

HAS University of Applied science

Mathematics - deficiency for HBM and IFA

Trial exam exercises 2022

- For a pass, you need 6 or more (out of 10) correct answers.
- The decimal notation is with a dot (.). Consequently, the comma (,) is used as the separator notation for thousands.
- The correct answers are on the final page.

Question 1

Which of the following expressions is equivalent to: $5 \cdot (4-x) - 2 \cdot (3-2x)$?

- 14-9x
- 14-3x
- 14-x
- 14+x

Question 2

The distance from A to B is 60 km.

Maria drives from A to B with a velocity of 18 km/h.

Jaime drives from B to A with a velocity of 15 km/h.

After how many minutes (rounded) will they meet each other?

- 20 minutes
- 100 minutes
- 105 minutes
- 109 minutes

Question 3

Which of the four equations is equivalent to: $3*(p-2q) + 5 = 8 - 5*(q-2p)$?

- a. $q = -3 - 7p$
- b. $q = -3 + 13p$
- c. $q = 3 - 7p$
- d. $p = 3 - 3q$

Question 4

Which of the following expressions is equivalent to: $2^{x+2} - (2^{x+1} - 2^x)$?

- a. 2^x
- b. 2^{x+1}
- c. $3*2^x$
- d. $(3*2)^x$

Question 5

Suppose you have two kinds of coins: coins worth 30 eurocents each, and coins worth 75 eurocents each. How many combinations of coins are possible if the total amount is 1,500 euro?

- a. 1,000
- b. 1,001
- c. 2,000
- d. 5,000

Question 6

Which of the four expressions is equivalent to: $\log(x^3) - 2 + \log(50/(x^2))$?

- a. $0.5 + \log x$
- b. $\log(0.5 \cdot x)$
- c. $\log(48 \cdot x)$
- d. $\log(48 \cdot x^5)$

Question 7

The value of a machine decreases at a rate of 10% per year. Three years after acquisition the value is 459,000 euro. What was the value (rounded) of the machine when it was bought?

- a. 596,700 euro
- b. 610,929 euro
- c. 628,767 euro
- d. 629,630 euro

Question 8

Solve for A: $10^{1-A} \geq 100 \cdot \sqrt{10}$

- a. $A \leq -3\frac{1}{2}$
- b. $A \geq -3\frac{1}{2}$
- c. $A \leq -1\frac{1}{2}$
- d. $A \geq -1\frac{1}{2}$

Question 9

The value of a share at the stock market increases at 20% in the first year. The total increase over the first and second year together, is 14%. How much was the value change in the second year?

- a. -5%
- b. -6%
- c. -8.8%
- d. +34%

Question 10

Which of the four equations is equivalent to: $6xy + 3x = y$?

- a. $x = (2y+1)/(3y)$
- b. $1/(3x) - 1/y = 2$
- c. $y = (3x)/(6x-1)$
- d. $3y = x/(1-6x)$

Please find the answers on the next page.

The correct answers are:

1	c	$14-x$
2	d	109 minutes
3	a	$q = -3-7p$
4	c	$3 \cdot 2^x$
5	b	1,001
6	b	$\log(0.5 \cdot x)$
7	d	629,630 euro
8	c	$A \leq -1\frac{1}{2}$
9	a	-5%
10	b	$\frac{1}{3x} - \frac{1}{y} = 2$

Explanations

Question 1

$$5 \cdot (4-x) - 2 \cdot (3-2x) = 20 - 5x - 6 + 4x = 14 - x.$$

Question 2

Let x be the number of hours needed until they meet. In x hours, they travel $18x + 15x$ km. They meet when $18x + 15x = 60$. So $33x = 60$, and $x = 60/33$ hours, which is $(60 \cdot 60)/33$ minutes, which equals (rounded) 109 minutes.

Question 3

$$\begin{aligned} 3 \cdot (p-2q) + 5 &= 8 - 5 \cdot (q-2p) \iff 3p - 6q + 5 = 8 - 5q + 10p \iff -7p - q = 3 \\ &\iff q = -3 - 7p. \end{aligned}$$

Question 4

$$2^{x+2} - (2^{x+1} - 2^x) = 2^x \cdot 2^2 - 2^x \cdot 2^1 + 2^x \cdot 1 = 2^x \cdot (4 - 2 + 1) = 3 \cdot 2^x.$$

Question 5

The number of coins worth 75 eurocents cannot be odd, but must be even. Its minimal value is 0, its maximal value is 2,000. Counting from 0 to 2,000 in steps of 2 results in 1,001 possibilities.

Question 6

$$\begin{aligned} \log(x^3) - 2 + \log(50/x^2) &= \log(x^3) + \log(50/x^2) + \log(1/100) \\ &= \log((x^3 \cdot (50/x^2) \cdot (1/100))) = \log((50x^3)/(100x^2)) = \log(x/2) = \log(0.5 \cdot x). \end{aligned}$$

Question 7

$$459,000: (0,9^3)$$

Question 8

$$\begin{aligned} 10^{1-A} \geq 100 \cdot \sqrt{10} &\Leftrightarrow 10^{1-A} \geq 10^2 \cdot 10^{0.5} \Leftrightarrow 10^{1-A} \geq 10^{2.5} \Leftrightarrow 1-A \geq 2.5 \\ 1-2.5 \geq A &\Leftrightarrow A \leq -1.5 \end{aligned}$$

Question 9

Let x be the multiplication factor corresponding to the second year.
Then $1.20 \cdot x = 1.14$, so $x = 1.14/1.20$, so $x = 0.95$, which corresponds to a value decrease of 5%.

Question 10

$$6 \cdot x \cdot y + 3x = y$$

This final question is a bit harder, as the approach is not straightforward. However, the usual approach is to separate x or y . As separating x does not lead to a direct solution, we separate y :

$$\begin{aligned} 6 \cdot x \cdot y - y &= -3x \Leftrightarrow (6x-1) \cdot y = -3x \Leftrightarrow y = (-3x)/(6x-1). \text{ Arriving here, we easily} \\ \text{see that solutions c and d are incorrect. As solution b contains } 1/y, &\text{ we invert:} \\ y = (-3x)/(6x-1) &\Leftrightarrow 1/y = (6x-1)/(-3x) \Leftrightarrow 1/y = -2 + 1/(3x) \\ \Leftrightarrow 1/(3x) - 1/y &= 2. \end{aligned}$$