1. Real Numbers with solutions

Task 1.01. (0-1) (2015 - task 07)

Let us assume that $\frac{15}{16}$ is approximately equal to 0.9. The approximation error expressed as a percentage will be equal to

A. 4% B. 0.04% C. 3% D. 0.03%

Solution 1.01. A

$$\frac{\left|\frac{15}{16}-0.9\right|}{\frac{15}{16}}\times 100\% = \left|\frac{15}{16}-\frac{9}{10}\right|\times\frac{16}{15}\times 100\% = \frac{6}{160}\times\frac{1600}{15}\% = 4\%$$

Task 1.02. (0-1) (2016 - task 01)

The following table shows the number of votes received by each candidate in a by-election.

Candidate	I	II
Number of votes	13970	17780

The number of votes received by the winner was higher than the number of votes received by the other candidate by:

A. 56 percentage points. **B.** 44 percentage points.

C. 27 percentage points. **D.** 12 percentage points.

Solution 1.02. D

Number of all votes: $17780 + 13970 = 31750$.

Winner percentage result: $\frac{17780}{31750}\times 100\% = 56\%$.

Other candidate percentage result: 44%.

A percentage point (pp) is the unit for the arithmetic difference of two percentages: $56\% - 44\% = 12$ pp.

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Task 1.03. (0-1) (2016 - task 02)

If $\log a = \frac{1}{2}$ and $\log b = \frac{2}{5}$, where $a > 0$ and $b > 0$, then the value of the expression $\log(a^2 b)$ equals

A. $\frac{7}{5}$ B. $\frac{4}{10}$ C. $\frac{13}{20}$ D. $\frac{1}{10}$

Solution 1.03. A

$\log(a^2 b) = \log(a^2) + \log(b) = 2\log(a) + \log(b) = 2 \times \frac{1}{2} + \frac{2}{5} = \frac{7}{5}$

Task 1.04. (0-1) (2016 - task 03)

The number $4(4^{18} + 4^{17})$ equals

A. 4^{35} B. 4^{36} **C.** 5×4^{17} D. 5×4^{18}

Solution 1.04. D

$4(4^{18} + 4^{17}) = 4 \times 4^{17}(4 + 1) = 4^{18} \times 5$

Task 1.05. (0-1) (2017 - task 01)

It may be assumed that 0.3 is an approximation of $\frac{5}{16}$. What is the percentage error of this approximation?

A. 2.5% B. 0.025% C. 4% D. 0.04%

Solution 1.05. C

$$\frac{\left|\frac{5}{16} - 0.3\right|}{\frac{5}{16}} \times 100\% = \left|\frac{5}{16} - \frac{3}{10}\right| \times \frac{16}{5} \times 100\% = \frac{2}{160} \times \frac{1600}{5}\% = 4\%$$

Task 1.06. (0-1) (2017 - task 02)

Among those listed below, the only positive number is:

A. $(-3)^0$ B. -3^0 **C.** $(-3)^{2017}$ **D.** -3^{2017}

Solution 1.06. A

$(-3)^0 = 1 > 0$ $-3^0 = -1 < 0$ $(-3)^{2017} = -3^{2017} < 0$

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Task 1.07. (0-1) (2018 - task 10)

In February, the price of a certain product remained constant, but on March 1st it was increased by 10%. After a week, the new price was decreased by 20%. As a result of these two changes, the initial price of the product was decreased by

A. 12% B. 14% C. 9% D. 4%

Solution 1.07. A

Let x be the first price.

The increase factor is $100\% + 10\% = 110\% = 1.1$.

The decrease factor is $100\% - 20\% = 80\% = 0.8$.

After the two price changes the new price will by 12% less

because: $x \times 1.1 \times 0.8 = x \times 0.88 = 88\%x = x - 12\%x$

Task 1.08. (0-1) (2019 - task 01)

If we assume that $\frac{8}{9}$ is approximately equal to 0.9/ the percentage error of this approximation is equal to:

A. 1% B. 1.25% C. 0.0125% D. 0.01%

Solution 1.08. B

$$\frac{\left|\frac{8}{9} - 0.9\right|}{\frac{8}{9}} \times 100\% = \left|\frac{8}{9} - \frac{9}{10}\right| \times \frac{9}{8} \times 100\% = \frac{1}{90} \times \frac{900}{8}\% = 1.25\%$$

1. Real Numbers with solutions

Task 1.09. (0-1) (2020 - task 01)

The reciprocal of $3\frac{2}{9}-5\frac{1}{3}\times\sqrt{\frac{49}{144}}$ is:

A. -9 B. $-\frac{1}{9}$ C. $\frac{1}{9}$ D. 9

Solution 1.09. C

$$3\frac{2}{9}-5\frac{1}{3}\times\sqrt{\frac{49}{144}}=3\frac{2}{9}-\frac{16}{3}\times\frac{7}{12}=\frac{29}{9}-\frac{28}{9}=\frac{1}{9}$$

Task 1.10. (0-1) (2020 - task 05)

The number $\frac{4^8+4^7}{320\times4^4}$ is equal to:

A. 4^{-1} B. 4^0 C. 4^1 D. 4^2

Solution 1.10. B

$$\frac{4^8+4^7}{320\times4^4}=\frac{4^7(4+1)}{4^3\times5\times4^4}=1=4^0$$

Task 1.11. (0-1) (2020 - task 06)

If $\log_3 5=0.68$ then $\log_3 45$ equals:

A. 1.32 B. 1.36 C. 2.68 D. 6.8

Solution 1.11. C

$$\log_3 45=\log_3(3^2\times5)=\log_3(3^2)+\log_3(5)\approx2+0.68=2.68$$

1. Real Numbers with solutions

Task 1.12. (0-1) (2021 - task 02)

The Seine is shorter than the Vistula by 25%, and the Rhine is longer than the Vistula by 17%. Thus the Rhine is longer than the Seine by

A. 64% **B.** 56% **C.** 42% **D.** 21%

Solution 1.12. B

Let S be the length of Seine river.

Let V be the length of Seine river.

Let R be the length of Seine river.

$S = 0.75V \quad R = 1.17V$

$\frac{R-S}{S} = \frac{1.17V-0.75V}{0.75V} = \frac{0.42V}{0.75V} = \frac{42}{75} = \frac{14}{25} = \frac{56}{100} = 56\%$

Task 1.13. (0-4) (2021- task 18)

Write down each of the sentences a–d below as an algebraic expression.

a) The difference of a squared and b.

.....

b) The absolute value of the sum of b and tripled a.

.....

c) The quotient of a squared and the third power of b.

.....

d) The product of a increased by 5 and the square root of b.

.....

Solution 1.13.

1.13 a) $a^2 - b$ b) $|b + 3a|$ c) $a^2 \div b^3$ d) $(a + 5) \times \sqrt{b}$

1. Real Numbers with solutions

Answers

1.01 A	1.02 D	1.03 A	1.04 D	1.05 C
1.06 A	1.07 A	1.08 B	1.09 C	1.10 B
1.11 C	1.12 B			

1.13 a) $a^2 - b$ b) $|b + 3a|$ c) $a^2 \div b^3$ d) $(a + 5) \times \sqrt{b}$