

Students 2004

3 points

1 If m pens are bought at t euros each, and n pens at t euros each, then the average cost per pen, in euros, is :

- A) 1 B) $\frac{m+n}{2}$ C) $\frac{2mn}{m+n}$ D) mn E) $\frac{m^2n^2}{2}$

2 A pyramid has 17 faces. How many edges does it have ?

- A) 16 B) 17 C) 18 D) 32 E) 34

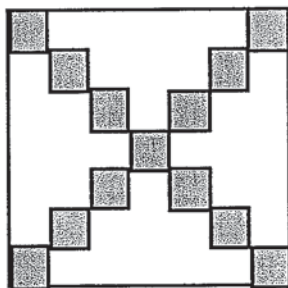
3 The smallest real number x satisfying the inequality $x^2 - 2004 \leq 0$ is:

- A. -2004 B. 2004 C. 0 D. $\sqrt{2004}$ E. $-\sqrt{2004}$

4 Each martian has one, two or three tentacles on its head. Exactly 1% of the martian population consists of individuals with three tentacles, exactly 97% comprise of Martians with two tentacles and the remaining 2% consists of individuals with one tentacle. How many percent of Martians have more tentacles on their head than the average of the whole Martian population ?

- A) 1% B) 3% C) 97% D) 98% E) 99%

5 s is an odd integer. In this square of side s , some squares of side 1 have been coloured (see the picture). What is the white area ?



- A) s^2+1-2s B) s^2+4-4s C) $2s^2+1-4s$
 D) s^2-1-2s E) s^2-2s

6 How many two-digit numbers exist whose square and cube end in the same digit?

- A: 1 B: 9 C: 10 D: 21 E: more than thirty

7 A square consists of 18 small squares, 17 of which have sides equal to 1. The area of the big square is:

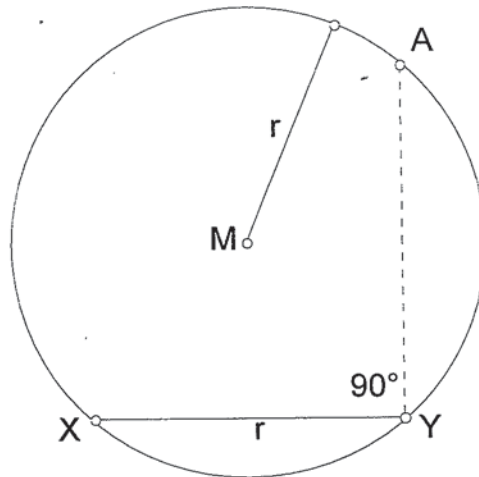
- A: 25 B: 49 C: 81 D: 100 E: 225

8 How many right-angled triangles can be formed by joining three vertices of a given regular 14-gone ?

- A) 72 B) 82 C) 84 D) 88 E) other answer

- 9 On a field there were 15 sheep and a certain number of shepherds. When one half of the shepherds and one third of the sheep left, there were total of 50 legs on the ground. What was the number of legs on the ground at the beginning?
- A) 60 B) 72 C) 80 D) 90 E) 100

- 10 $\angle XAY = ?$



- A) $22\frac{1}{2}^\circ$ B) 30° C) 45° D) 60° E) 90°

4 points

- 11 How many squares with vertex $A(-1,-1)$ exist such that at least one of the coordinate axes is an axis of symmetry of the square?

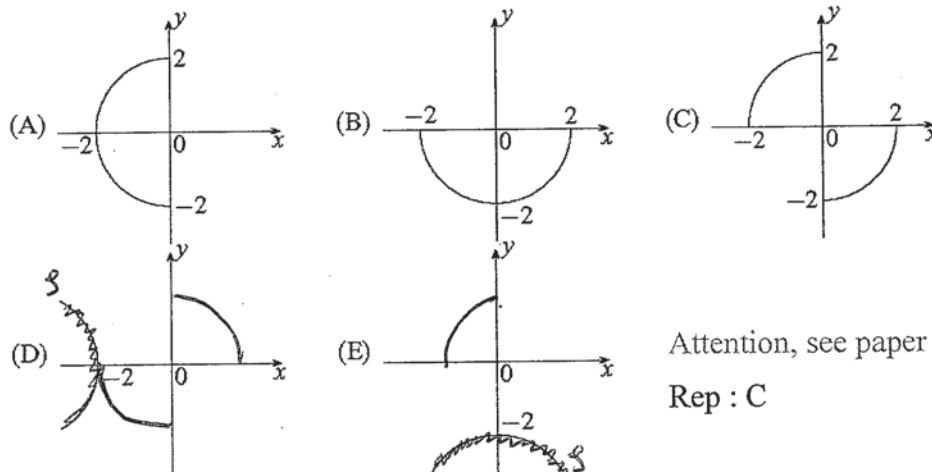
- A) 2 B) 3 C) 4 D) 5 E) 6

- 12 There are 100 cards in a non-transparent envelope, numbered with natural numbers from 1 to 100. There is a different number on each card. What is the smallest number of cards we have to pull out of the envelope at random to be sure that the product of the numbers on the chosen cards is divisible by four?

