BRITISH COLUMBIA SECONDARY SCHOOL MATHEMATICS CONTEST, 2015
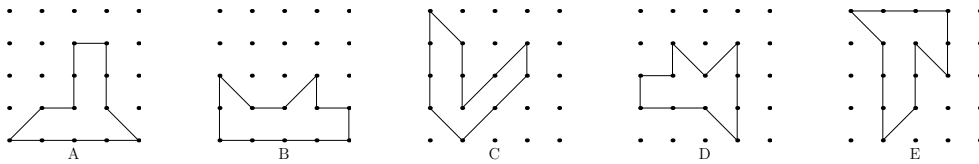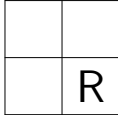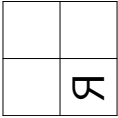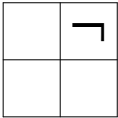
Junior Preliminary

Wednesday, April 1

1. When Raven Riddle was asked his age, he replied, "If I was twice as old as I was eight years ago, I would be the same age as I will be four years from now." Raven's age now is:
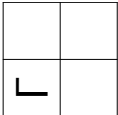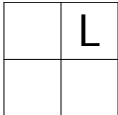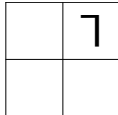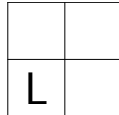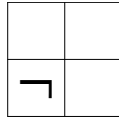
    (A) 12 (B) 16 (C) 20 (D) 24 (E) 26

2. In the diagram below, the polygon with the largest area is:

    (A) A (B) B (C) C (D) D (E) E

3. The letter R is placed in a 2×2 grid: . The grid is rotated about its centre and reflected across one of the centre lines to produce the grid: . The same operations are applied in the same order to the same 2×2 grid with the letter L placed in one of the squares in some orientation. The result is: . The original position and orientation of the letter L is:

    (A) (B) (C) (D) (E)

4. A prime number is an integer greater than one that is divisible only by one and itself. The sum of the first eleven prime numbers is:

    (A) 100 (B) 122 (C) 150 (D) 160 (E) 166

5. For nonzero real numbers w and z
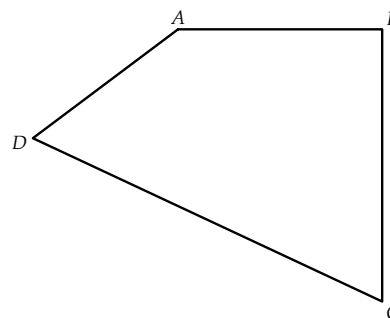
    $$\frac{\dfrac{1}{w} + \dfrac{1}{z}}{\dfrac{1}{w} - \dfrac{1}{z}} = 2015$$

    The value of $\dfrac{w + z}{w - z}$ is:

    (A) -2015 (B) $-\dfrac{1}{2015}$ (C) $\dfrac{1}{2015}$ (D) 2015 (E) Impossible to determine

6. In quadrilateral $ABCD$, the side lengths are $AB = 9$, $BC = 12$, $AD = 8$, $CD = 17$, and $\angle ABC = 90°$. The area of quadrilateral $ABCD$ is:

    (A) 72   (B) 81   (C) 94

    (D) 108   (E) 114

7. Given a set, S, of natural numbers, the *sumset* $S \oplus S$ is the set of all distinct sums of any pair of numbers taken from the set S (including, possibly, a number in the set added to itself). A set S is said to be *sumfree* if no numbers in the sumset are numbers in S. For example, for the set $X = \{1, 2, 3\}$, the sumset of X is

    $$X \oplus X = \{1 + 1, 1 + 2, 1 + 3, 2 + 1, 2 + 2, 2 + 3, 3 + 1, 3 + 2, 3 + 3\} = \{2, 3, 4, 5, 6\}$$

    Since the number 2 and 3 are in both X and its sumset, the set X is not sumfree. Consider the sets

    A = the set of odd numbers   B = the set of even numbers
    C = the set of prime numbers   D = the set of squares
    E = the set of all positive integer powers of 2   F = the set of all positive integer powers of 3

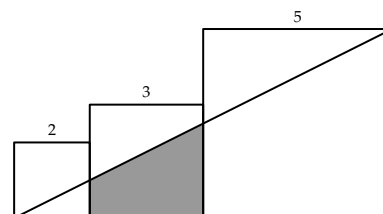   The number of them that are sumfree is:

    (A) 0   (B) 1   (C) 2   (D) 3   (E) 4

8. Alex has a basket of coloured eggs. There are exactly four blue eggs in the basket, plus some red and some white eggs. Alex has a blindfold over his eyes and takes eggs out of the basket one at a time. To be certain of getting at least one white egg, Alex must take out 44 eggs. The number of eggs that Alex must take out to be guaranteed of getting at least one white or one blue egg is:

    (A) 39   (B) 40   (C) 42   (D) 43   (E) 47

9. Three squares have dimensions as indicated in the diagram. The area of the shaded quadrilateral is:

    (A) $\frac{21}{4}$ (B) $\frac{9}{2}$ (C) 5

    (D) $\frac{25}{4}$ (E) $\frac{15}{2}$

10. On a walk down Bernard Street, Randy passed five houses, each painted a different colour: green, yellow, red, blue, and white, in some order. Randy passed the white house before the yellow house and the red house before the blue house. The red and blue houses were not side-by-side. The number of possible orderings of these five houses along Bernard Street is:

    (A) 16   (B) 18   (C) 36   (D) 48   (E) 120

11. Each runner maintains a constant speed throughout a 24 km race. Runner A crosses the finish line when runner B is still 6 km from finishing and when runner C is still 9 km from finishing. The number of kilometres runner C will have left to run when runner B crosses the finish line is:

    (A) 8   (B) 6   (C) 5   (D) 4   (E) 3

12. A set S consists of all triangles whose sides have integer lengths less than 5 and for which no two of these triangles are similar or congruent. The number of triangles in the set S is:

    (A) 8   (B) 9   (C) 10   (D) 11   (E) 12