

THE GEORG MOHR CONTEST 2008

First round

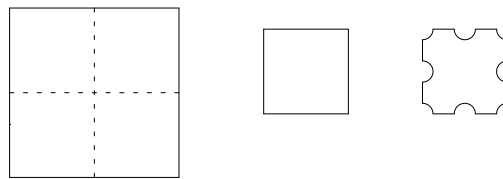
December 4, 2007

Duration: 45 minutes

Tools allowed: none

Answer by ticking the answering sheet enclosed

1. If the paper napkin shown in the figure in the middle is unfolded, it appears as shown on the left. If we cut the edge of the folded napkin as shown on the right before unfolding, how many holes will the unfolded napkin then have?

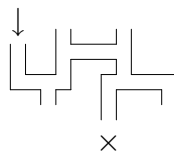


- A) 0 B) 2 C) 4 D) 5 E) 8

2. A and B start simultaneously at each end of a long winding forest path and run towards each other until they meet. Then they turn around and run back. A runs somewhat faster than B. Who returns to his or her starting point first?

- A) A B) B C) they arrive simultaneously
 D) it depends on where they meet E) it depends on whether A is more than twice as fast as B

3. Marie enters the maze at \downarrow , and at each bifurcation, she tosses a coin to choose a branch. What is the probability of Marie exiting at \times ?



- A) $\frac{1}{5}$ B) $\frac{2}{5}$ C) $\frac{1}{6}$ D) $\frac{1}{8}$ E) $\frac{1}{16}$

4. The altitude to the base of an isosceles triangle with area 60 is 5. What is the circumference of the triangle?

- A) 50 B) 38 C) 20 D) 60 E) 24

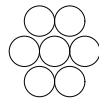
5. Which of the following numbers is not divisible by 18?

- A) 540 B) $1818 + 7216$ C) $36 \cdot 4226$ D) $2007 \cdot 2008 \cdot 2009$
E) $9 \cdot 888 - 8 \cdot 999$

6. Playing 7-bang! consists in counting aloud from 1 to 100, but each time one encounters a number that is divisible by 7 or in which 7 is a digit, one must say "bang!" instead of the number. How many times must one say "bang!" ?

- A) 10 B) 14 C) 24 D) 30 E) 34

7. The seven numbers $-3, -2, -1, 0, 1, 2$ and 3 are placed at random in the seven rings. What is the probability of the sum of the numbers in the six outer rings being -3 ?



- A) $\frac{1}{3}$ B) $\frac{1}{6}$ C) $\frac{1}{7}$ D) $\frac{1}{9}$ E) $\frac{3}{49}$

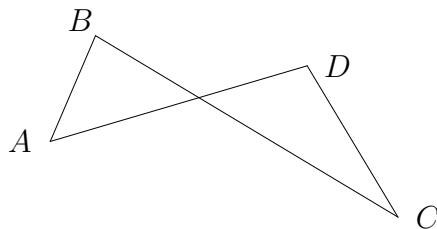
8. Which number solves the equation $1 + \sqrt{1 + \sqrt{1 + \sqrt{x}}} = 3$?

- A) 0 B) $\sqrt{6}$ C) 6 D) 64 E) the equation has no solution

9. X says: "I am happy". Y says: "X is lying". Z says: "X and Y are both annoyed". Exactly one of the persons is lying. What may hence be deduced?

- A) X is happy B) Y is happy C) Z is happy
D) Y is annoyed E) Z is annoyed

10. A plane figure $ABCD$ consisting of segments AB, BC, CD and DA , where BC and DA intersect, is called a bow. What can be said about the sum of angles $\angle A + \angle B + \angle C + \angle D$ in a bow? It is:



- A) greater than 90° B) 180° C) less than 360°
D) 360° E) 540°

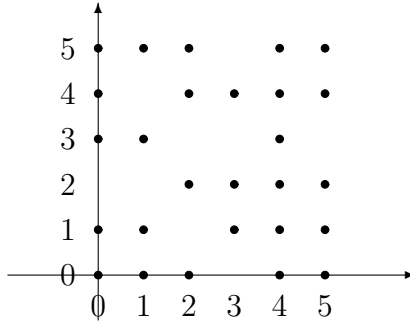
11. In an election in two rounds with the candidates P1, P2 and P3, only P1 and P2 go on to the second round. In the first round, P3 got 25 % of the votes. His voters are expected to distribute themselves in the second round with 20 % to P1 and 80 % to P2, who is then expected to obtain a total of 55 % of the votes. How big was P1's part of the votes in the first round?

