BRITISH COLUMBIA SECONDARY SCHOOL MATHEMATICS CONTEST, 2007

Junior Final, Part A

Thursday May 3

1. Given that 223 is a prime number, the number of factors of 2007, including 1 and 2007, is:

   (A) 2   (B) 3   (C) 5   (D) 6   (E) 7

2. In the diagram, segments AB, BC, CD, DE, and EF all have length 2 and $\angle ABC$, $\angle ACD$, $\angle ADE$, and $\angle AEF$ are all right angles. The length of the segment AF is:

   (A) $3\sqrt{2}$ (B) $2\sqrt{3}$ (C) 4

   (D) $2\sqrt{5}$ (E) $5\sqrt{2}$

3. The length, L, of a rectangle is doubled and the width, W, is increased by 50% to form a larger rectangle. The larger rectangle has an area of $60\,\text{cm}^2$. Assuming that L and W are integers with $L > W$, the largest possible perimeter, in cm, of the larger rectangle is:

   (A) 42   (B) 32   (C) 64   (D) 46   (E) 83

4. The area of the triangle with vertices at the points with coordinates $(1,2)$, $(5,4)$, and $(4,7)$ is:

   (A) 7   (B) $\dfrac{17}{2}$ (C) $\dfrac{29}{2}$

   (D) 16   (E) 20

5. An operation $\star$ is defined so that if a and b are integers, then $a \star b$ equals the smallest integer that is a multiple of both a and b. The value of $20 \star (8 \star 6)$ is:

   (A) 2   (B) 120   (C) 240   (D) 480   (E) 960

6. The distance between a point P and a line L is the length of the line segment PQ where Q is a point on the line L and PQ is perpendicular to L. Three points A, B, and C lie in a plane but do not lie on the same line. The number of lines that can be drawn in the plane that are equidistant from A, B, and C is:

   (A) 0   (B) 1   (C) 3   (D) 6   (E) more than 6

7. If you write all the integers from 1 to 5000, the number of times you write the digit 9 is:

   (A) 500   (B) 501   (C) 1000   (D) 1500   (E) 1501
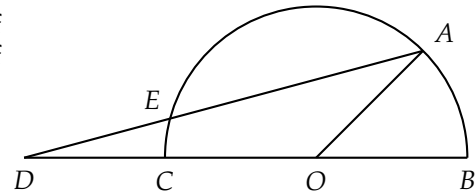
8. In the diagram the semicircle centred at O has diameter
    CB and D is on the extension of the diameter. The line
    AD intersects the circle at the point E and the length of
    the line segment DE equals the radius of the semicircle. If
    angle AOB is $45°$, the angle OAE, in degrees, is:

    (A)   15   (B)   20   (C)   30

    (D)   35   (E)   40

9. Nine chairs arranged in a row are to be occupied by six students and three mathematics professors.
    The three professors arrive before the students and decide to choose their chairs so that each professor
    is beside two students. The number of ways in which the professors can choose their seats is:

    (A)   20   (B)   35   (C)   42   (D)   60   (E)   504

10. In the town of Quark the people follow one of two religions: the Zor who worship the good god Blat
    and always tell the truth, and the Lan who worship the bad god Gak and always lie. Steve is an inhab-
    itant of Quark, but no one knows whether he is a Zorian or a Lannite. One day it became necessary to
    determine Steve's religion. So the town council asked the detective Sam to investigate the case. Sam
    came across Steve and his friend Jim. Now just because Steve and Jim were friends, did not mean that
    they were of the same religion. Being a sly detective, Sam did not want to ask Steve directly what
    his religion was, so first he asked Jim: "Is either of you a Zorian?". Jim answered, but Sam could not
    determine Steve's religion from Jim's answer. Then Sam asked Steve: "Did Jim tell the truth?". Steve
    answered, and then Sam knew Steve's religion. The religions of Steve and Jim are:

    (A)   Both Steve and Jim are Zorians.   (B)   Steve is a Zorian and Jim is a Lannite.

    (C)   Steve is a Lannite and Jim is a Zorian.   (D)   Both Steve and Jim are Lannites.

    (E)   There is not enough information.