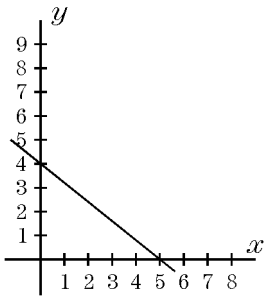
Junior Preliminary 2006

Team Math Quest - Category A

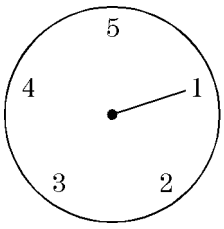
1. What is the equation of the line show on the coordinate system? Express your answer in the form of $y = ax + b$.



Junior Preliminary 2006

Team Math Quest - Category A

2. Consider a five-hour clock that has an hour hand only. If the hour hand currently points to "1", to what number will the hour hand point in 48 hours?



Junior Preliminary 2006

Team Math Quest - Category A

3. Find all possible values of n [redacted]

$|n-1|+5=10$

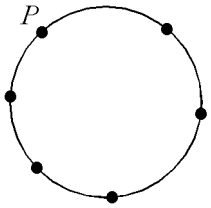
Junior Preliminary 2006

Team Math Quest - Category A

4. Arnold participated in the Iron Man competition. His times for the three legs of the race appear in the chart shown. What was his rate of speed, in miles per hour, for the entire competition? Round your answer

Leg	Time (hrs:min:sec)
120-mile bike	6:11:18
1.2-mile swim	1:16:31
26-mile run	3:17:11

5. Using the 6 points on the circle for vertices, how many triangles are possible that have point P as one vertex?



6. The positive odd integers are arranged in 5 columns, A, B, C, D, and E, continuing the pattern shown.

A	B	C	D	E
15	13	11	9	
	17	19	21	23
47	45	43	41	
	49	51	...	

In which column will 1599 appear?

Junior Preliminary 2006

Team Math Quest - Category A

7. A number palindrome is a number that reads the same from left to right as from right to left. Consider the number 180 and the following process:

$$\begin{array}{rl} & 180 \\ + & \underline{081} \\ & 261 \\ + & \underline{162} \\ & 423 \\ + & \underline{324} \\ & 747 \end{array}$$ A palindrome! (In three steps)

How many steps (additions) does it take to get a palindrome if you begin with the number 549?

Junior Preliminary 2006

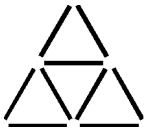
Team Math Quest - Category A

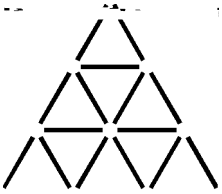
8. Simplify and give your answer as a mixed number:

$$\cfrac{1}{1+\cfrac{1}{2+\cfrac{1}{3+\cfrac{1}{4+\cfrac{1}{5+\cfrac{1}{6}}}}}}$$

depicted, respectively. How many matches would be needed to construct a similar figure with a ten match-stick base?


= 3 matches

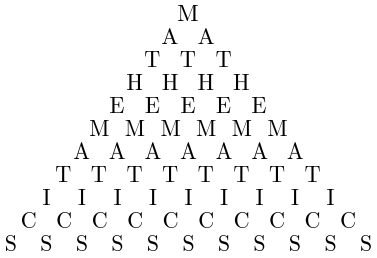

= 9 matches


= 18 matches

Junior Preliminary 2006

Team Math Quest - Category A

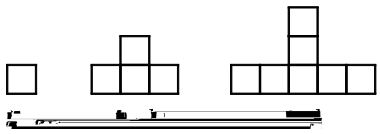
10. Beginning with the letter M at the top of the triangle and reading diagonally downward to an adjoining letter, in how many ways is it possible to read MATHEMATICS?



Junior Preliminary 2006

Team Math Quest - Category A

11. How many squares are needed to build the 10th shape in the pattern?



12. The first six rows of Pascal's triangle are shown, beginning with row zero. Except for the '1' at each end,

```
          1
        1   1
      1   2   1
    1   3   3   1
  1   4   6   4   1
1   5   10  10  5   1
```

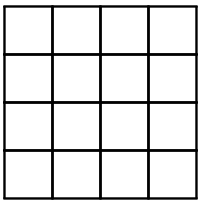
13. Consider the following pattern:

$$\sqrt{1+1\cdot 2\cdot 3\cdot 4}=5$$
$$\sqrt{1+2\cdot 3\cdot 4\cdot 5}=11$$
$$\sqrt{1+3\cdot 4\cdot 5\cdot 6}=19$$
$$\sqrt{1+4\cdot 5\cdot 6\cdot 7}=29$$
$$\vdots$$
$$\sqrt{1+50\cdot 51\cdot 52\cdot 53}$$

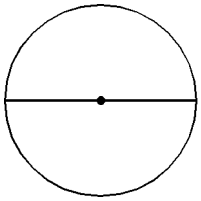
14. What positive value of n makes the sentence true?

$$\frac{n+2}{5} = \frac{7}{n}$$

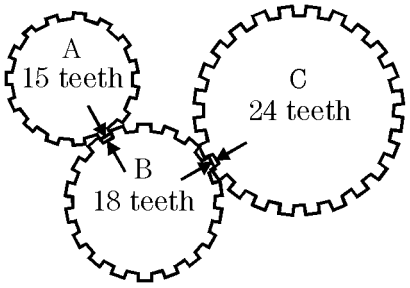
15. If only one X can be placed in each square, what is the maximum number of X's that can be placed in the 4-by-4 grid of squares so that no row, column, or diagonal contains 4 X's?



