

Department of Mathematics and Statistics

“Matematiikka tutuksi”

18.5.2006

Duration of the test: two hours.

Write your name and your social security or student number in each paper that you leave.

Weight of the problems: Problems 1 and 2 both 25%; Problems 3-7 10% each.

With problems 1 and 2, the mere answer is not enough, show also the calculations!

1. Solve the system of equations
$$\begin{cases} 2x + y - 2 = x + 3y + 3 \\ 3x + y - 3 = x + 2y + 2 \end{cases}$$

2. Solve the inequality $2|x| > |x - 1| + 1$.

With problems 3-7, you don't need to show the calculations. Four suggested answers are given in connection with each problem. If one of them is correct, write its letter (a,b,c or d) under the number of the problem in the table below ; otherwise, write there an “x”.

3. When the polynomial $1 + 2x - x^2 + 2x^3$ is divided by the polynomial $1 + x^2$, the remainder is

(a) 0 (b) x (c) 2 (d) 3

4. The number of the points of intersection of the ellipse $x^2 + 4y^2 = 100$ and the hyperbole $3x^2 - 20y = 120$ is

(a) 0 (b) 1 (c) 2 (d) 4

5. The sum of the first sixteen terms of the geometric sequence (3, 12, 48...) is

(a) $3(4^{16} - 1)$ (b) $4^{15} - 1$ (c) $3(4^{15} - 1)$ (d) $4^{16} - 1$

6. The function $f(x) = x^5 - 20x^2 + 8$ has an extremum at the point

(a) -1 (b) 1 (c) 2 (d) 4

7. Two (symmetric) dice, one black and one white, are being thrown. The probability that the black one gives a bigger number than the white one, is

(a) $\frac{1}{2}$ (b) $\frac{1}{3}$ (c) $\frac{3}{8}$ (d) $\frac{5}{12}$

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Department of Mathematics and Statistics

“Matematiikka tutuksi”

20.10.2006

Write your name and your social security or student number in each paper that you leave.

Weight of the problems: Problems 1 and 2 both 25%; Problems 3-7 10% each.

With problems 1 and 2, the mere answer is not enough, show also the calculations!

1. Solve the system of equations $\begin{cases} 2x + 3y = 4 \\ 5x + 8y = 2 \end{cases}$.

2. Solve the inequality $3(x^2 - 4) \leq x^2 - 2x$.

With problems 3-7, you don't need to show the calculations. Four suggested answers are given in connection with each problem. If one of them is correct, write its letter (a,b,c or d) under the number of the problem in the table below ; otherwise, write there an “x”.

3. When the polynomial $1 + x - x^2 + 2x^3$ is divided by the polynomial $1 - x$, the remainder is

(a) 0 (b) 1 (c) $2x$ (d) 3

4. The number of the solutions of the group of equations displayed at the right is

$$\begin{cases} 2x - 2y - 3z = 9 \\ 3x - y + 2z = 1 \\ 2x - 7y + z = -11 \end{cases}$$

(a) 0 (b) 1 (c) 2 (d) infinite

5. The sum of the first fifteen terms of the geometric sequence $(4, 6, 9, \dots)$ is

(a) $4\left(\left(\frac{3}{2}\right)^{15} - 1\right)$ (b) $\frac{3^{15} - 2^{15}}{2^{12}}$ (c) 2243 (d) $3^{15} - 2^{14}$

6. The sum of the numbers obtained at the throw of three (symmetric) dice is 4 with probability

(a) $\frac{1}{4}$ (b) $\frac{1}{12}$ (c) $\frac{1}{48}$ (d) $\frac{1}{72}$

6. The function $f(x) = 3x^4 + 3x^2 - 15$ has an extremum at the point

(a) -1 (b) 0 (c) 1 (d) 2

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Department of Mathematics and Statistics

“Matematiikka tutuksi”

March 6, 2007

Duration of the test: two hours.

Write your name and your social security or student number in each paper that you leave.

Weight of the problems: Problems 1 and 2, both 25%; Problems 3-7, 10% each.

With problems 1 and 2, the mere answer is not enough, show also the calculations!

1. Solve the system of equations
$$\begin{cases} 2x - 4 = 3y + 5 \\ 3x + 2 = 4y - 8. \end{cases}$$

2. Solve the inequality $2|x| > |x - 1| + 1$.

With problems 3-7, you don't need to show the calculations. Four suggested answers are given in connection with each problem. If one of them is correct, write its letter (a, b, c or d) under the number of the problem in the table below; otherwise, write there an “x”.

3. The number of the solutions of the group of equations displayed at the right is

(a) 0 (b) 1 (c) 2 (d) 4

$$\begin{cases} x^2 - 2x + y^2 + 4y - 2 = 0 \\ x^2 + 4x + y^2 - 2y + 4 = 0 \end{cases}$$

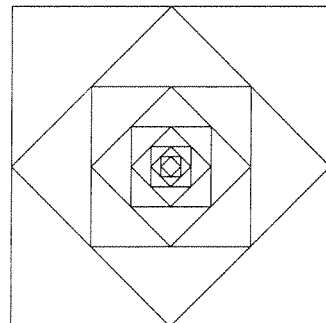
4. The number $\frac{\sqrt[3]{4} - \sqrt[5]{27}}{\sqrt[2]{6}}$ can be written as

(a) $2^{\frac{1}{6}} - 3^{\frac{1}{10}}$ (b) $\frac{\sqrt[6]{2}}{\sqrt{3}} - \frac{\sqrt[10]{3}}{\sqrt{2}}$ (c) $(\frac{2}{3})^{\frac{1}{3}} - (\frac{3}{2})^{\frac{3}{5}}$ (d) $\frac{\sqrt[3]{2}}{\sqrt{3}} - \frac{\sqrt[10]{3}}{\sqrt{2}}$

5. The figure on right shows ten mutually inscribed squares.

If the length of the side of the outermost square is 4 cm, then the length of the side of the innermost square is

(a) $\sqrt[10]{4}$ cm (b) $\frac{1}{8\sqrt{2}}$ cm (c) $\frac{\sqrt{2}}{8}$ cm (d) $\frac{4}{\sqrt[5]{2}}$ cm



6. In the interval $\{x \in \mathbb{R} : 0 < x < 1\}$, the function $f(x) = x^3 - x^2 - 1$ is

(a) increasing (b) decreasing (c) constant (d) none of these

7. Two (symmetric) dice, one white and one black, are being thrown. The probability that the number given by the black one is bigger than that given by the white one, is

(a) $\frac{1}{2}$ (b) $\frac{1}{3}$ (c) $\frac{3}{8}$ (d) $\frac{5}{12}$

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