

2007 MathEdge+ Intermediate Level Contest

Please box the answer. No partial credit will be given. Only correct answer counts. No Calculator. 40 mins

- 1) Using only digits 1, 2, and 3, how many different 1-, 2-, or 3-digit counting numbers can one make?

ANS: 39

SOL: 3 one-digit numbers + 9 two-digit numbers + 27 three digit numbers = 39

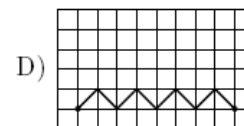
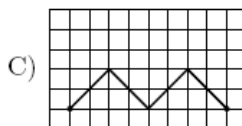
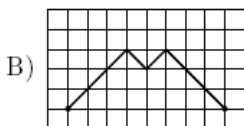
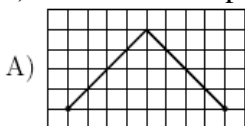
- 2) Using 6 matches, only one rectangle with a perimeter of 6 matches can be made (see the picture). How many different rectangles with a perimeter of 18 matches can be made?



ANS: 4

SOL: Length+Width = $18 \div 2 = 9$. There are 4 ways: (1,8), (2,7), (3,6), (4,5).

- 3) Between two points four routes are drawn. Which route is the shortest?



ANS: All are same or none is shortest.

- 4) 100% of a number is equal to 964. What is the number?

ANS: 964

SOL: 100% is one whole thing of the number – 964 in this case.

- 5) On each day that Andy does his homework his mother gives him \$4, and on days he doesn't she takes \$1 away from him. After 30 days Andy notices that he has the same amount of money as when he started even though he has spent nothing and had no other source of income. On how many of the 30 days did he do his homework?

ANS: 6

SOL: Assume x be the number of days that he does homework. $4x = (30-x) \Rightarrow 5x = 30; x = 6$.

- 6) Ada has 14 gray balls, 8 white balls and 6 black balls in a bag. What is the least number of the balls she has to take out of her bag having her eyes closed to make sure that she took at least one ball of each color?

ANS: 23

SOL: The worst case is when she takes out 14 gray, then 8 white, and then one black: $14 + 8 + 1 = 23$

- 7) Alisa's phone number is a 7-digit number where each digit is greater than each of the digits to its left. Her phone number doesn't start with 0 or 1. How many different phone numbers can be her phone number?

ANS: 8

SOL: There are 8 possible numbers can be used, namely: 2,3,4,5,6,7,8,9. To form a 7-non-repeating digit number using 8 numbers, it has ${}_8C_7 = 8$ ways. Can list them out also.

- 8) Find a prime number p such that $23p + 1$ is also prime.

ANS: 2

SOL: All primes are odd except 2. For " $23p + 1$ " to be odd, p has to be even. P = 2 is the only choice.

- 9) Mrs. Jones has two sons whose ages differ by 1. In 2002, the age of Mrs. Jones was 8 times the sum of her sons'. In 2007, the age of Mrs. Jones was 3 times the sum of her sons'. How old was Mrs. Jones when her elder son was born?

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ANS: 37

SOL: Assuming the age of Mrs. Jones in 2002 was x and the age of her elder son is a .
 $X = 8(2a - 1)$ and 5 years later: $(x+5) = 3(2a - 1 + 10)$. Solving the two equations, $a = 3$ and $x = 40$.
 The age of Mrs. Jones when her elder son was born was $40 - 3 = 37$.

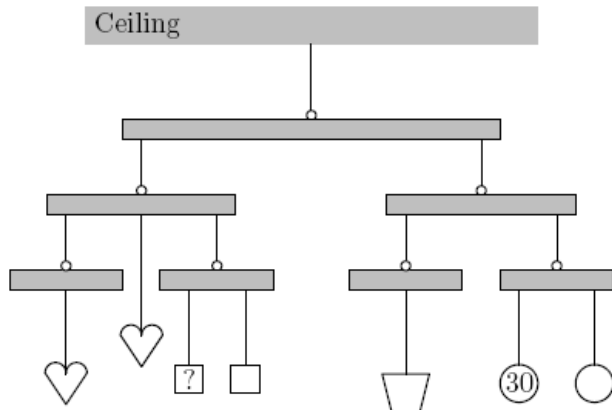
- 10) Below are two zig-zag shapes made of identical little squares 1 cm on a side. The first shape has 6 squares and a perimeter of 14 cm. The second has 9 squares and a perimeter of 20 cm. What is the perimeter of the zig-zag shape with 15 squares?



ANS: 32

SOL: The perimeter is the number of squares $\times 2 + 2$. Thus for 15 squares, the perimeter = $15 \times 2 + 2 = 32$.

- 11) The weights in the figure are in balance. The same shapes have the same weight. The weight of each circular shape is 30 ounces. What is the weight of the square shape indicated with the question mark?