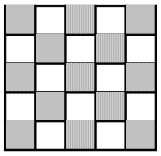
16. At Joe's Pizza a 16-inch-diameter pizza and a 12-inch-diameter pizza cost the same per square inch of top surface area. If the cost of a large pizza is \$9.60, what is the cost, in dollars, of the smaller pizza?



17. Gears are aligned as shown, and each gear has the number of teeth indicated. What is the least positive number of rotations gear C must make before the arrows will again be aligned in the same way?



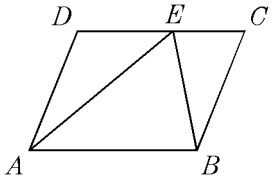
18. What percent of the 5×5 square is shaded?



Junior Preliminary 2006

Team Math Quest - Category A

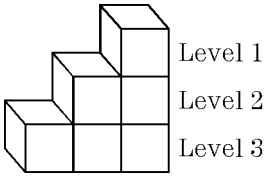
19. What is the ratio of the area of $\triangle AEB$ [redacted] $ABCD$?



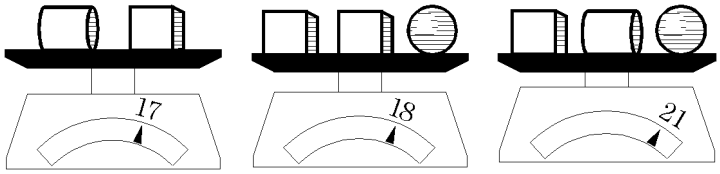
Junior Preliminary 2006

Team Math Quest - Category A

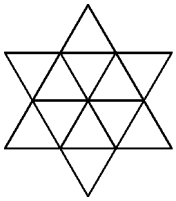
20. The 3 steps in the figure below are made by stacking cubes. What is the number of cubes required to make 15 steps given that each level contains 1 more cube than the level above it?



21. The scales show the masses of different collections of cylinders, cubes and spheres. Weights given by the scales are in kilograms. One cylinder and one cube weigh 17 kg, two cubes and one sphere weigh 18 kg, and one cube, one cylinder and one sphere weigh 21 kg. Assuming that the same shapes weigh the same amount, what is the number of kilograms in the mass of a cylinder?

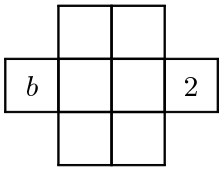


22. How many triangles are in this figure?



23. [illegible]

in region b?

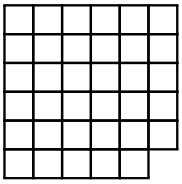


24. An equilateral triangle and a regular hexagon share a side. The perimeter of the triangle is 20 cm. How many centimeters are in the perimeter of the hexagon?

Junior Preliminary 2006

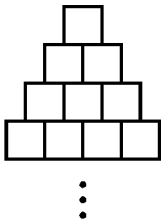
Team Math Quest - Category A

25. In the diagram shown there are squares of many sizes. How many squares are there in the diagram?

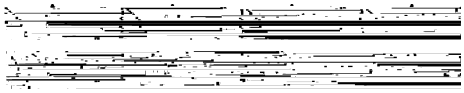


26. Simplify: $\dfrac{87 \cdot 73 + 47 \cdot 157 + 157 \cdot 73 + 47 \cdot 87}{73 + 47}$

27. Squares with sides 1 centimeter long are arranged as shown, each row containing one more square than the row above it. How many centimeters are in the perimeter of the figure formed by arranging 210 squares in this fashion?



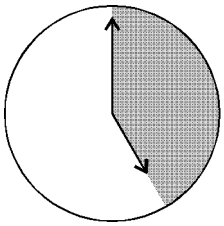
28. By continuing the pattern shown, how many no-overlapping triangles would appear in the last figure?



29. In the addition problem shown, whole numbers less than 10 are missing from the boxes. If the problem is done correctly, what is the sum of the numbers in these boxes?

$$\begin{array}{r} \square 6\,3 \\ 7\square 2 \\ +\ 5\,8\square \\ \hline \square 0\,4\,2 \end{array}$$

30. The hour hand of a broken clock points to 5 and the minute hand to 12. To the nearest percent what part of the clock face is shaded?



Answer List

1. $y = -\frac{4}{5}x + 4$
2. 4
3. 6, -4
4. 13.7 (mph)
5. 10 (triangles)
6. (column) A
7. 5 (steps)
8. $1\frac{7}{8}$
9. 165 (matches)
10. 1024 (ways)
11. 28 (squares)
12. 4 (rows)
13. 2651
14. 5
[redacted](X's)
16. \$5.40
[redacted]
19. 1 : 2
20. 120 (cubes)
21. 10 (kilograms)
22. 20 (triangles)
23. 7
24. 40 (centimeters)
25. 85 (squares)
26. 244
27. 80 (centimeters)
28. 40 (triangle)
29. 24
30. 42 (%)