BRITISH COLUMBIA SECONDARY SCHOOL MATHEMATICS CONTEST, 2014

Senior Preliminary

Wednesday, April 2

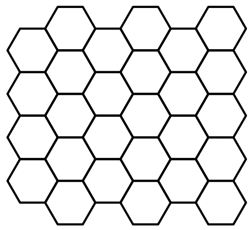
1. Consider the product

$$\left(\frac{1}{2}\right)\left(\frac{3}{4}\right)\left(\frac{5}{6}\right)\cdots\left(\frac{2n-1}{2n}\right)$$

where n is a positive integer. The value of this product for $n = 5$ is:

(A) $\frac{5}{16}$ (B) $\frac{35}{64}$ (C) $\frac{45}{128}$ (D) $\frac{63}{128}$ (E) $\frac{63}{256}$

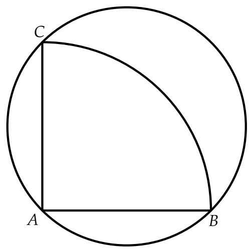
2. Leslie is instructed to colour the honeycomb pattern shown, which is made up of hexagonal cells. If two cells share a common side, they are to be coloured with different colours. The minimum number of colours required is:



(A) 2 (B) 3 (C) 4

(D) 5 (E) 6

3. A circular pizza has centre at point A. A quarter circular slice of the pizza, ABC, is placed on a circular pan with A, B and C touching the circumference of the pan. (See the diagram.) The fraction of the pan covered by the slice of pizza is:



(A) $\frac{1}{3}$ (B) $\frac{1}{2}$ (C) $\frac{2}{3}$

(D) $\frac{3}{4}$ (E) Cannot be determined

4. The shortest distance between the parabola $y = 4x^2 + 2$ and the parabola $y = -3x^2 - 4$ is:

(A) 1 (B) 2 (C) 6 (D) 7 (E) 13

5. The number of integers between 1 and 100 which contain at least one digit 3 or at least one digit 4 or both is:

(A) 36 (B) 38 (C) 40 (D) 45 (E) 48

6. If the equations $x^2 - 6x + 5 = 0$ and $Ax^2 + Bx = 1$ have the same roots, then the value of $A + B$ is:

(A) $-\frac{6}{5}$ (B) -1 (C) $-\frac{1}{5}$ (D) 1 (E) $\frac{6}{5}$

7. Consider the number n given by

$$n = 2014! = 1 \cdot 2 \cdot 3 \cdot 4 \cdots 2011 \cdot 2012 \cdot 2013 \cdot 2014$$

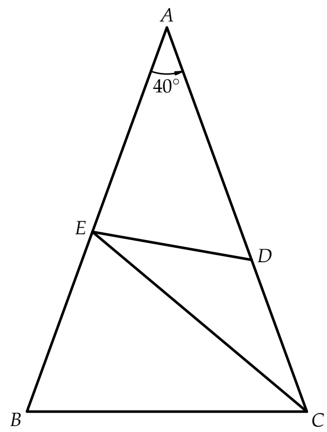
The number of consecutive trailing zeros in n (for example, the number 106,000,000 has six trailing zeros) is:

(A) 482 (B) 501 (C) 562 (D) 610 (E) 622

8. Triangle ABC is isosceles with $AB = AC$ and $\angle BAC = 40°$. Point E is on AB with $CE = BC$, and point D is on AC with $DE = CD$. (See the diagram.) The measure of $\angle ADE$, in degrees, is:

(A) 40 (B) 45 (C) 50

(D) 60 (E) 75



9. In Dale's job as a 3-D animator, she must cut off the corners of a cube so that a triangle is formed at each corner. The maximum number of edges of the resulting solid is:

(A) 24 (B) 30 (C) 36 (D) 48 (E) 60

10. Using only odd digits, all possible two-digit numbers are formed. The sum of all such numbers is:

(A) 1375 (B) 1500 (C) 2400 (D) 2475 (E) 2500

11. If $ab = k$ and $\frac{1}{a^2} + \frac{1}{b^2} = m$, then $(a-b)^2$ expressed in terms of m and k is:

(A) mk^2 (B) $k(km+1)$ (C) $k(km+2)$

(D) $k(km-m-1)$ (E) $k(km-2)$

12. Given that

$$\frac{1}{2} + \frac{1}{2^2} + \frac{1}{2^3} + \cdots + \frac{1}{2^n} + \cdots = 1$$

the value of the sum

$$\frac{1}{2} + \frac{2}{2^2} + \frac{3}{2^3} + \cdots + \frac{n}{2^n} + \cdots$$

is:

(A) 1 (B) $\frac{3}{2}$ (C) 2 (D) $\frac{5}{2}$ (E) 3