- A) 51 B) 52 C) 53 D) 54 E) 55

- 13 The set of all pairs (x,y) which satisfy conditions $x \cdot y \leq 0$ and $|x|^2 + |y|^2 = 4$

is on the graph :



Attention, see paper !

Rep : C

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- The diagram shows a large circle with a shaded circle labeled 'K' inside it. A square is inscribed in the large circle, with one corner at the center of circle K. The square's side is equal to the radius of the large circle.

- A. $a_3 \cdot a_4 > 0$ B. $a_2 \cdot a_3 < 0$ C. $a_2 \cdot a_4 < 0$
D. $a_2 < 0$ E. $a_2 \cdot a_3 > 0$

20 What is the second digit from the right of 11^{2004} ?

- (a) 0 (b) 1 (c) 2 (d) 3 (e) 4

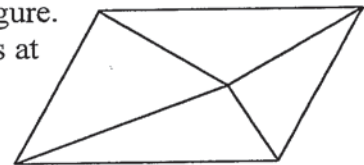
5 points

21 Elections in Herbville were held. Every voter who voted for the Broccoli Party had already eaten broccoli. 90 % of the remaining voter who voted for other parties had never eaten broccoli. How many percent did the Broccoli Party get in the elections, if precisely 46% of all voters attending the elections had eaten broccoli ?

- A) 40% B) 41% C) 43% D) 45% E) 46%

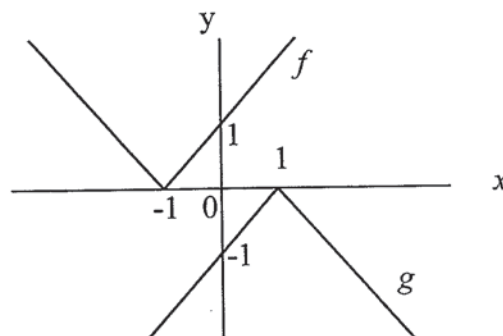
22 A parallelogram is divided into 4 triangles as shown in the figure. Of the following possibilities for the areas of the triangles at most one can be true. Which one is it ?

- A) 4, 5, 8, 9 B) 5, 6, 7, 12 C) 10, 11, 12, 19
D) 11, 13, 15, 16 E) none of A, B, C, D is true.



23 The figure shows graphs of functions f and g defined on real numbers. Which equality is satisfied for every real number x ?

- A) $f(x) = -g(x) + 2$ B) $f(x) = -g(x) - 2$ C) $f(x) = -g(x+2)$ D) $f(x+2) = -g(x)$
E) $f(x+1) = -g(x-1)$



24 An equilateral triangle ABC with sides of length 4 is given. The radius of the circular arc, with center at A, which divides the triangle into two parts of equal area is:

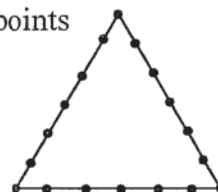
- A) $\sqrt{\frac{12\sqrt{3}}{\pi}}$ B) $\sqrt{\frac{24\sqrt{3}}{\pi}}$ C) $\sqrt{\frac{30\sqrt{3}}{\pi}}$ D) $\frac{6\sqrt{3}}{\pi}$ E) $\sqrt{\frac{48\sqrt{3}}{\pi}}$

25 We are given 200 natural numbers. In the beginning all of them are equal to zero. In the first step we add one to every zero. In the second step we add one to every second number, starting from the left. In the third step we add one to every third number and so on. Which number is on the 120th position from the left after two hundred step ?

- A) 16 B) 12 C) 20 D) 24 E) 32

26 How many triangles (not flattened) can be drawn with vertices in the 18 points shown in the figure ?

- A) 816 B) 711 C) 777 D) 717 E) 811.



27 If the sum of all the numbers that can be formed by permutation of the three different digits $0 < a < b < c$ is 1554, what is the value of c ?

- (a) 3 (b) 4 (c) 5 (d) 6 (e) 7

28 The number $m = 999 \dots 9$ consists of 999 nines. What is the sum of the digits of m^2 ?

- A) 8982 B) 8991 C) 9000 D) 9009 E) 9018

29 $\sin^8 75^\circ - \cos^8 75^\circ$ is equal to :

- A. $\frac{\sqrt{3}}{2}$ B. $\sqrt{3}$ C. $\frac{7\sqrt{3}}{16}$ D. 1 E. 0

30 Let ABCD be a convex quadrilateral with unit area, where AB and BD are the bases of two isosceles triangles ABC, BCD, respectively (as shown). The product AC.BD is equal to :

- A) $\frac{\sqrt{3}}{3}$ B) $\frac{2\sqrt{3}}{3}$ C) $\sqrt{3}$ D) $\frac{4\sqrt{3}}{3}$ E) Other answer

