

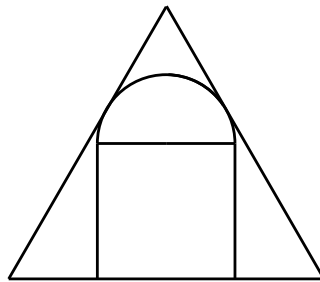
Section A.

In this section, there are 12 questions. Fill in the correct answer in the space provided at the end of each question. Each correct answer is worth 5 points.

1. Determine the maximum value of the difference of two positive integers whose sum is 2034 and whose product is a multiple of 2034.

Answer : _____

2. The diagram below shows a semicircle sitting on top of a square and tangent to two sides of an equilateral triangle whose base coincides with that of the square. If the length of each side of the equilateral triangle is 12 cm, what is the radius of the semicircle, in cm?



Answer : _____ cm

3. A four-digit number \overline{abcd} is a multiple of 11, with $b + c = a$ and the two-digit number \overline{bc} a square number. Find the number \overline{abcd} .

Answer : _____

4. The area of the equilateral triangle ABC is $8 + 4\sqrt{3}$ cm². M is the midpoint of BC . The bisector of $\angle MAB$ intersects BM at a point N . What is the area of triangle ABN , in cm²?

Answer : _____ cm²

5. There is a 2×6 hole on a wall. It is to be filled in using 1×1 tiles which may be red, white or blue. No two tiles of the same colour may share a common side. Determine the number of all possible ways of filling the hole.

Answer : _____

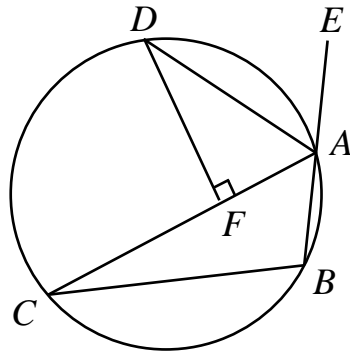
6. Let $N = 1^9 \times 2^8 \times 3^7 \times 4^6 \times 5^5 \times 6^4 \times 7^3 \times 8^2 \times 9^1$. How many perfect squares divide N ?

Answer : _____

7. How many positive integers not greater than 20112012 use only the digits 0, 1 or 2?

Answer : _____

8. The diagram below shows four points A, B, C and D on a circle. E is a point on the extension of BA and AD is the bisector of $\angle CAE$. F is the point on AC such that DF is perpendicular to AC . If $BA = AF = 2$ cm, determine the length of AC , in cm.



Answer : _____ cm

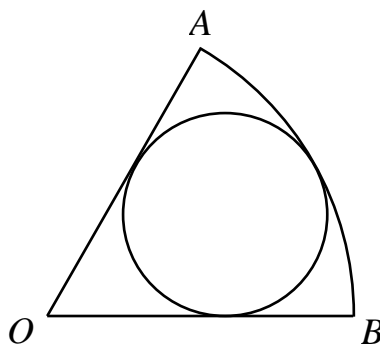
9. There are 256 different four-digit numbers \overline{abcd} where each of a, b, c and d is 1, 2, 3 or 4. For how many of these numbers will $ad - bc$ be even?

Answer : _____

10. In a plane, given 24 evenly spaced points on a circle, how many equilateral triangles have at least two vertices among the given points?

Answer : _____

11. The diagram below shows a circular sector OAB which is one-sixth of a circle, and a circle which is tangent to OA, OB and the arc AB . What fraction of the area of the circular sector OAB is the area of this circle?



Answer : _____

12. An 8×8 chessboard is hung up on the wall as a target, and three identical darts are thrown in its direction. In how many different ways can each dart hit the center of a different square such that any two of these three squares share at least one common vertex?

Answer : _____

Section B.

Answer the following 3 questions, and show your detailed solution in the space provided after each question. Each question is worth 20 points.

1. What is the integral part of M , if

$$M = \sqrt{2012 \times \sqrt{2013 \times \sqrt{2014 \times \sqrt{\dots \sqrt{(2012^2 - 3)} \times \sqrt{(2012^2 - 2)} \times \sqrt{(2012^2 - 1)} \times \sqrt{2012^2}}}}}} ?$$

Answer : _____

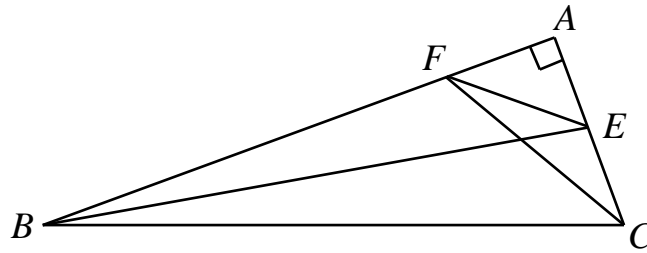
2. Let m and n be positive integers such that

$$n^2 < 8m < n^2 + 60(\sqrt{n+1} - \sqrt{n}).$$

Determine the maximum possible value of n .

Answer : _____

3. Let ABC be a triangle with $\angle A = 90^\circ$ and $\angle B = 20^\circ$. Let E and F be points on AC and AB respectively such that $\angle ABE = 10^\circ$ and $\angle ACF = 30^\circ$. Determine $\angle CFE$.



Answer : _____