
(A)	(B)	(C)




		
(D)	(E)	(F)

Degree of difficulty: low

**Example 2**

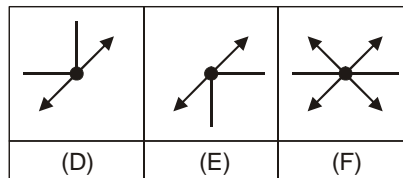
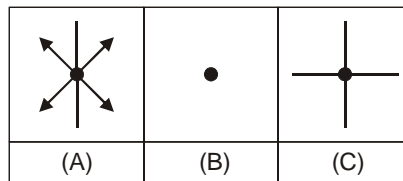
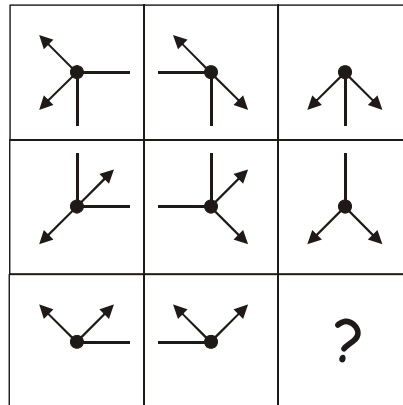
		
		
		?

		
(A)	(B)	(C)

		
(D)	(E)	(F)

Degree of difficulty : medium

### Example 3



Degree of difficulty: high

## Solutions

### Subtest “Completing Patterns”

#### Example 1

The rule here applies vertically. In every row, the arrow is turned clockwise by 45° from the first field to the second. The same is true from the second field to the third. The question mark must therefore be replaced with an arrow pointing straight downward.

(A) is therefore the correct solution.

#### Example 2

Here the rule applies vertically and horizontally. Every row and every column must contain a square, a triangle and a circle. The colours alternate between black and white.

1. The forms: In the bottom row there are a circle and a square. A triangle must therefore take the place of the question mark.

2. The colours: The circle is black; the square is white. The colour of the triangle must accordingly be black.

The correct solution is therefore (E).

#### Example 3

Here there are two rules and they apply both horizontally and vertically.

1. The arrows: In every row, only arrows are shown in Field 3 which are not in the same position in Field 1 and Field 2. Please look at Row 1. The arrow pointing towards the upper left appears in Field 1 and Field 2. It therefore does not appear in Field 3. The arrow pointing towards the bottom left appears only in Field 1, the one pointing towards the bottom right appears only in Field 2. Field 3 therefore shows an arrow pointing towards the bottom left

and an arrow pointing towards the bottom right.

2. The lines: In every row, only the lines which are in the same position in Fields 1 and 2 appear in Field 3. Please look at Row 1. In Field 1, there is a line pointing towards the right. In Field 2 there is a line pointing towards the left. In both fields there is a line pointing downward. Therefore, only the downward-pointing line appears in Field 3.

3. In Row 3, both arrows in Fields 1 and 2 are pointing in the same direction. For that reason, they both disappear in Field 3. The figure in Field 3 therefore has no arrows. The lines in Fields 1 and 2 are not in the same position. Therefore both lines must also disappear. The figure in Field 9 accordingly also has no lines.

The solution is therefore (B)

## Subtest "Continuing Numerical Series"

The subtest "**Continuing Numerical Series**" provides a series of numbers structured according to a specific rule. You are to find the rule and apply it in order to identify the missing number.

This test measures logical numerical thought. Knowledge of the four basic arithmetic operations addition, subtraction, multiplication and division is sufficient to answer the questions.

### Instructions

Working time: **25 minutes**

The four basic arithmetical operations are represented like this on the website: Addition (+), subtraction (-), multiplication (\*), division (/)

Each item consists of a numerical series, formed according to a particular rule. Your task is to find the next number in the series – its place is marked by the question mark (?).

Example 1:

5 15 13 23 21 31 29 ?

The numerical series is formed by the following arithmetical operation:  $+10 -2 +10 -2 +10 -2$ .

$5+10=15$   $15-2=13$   $13+10=23$  and so on.

The number that should be in the place of the question mark (?) is therefore **39** ( $29 + 10$ ).

Example 2:

35 30 120 60 55 220 110 ?

The rule for this numerical series is as follows:  $-5 \cdot 4 \div 2 -5 \cdot 4 \div 2$ . The number that should be in the place of the question mark (?) is therefore **105** ( $110 - 5$ ).

Each rule can contain only the four basic arithmetical operations [addition (+), subtraction (-), multiplication ( $\cdot$ ) and division ( $\div$ )].

Proceed step by step:

1. First take a look at the numerical series.
2. Work out the rule on which the numerical series is based.
3. Then apply the rule in order to find the next number in the series. Carry out the necessary arithmetical operation and calculate the number that should be entered in the place of the question mark (?).
4. **Mark the digits that make up this number on your answer sheet.**

The solution number is always a **whole number**. The solution number can be positive, negative or zero. **Any digit only ever occurs once in a solution number; in other words, solutions numbers such as 11, 44 or 100 cannot occur.**

**On the answer sheet**, mark the digits that appear in the solution number. If the number is negative, please mark the "-" on the answer sheet as well as the digits. The **order** of the digits **does not matter**.

**Example:** For the number "14", mark the "1" and the "4".

	-	0	1	2	3	4	5	6	7	8	9
<b>01</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

For the number "41", also mark the "1" and the "4".

	-	0	1	2	3	4	5	6	7	8	9
<b>02</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

For the number "-14", mark the "-", the "1" and the "4".