A) 30 % B) 35 % C) 40 % D) 45 % E) 50 %

12. Which of the following expressions is equal to $(a + b)^2 - (a - b)^2$?

A) 0 B) $2a^2$ C) $2b^2$ D) $2a^2b^2$ E) $4ab$

13. Some stones are placed in a coordinate system (see the places in the figure). You stand at $(0, 0)$ and may hop from one stone to another in hops of length 1 or $\sqrt{2}$. The stones which you can reach from $(0, 0)$ in at most 5 hops are yours! How many stones aren't yours?

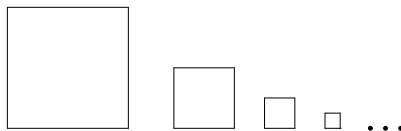


A) 0 B) 2 C) 4 D) 6 E) 9

14. Which product is cheapest? For 6 kg A one must pay 11 kroner, 7 kg B cost 12 kroner, the price of one kilogram C is 2 kroner, 5 kroner is enough to buy 11 kg D, and one can get 600 g E for 1 krone.

A) A B) B C) C D) D E) E

15. Infinitely many squares are drawn beside each other. The side length of each square is half the side length of the preceding one. The first square has side length 1. What is the total area of the squares?

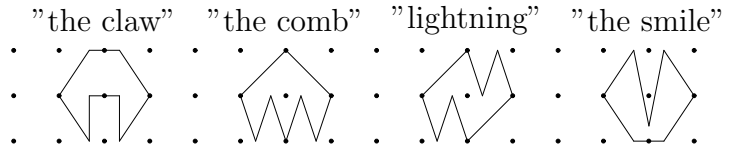


A) $1\frac{1}{2}$ B) $1\frac{1}{3}$ C) $1\frac{1}{4}$ D) $1\frac{3}{8}$ E) the area is infinitely large

16. It takes 5 minutes to fill in a certain questionnaire on a computer. How many computers are required if x persons shall be able to fill in the questionnaire in an hour? You need about

A) $\frac{x}{5 \cdot 60}$ B) $\frac{60 \cdot x}{5}$ C) $\frac{x}{12}$ D) $\frac{12}{x}$ E) $\frac{60 \cdot 5}{x}$

17. Which logo has the largest area?

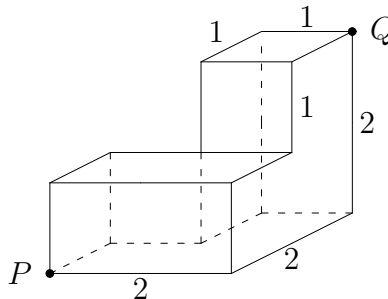


- A) "the claw" B) "the comb" C) "lightning" D) "the smile"
E) all of them have the same area

18. Let us denote by $m(a, b)$ the largest of the numbers a and b . Which of the following rules is correct?

- A) $m(a, a) + m(b, b) = m(a, b)$ B) $m(a + b, b + c) = m(a + c, a + b)$
C) $m(a, b) + m(b, c) = m(a, c)$ D) $m(a + c, b + c) = m(a, b) + c$
E) $m(a, b) = a + b$

19. A beetle must crawl from P to Q across the surface of the block shown. How long is the shortest route?



- A) $3\sqrt{2}$ B) $2\sqrt{5}$ C) $1 + \sqrt{5} + \sqrt{2}$ D) $2 + 2\sqrt{2}$ E) 5

20. By a binary word of length n one understands a series of n digits each of which is either 0 or 1. By the distance between two binary words one understands the number of places where the two words deviate. For example, the distance between the two words 100010 and 010011 is equal to 3. How many binary words of length 6 have the distance at most 4 from the the word 100010?

- A) 6 B) 18 C) 24 D) 31 E) 57