ANS: 20

SOL: $1\text{Heart} = 2\text{Squares}$; $3\text{Hearts} = 4\text{Circles} = 4 \times 30 = 120 \Rightarrow H = 40$; $S = 40 \div 2 = 20$

- 12) In the addition problem below, the square, the triangle, and the circle represent a different digit. What is the digit sum of one square and one circle?

$$\begin{array}{r}
 \square \square \square \\
 \square \square \circ \\
 + \square \triangle \triangle \\
 \hline
 2003
 \end{array}$$

ANS: 6

SOL: square = 6; triangle = 7; circle = 0. Thus square + circle = $6 + 0 = 6$.

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- 13) The cyclist went up the hill with the speed of 12 km/h and went down the hill with the speed of 20 km/h. The ride up the hill took him 16 minutes longer than the ride down the hill. How many minutes did the cyclist take to go down the hill?

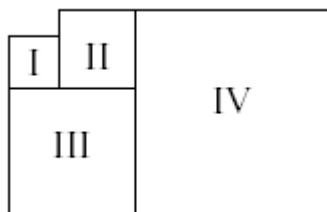
ANS: 24mins

SOL: Assume the hill is x km. The time to go uphill – the time to go downhill =

$$\frac{x}{12\text{km/h}} - \frac{x}{20\text{km/h}} = \frac{16}{60}h \implies x = 8\text{km.}$$

The time to go downhill = $\frac{8\text{km}}{20\text{km/h}} \times 60 \text{ mins} = 24\text{mins}$

- 14) Figures I, II, III and IV are squares. The perimeter of square I is equal to 16 units, and the perimeter of square II is equal to 24 units. The perimeter of square IV is equal to:



ANS: 64 units

SOL: Side of III = $4 \div 4 = 1$. Side of IV = $10 + 6 = 16$; thus, perimeter of IV = $16 \times 4 = 64$.

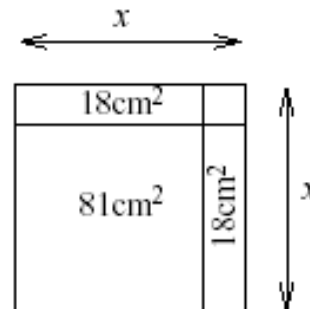
- 15) In a chess tournament, 32 players were competing by rounds of eliminations. In each round all the players were divided into groups of four. In each of these groups every player played once with every other player. The two best players from the group went to the next round and the two worst players were out of the competition. After the round in which four last players played, the two best players were playing an additional final game to determine the champion. How many total number of games were played during the entire tournament?

ANS: 91

SOL: In a group of 4 players, 6 games ($\frac{4 \times 3}{2} = 6$) would be played. Each round, half of

the players would be eliminated. Thus the total number of 4-person groups in the entire competition = $8 + 4 + 2 + 1 = 15$. Since each 4-person groups, 6 games are played, the total number of games played = $15 \times 6 = 90$ games plus one more to decide the champion. Thus, the answer is $90 + 1 = 91$.

- 16) A square with the length of side equal to x consists of a square with an area of 81 cm^2 , two rectangles with areas of 18 cm^2 each, and a small square. What is the value of x ?



ANS: 11cm

SOL: The side of the bigger square is $9 + 2 = 11$

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- 17) Emily has 29 balls consist of four colors: yellow, green, blue, and black. 19 of them are not green, 5 are black, and 18 are not yellow. How many blue balls does Emily have?

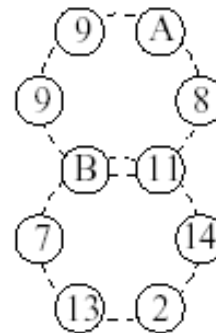
ANS: 3

SOL: green = $29 - 19 = 10$; yellow = $29 - 18 = 11$; black = 5; Thus, Blue = $29 - 10 - 11 - 5 = 3$

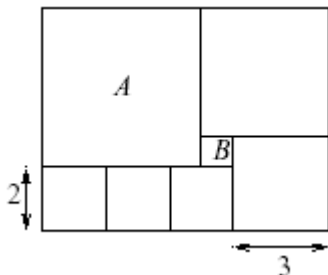
- 18) Two of the numbers located on the two circles (see the picture) are represented by letters A and B. The sum of the numbers on each circle is equal to 55. What number is represented by letter A?

ANS: 10

SOL: Sum of lower circle = $47 + B = 55 \rightarrow B = 8$; Sum of upper circle = $37 + A + B = 55 \rightarrow A + B = 18$. Since $B = 8$, then $A = 18 - 8 = 10$.



- 19) The figure in the picture consists of 7 squares. Square A has the greatest area, and square B - the smallest area. The lengths of two of the squares are given. How many B squares will it take to fill up square A completely?



ANS: 25

SOL: side of B = $3 - 2 = 1$. Side of A = 5. Thus, the area of A = $5 \times 5 = 25$. The B square has area of $1 \times 1 = 1$.

- 20) Let ABC be the right triangle with AB = 3, BC = 5, AC = 4. Find the length of the altitude AH from A to BC.

ANS: $\frac{12}{5}$

SOL: Using Pythagorean triple (3,4,5): BC = 5. Area =

$$\frac{(3 \times 4)}{2} = \frac{(5 \times AH)}{2} \Rightarrow$$

$$\text{Thus, } AH = \frac{12}{5}$$