	-	0	1	2	3	4	5	6	7	8	9
<b>03</b>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

### Example 1

25	35	15	45	5	55	?
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Degree of difficulty: low

### Example 2

60	66	96	100	120	122	?
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Degree of difficulty : medium

### Example 3

2048	32	1	16	128	32	?
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Degree of difficulty: high

# Solutions

## Subtest “Continuing Numerical Series“

### Example 1

You begin by looking at the entire series of numbers. What you notice is:

- that the last digit of every number is 5,
- that the numbers become greater and smaller alternately and
- that the differences between the numbers become greater and greater.

Your next step is to take a closer look at pairs of neighbouring numbers. Develop a hypothesis as to a possible arithmetical operation with which the one number could be derived from the other. In the process, you can begin at any random place within the numerical series; frequently (but not always!) it is easiest to begin with the first two numbers.

What arithmetical operation can be used to derive 35 from 25? Begin with a simple calculation, here, for example +10 (/5 x7 would also be possible – but more complicated. Check this hypothesis only if you have determined that the simpler hypothesis doesn't work.)

Now check the next two numbers. What arithmetical operation can be used to derive 15 from 35? A simple possibility is -20.

Checking the third pair of numbers: What arithmetical operation can be used to derive 45 from 15? A simple possibility is +30.

In many cases you can develop an assumption about the rule governing the numerical series after checking three pairs of numbers.

In the case of this problem, you now have hypotheses about the first three arithmetical operations: +10, -20, +30

A possible assumption about the rule would be: Addition and subtraction are carried out alternately, using a number that increases by 10 each time.

The following arithmetical operations, therefore, would be -40, +50, -60, +70, etc.

Now test your assumption:  $45 - 40 = 5$ ;  $5 + 50 = 55$

The numerical series is therefore based on the rule you assumed. Now you must apply that rule once more, to the last number:  $55 - 60 = -5$

You have thus solved the problem. The solution is - 5.

On your answer sheet, you accordingly have to mark the "-" and the 5.

### Example 2

The first things we notice about this number series are

- that each number is greater than the one preceding it
- that the intervals between the numbers vary
- and that none of the numbers is a multiple of the one preceding it.

On the basis of this initial assessment, we can already arrive at a few assumptions about the rule: A different number is added in each case.

The next step is to determine which number is added in each case.

We get from 60 to 66 by adding 6.

We get from 66 to 96 by adding 30.

We get from 96 to 100 by adding 4.

We get from 100 to 120 by adding 20.

We get from 120 to 122 by adding 2.

Now a rule can be discerned: The first, third and fifth of the numbers added (6, 4 and 2) and the second and fourth of the numbers added (30 and 20) can be more easily associated with one another than any of these added numbers with the one immediately preceding or succeeding it. In the first group, each number is obtained by subtracting 2 from the preceding number; in the second group, 10 is subtracted.

Moreover, some of us may have noticed that each of the larger added numbers is the result of the number preceding it multiplied by 5:  $6 \times 5 = 30$  and  $4 \times 5 = 20$ .

Thus we have two means of arriving at the last number to be added:

$$20 - 10 = 10$$

$$2 \times 5 = 10$$

We must now apply this rule to the last number shown in the series, i.e. we must add 10 to that number:

$$122 + 10 = 132.$$

The solution is therefore 132.

On the answer sheet, we must therefore mark the 1, the 2 and the 3.

### Example 3

At first sight, all you notice about this numerical series is:

- that they get smaller, then larger, then smaller again.

In this case, it is probably easier not to begin with the first two numbers in the series, but with the 1, the third number in the series.

What arithmetical operation can be used to derive 1 from 32? Two simple possibilities are:  $-31$  and  $/32$ . It is best to make a note of both possibilities.

What arithmetical operation can be used to arrive at 16 from 1? Here, two simple possibilities are  $+15$  and  $\times 16$ .

Before you look at the third pair of numbers, you should decide which arithmetical operation is more likely to be part of the rule governing this series. How can  $31 / 32$  be related to  $15 / 16$ ? The simplest relationship is between 32 and 16 ( $32 / 2 = 16$ ). The probability that  $"/32"$  and  $"\times 16"$  are part of the rule is greater than the probability that  $"-31"$  and  $" +15"$  are part of it.

Check another pair of numbers against this assumption. Choose a pair of numbers with which you can recognize a probable arithmetical operation as quickly as possible. In this case, the pair could be 128 and 32. What arithmetical operation can be used to arrive at 32 from 128? A simple possibility is  $/4$  (which is more likely to be related to your hypotheses  $/32$  and  $\times 16$  than the possibility  $-96$ ).

Now it has undoubtedly become simpler to check the previous pair of numbers. What arithmetical operation can be used to derive 128 from 16? A simple possibility is  $\times 8$  (and looks more closely related to your hypotheses than  $+112$ ).

In the meantime, you have the following hypotheses:

\_\_\_\_,  $/32$ ,  $\times 16$ ,  $\times 8$ ,  $/4$ , \_\_\_\_

You see that each number is half of the previous number. The first arithmetical operation, which you don't know yet, could therefore contain a 64. Take a look at the first pair of numbers. You arrive at 32 from 2048 when you use the arithmetical operation "/64." If you still have plenty of time, check this calculation. If you are running out of working time, a rough estimation will suffice.

Now you see that, in the rule, two divisions are followed by two multiplications and then another division. A systematic rule would result if the last arithmetical operation were also a division. The number used in the final arithmetical operation should be half the previous, that is: 2.

Now apply the rule to the last number in the series:  $32 / 2 = 16$

The solution to this problem is **16**. On the answer sheet, you would have to mark the 1 and the 6.